ALLEGHENY COLLEGE

INTERNATIONAL STUDIES 610

SENIOR PROJECT

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WRITING HISTORY UNDER THE PINE TREES: AN EXAMINATION OF PRE-MODERN CHINESE ENVIRONMENTAL PAST, TREATMENT, AND TRADITION FROM NEOLITHIC CULTURES TO 1800.

Department *of* International Studies



WRITING HISTORY UNDER THE PINE TREES: AN EXAMINATION OF PRE-MODERN CHINESE ENVIRONMENTAL PAST, TREATMENT, AND TRADITION FROM NEOLITHIC CULTURES TO 1800.

Submitted to the Department of International Studies of Allegheny College in partial fulfillment of the requirements for the degree of Bachelor of Arts.

APRIL 15TH, 2016

I hereby recognize and pledge to fulfill my responsibilities as defined in the Honor Code and to maintain the integrity of both myself and the College community as a whole.

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Special thanks to Rogina Chen 陈柔均 for assisting me throughout the Chinese writing process (and being the the most fantastic TA, roommate, and friend), to Professor Shi for always being patient with me during the Chinese language learning process, to Walter Cowles-Costigan for helping me decide on a title, to my mother and my grandfather for reading through my long (and sometimes dreadful) drafts of this project from the very beginning, and finally to Max Ashbrook for being ever so supportive.

ABSTRACT

虽然环境恶化常常是现代讨论的议题，环境恶化的难题从古代到现代一直存在。很多的人相信环境恶化在工业革命以后才开始，然而这不是事实。由于中国是历史上最古老的社会之一，在历史上中国的环境恶化问题就一直都是难题。虽然很多古代的和现代的历史书都不写坏境恶化问题，中国历史上坏境恶化问题一直被忽视，但是中国的古代历史学家经常写在每个朝代发生了什么事件。所以从这些历史证据我们可以找出关于气温的巨变， 森林覆盖面积的改变，水质的改变的线索，也可以看出社会的价值观和政府的政策造成了这些问题。因而我的论文会检视中国的环境改变的历史，我会用 Robert Marks’ China: An Environmental History 和 Mark Elvin’s The Retreat of the Elephants 还有其他的资料来延伸我的观点，完成我的论文。

在我的论文里我会讨论环境改变所带来的危机，我不仅会关注这些问题如何发生，还会关注这些问题为什么会发生。我会讨论环境危害对于森林，水和动物的影响。因为在古代中国非常重视农业，所以造成环境剧烈改变。因为农业社会的稳定发展让政局稳定和经济无虞，人口因而急速成长， 人口的快速增长带来环境的危害。在第一章里，我会从新石器时代社会讨论到秦朝，因为在这段时间里很多的传统被形成并流传下来。在新石器时代这段时间，开始了农业社会取代了打猎和采集的生活方式。于是人与环境的关系开始发展。人们使用土地的方式，破坏了耕作环境。人口很少的时候，这样的农业耕作是可行的；然而，社会趋于稳定的时候，人口便开始急速增长，这造成环境的过度利用。在秦朝，秦朝统一了中国，奠定了中国走向农业国家也为未来的农业形式打下了雏形。在第二章中，我从汉代讨论到唐朝。这段时间领土被扩张，北边匈奴也开始进行农业耕作，这使的北边中国从草原到严重沙漠化，所以我们到现代面临中国难解的荒漠化问题。汉代以后，很多的人移民到中国的南边，这也扩大之后朝代的版图。在唐朝这段时间中，人们过度利用环境，也面临了气温改变的挑战。 在第三章里，我从宋朝讨论到近现代中国。这段时间中环境发生了大幅度的改变。因为巨大的人口压

力导致环境的恶化， 开始影响中国人民的生存。在宋朝，人口的快速成长超出了环境的负荷。在元朝蒙古人跟自然的互动关系不同于以往的汉民族，但是蒙古政权对于环境政策没有大幅度的改变。清朝以后，有很多的人没有土地，没有房子，所以他们常常被饿死或者冻死。环境的恶化造成没有太多的土地可以耕作。所有这些起因于中国有很强大农业社会传统，这样的传统不仅危害环境也让百姓遭殃。

从历史的角度讨论环境改变很有意义，因为环境恶化不仅事实现代的问题，也是古代中国社会遇到的难题。这个论文有助于深入了解中国环境的历史，也有助于深入了解为什么人类会破坏他们的环境。如果在未来里人类希望嫩改善环境，他们得知道环境问题的历史根源。



Fig. 1: Wang Meng 王蒙, *Writing Books Under the Pine Trees*, 1360s, double album leaf mounted as a hanging scroll, 66.70 x 70.50 cm, in. The Cleveland Museum of Art, Cleveland, < http://www.clevelandart.org/art/1997.94>.

INTRODUCTION

The discussion of ecological degradation and environmental conservationism is a relatively modern one in the scope of human history, having been largely discussed in the West following industrial revolutions that took a heavy toll on the health of the environment; however, neither ecological degradation nor environmental conservationism are modern issues. Human-induced changes to the environment have historical significance since humankind's evolvement from her primate ancestor. Particularly, a vexing question for many great thinkers alike is how humankind came to live almost antithetically to environmental benefit and growth, especially considering humankind's emergence from the natural process of evolution and the nurturing of humankind growth via the natural world. In many ways, it almost seems that humankind and the natural environment are in a never-ceasing battle, where if humankind suffers the environment benefits, and where if the environment suffers then humankind benefits. Of course, knowing that the environment must maintain a certain level of health to also sustain the human population is where the crux of environmental degradation comes into play, for at a certain point the human population *must* stop benefitting from the environment. This naturally makes conservation law and movements difficult, as a desirable solution for or compromise between producing better living standards and generating a healthier environment has not yet been discovered.

The ancient Chinese were marvelous chroniclers, often keeping records of most major events occurring throughout their dynasties as early as their language and society developed. As this project will later show, the concern for environmental conservation is not simply a Western ideal, but has been considered in ancient Chinese history via laws and actions for several

thousand years. Even in destructive patterns of action that the ancient Chinese may not have had the science or knowledge to understand, observable instances of environmental degradation and change are present through much of pre-modern Chinese written history. This piece will not only focus on those patterns, but also examine the social and political reasoning behind these changes in order to deeply analyze the ecological degradation that began in pre-modern China, and hopefully construct a bridge between ecological thinking of ancient times and the present.

Although, especially in the West, the topic of environmental issues in ancient China is not a widely written one, the authors Mark Elvin (*The Retreat of the Elephants*) and Robert B. Marks (*China: Its Environment and History*) are both frontrunners in examining Chinese environmental history, and both thoroughly compile a history of China that also examines ecological concerns.[1] [2]While many historical narratives are progressed by economic, political, and social issues, both of these authors' works utilize environmental changes to further their respective narratives. Both of these pieces critically comment upon Chinese ecological intervention, as the ecological history of Neolithic and Imperial China largely have shaped environmental issues that exist modernly in China and throughout the rest of the world.

Despite the clear and succinct narrative that both Elvin and Marks have to offer, this project will strive to expand the existing literature by examining the reasons behind Chinese anthropogenic environmental changes and act as a platform in which to contemplate and discuss modern environmental issues. Very few environmental changes brought on by humankind have been without economic, social, or political reasoning. There is an unavoidable nature of environmental degradation with current human thought, practices, customs, and policies, and in

[1] Mark Elvin, *The Retreat of the Elephants,* (New Haven and London: Yale University Press, 2004).
[2] Robert B. Marks, *China: Its Environment and History,* (Lanham: Rowman & Littlefield Publishers, Inc., 2012).

this project I hope to highlight the inescapability of ecological deterioration with current societal norms and expectations utilizing Chinese Neolithic and imperial history as an example of this thought.

Utilizing and synthesizing both Marks and Elvin's works, the works of many others regarding both Chinese history and environmental science, and similarly some primary historical texts such as edicts from the Han Dynasty and writings from Tan Qian in Ming Dynasty, this project will focus on historical occurrences regarding environmental changes, adding commentary and analysis on aforementioned occurrences. Similarly subsections regarding trees ("木"), water ("水"), and animals ("动物") will also account for environmental changes. Many changes regarding trees, water, and animals were not well accounted for in Chinese dynastic history but instead are offered to our overall understanding of human-environment interaction only through archeological efforts. Therefore, some accounts are brief, hence why I have chosen to include them following summation of the dynastic environmental histories; additionally, because environmental change takes shape over a long course of time, changes may not have been contained within a single dynasty. Each of these subsections are incredibly important indicators of environmental health and changes in the quality or amounts of them cause significant complications in ecological mitigation. For example, massive deforestation efforts lead to a lowered standard of living for communities in which they occur, a disturbance in natural ecosystems within the region and also regions that have a secondary reliance on forests (such as the ecosystems existing within rivers and other water systems that rely on forests absorbing

groundwater), changes in biodiversity, and similarly increases in global warming.[3] Water environments are an important indicator for aquaculture health and conservation and similarly resource preservation; similarly, most life on earth requires uncontaminated water for subsistence which is reason for alarm when severe droughts occur. The preservation and continuity of water-based environments is imperative not only to human life but to all life on the planet. Finally, animal endangerment and extinction is an important gauge of environmental detriment, as the loss of certain lifeforms causes disturbances in not only food-chains but natural ecosystems. In particular, this project will examine the establishment of traditions which shaped future ecological identity towards the beginning of Chinese culture, the intertwining of tradition and early environmental treatment in the middle period, and the breaching of the human-environment relationship during and following the Song dynasty which drastically reshaped the Chinese landscape in the later imperial period.

"Pre-modern" China is a difficult time period to pinpoint, as China Proper has not always belonged to the Han Chinese but instead various groups of nomadic kingdoms. Similarly, Chinese history dates back some 7,000 years or more, causing difficulties in obtaining information and accurate information at that. Therefore, this project's time frame will span from early Neolithic cultures whose practices directly act as a foundation for later Chinese ecological treatment and thought (with a brief discussion on Paleolithic environments and humans) to the early Qing dynasty around 1800, which is often considered to be the end of the "pre-modern" era due to the beginning of Western and Chinese entanglement with the Opium War. Moreover,

[3] Andrew K. Jorgenson, "Unequal Ecological Exchange and Environmental Degradation: A Theoretical Proposition and Cross-National Study of Deforestation, 1990-2000*," *Rural Sociology* 71, no. 4 (2006): 686, doi: 10.1526/003601106781262016.

periods of unity will more largely be focused upon as opposed to periods of disunity, as collective, large-scale actions which have altered the ecological landscape are more clearly to appear under a united nation.

There is an undeniable and pressing importance to study the natural environment from all perspectives of scholarly practices, especially with global temperatures already breaching 1°C since pre-industrial levels, and are expected to reach above a disastrous 2°C by the end of the millennium. However, when multitudes of scholarly discourse simply portray actors in environmental deterioration as negative, it is easy to feel a disconnect between historical actors in environmental deterioration and modern actors. Environmental problems faced in the past are not terribly different or completely separated from environmental problems faced in the present. There is danger in not being able to understand the similarities between the choices made in the past and the choices made in the present. For example, there is no doubt that the ancient Chinese knew that the killing of large amounts of tigers was bad, especially considering the slaying of animals is explicitly frowned upon by Buddhism and additionally against Chinese conservationist ideals present in government throughout various dynasties. However, because tigers posed a larger and larger threat to human life—especially so with encroachment on tiger territories undertaken by previous generations—tiger destruction at the time seemed necessary. The ancient Chinese did not have some bizarre eagerness for tiger bloodshed, but instead were simply attempting to preserve human life. If humankind cannot acknowledge this reasoning, we are bound to continue making the same mistakes in regard to the environment. Sometimes, the choices that best serve the environment are not the ones that best serve mankind, and vise versa.

The decisions that are beneficial to the environment are not going to be the easy ones to make. Those decisions, sometimes, will not be in the interest of human life.

Historical Context

Modernly, human-induced environmental disasters are becoming an increasingly more common occurrence in China. Therefore, there is an increasing need for the consideration and study of environment in both modern China and pre-modern China. Throughout pre-modern China, there was an awareness within the society regarding ecological issues, and a desire to recognize how to address ecological issues, especially as they arose more and more within the landscape. While this may have been merely an ecological consciousness present in Chinese culture, there is also evidence to suggest that the early Chinese felt the impact of their ecological degradation and did so earlier than other cultures throughout the world due to the early emergence of industrialized society. Therefore, there is a likelihood that Chinese government focus on environmentalism was more so a reactive measure than a proactive one. Regardless of this, as will be discussed in subsequent chapters, there was still a lack of government control over environmental degradation, and despite laws created throughout much of Chinese history that attempted to protect the environment, there was a lack of policy that actually had a dramatic effect. There was also an issue of private interests conflicting with public interests in regard to

the environment, where private interests usually emphasized use of the environment for profit instead of longevity.[4]

It must additionally be noted that the distinction between man and nature in the West is not one that exists within the early Chinese context. Robert Marks claims that there, "...is a long and very interesting history of the 'concept of nature' in China," that would take an incredibly long time to dissect.[5] Whereas in the West there is a distinction between mankind and nature, between humanity and savagery likely sprouting from Christian distinction between man and beast, this concept in the Chinese thought did not exist through much of China's pre-modern history. However, this should not be taken to mean that the Chinese then did not evoke distress on their natural environment—in fact, human-induced environmental changes are incredibly visible throughout much of pre-modern Chinese history and still have effects on modern China and the world today. Due to the rapid construction of a stable civil society within ancient China, the Chinese were able to organize and change the environment that surrounded them rather substantively through agriculture and population growth. Chinese distinction between man and environment varied depending upon which type of Chinese thought one was talking about environmental factors. This paper will later touch upon Confucianism and Daoism briefly as contexts in which environmental issues were addressed.

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[4] Peter C. Perdue, Rev. of "Lakes of Empire: Man and Water in Chinese History," by R. Keith Schoppa, *Xiang Lake: Nine Centuries of Chinese Life,* (New Haven: Yale University Press, 1989), *Modern China* 16, no. 1 (Sage Publications, Inc.: 1990), 125, http://www.jstor.org/stable/189185, (accessed January 28, 2016).

[5] Robert B. Marks, *China: Its Environment and History*, 93.

CHAPTER 1 Establishing an Environmental Tradition

This chapter will discuss the period of time where little environmental deterioration was recorded, although just because they were not recorded does not mean they did not occur. Instead, this chapter will discuss the beginnings of Chinese culture, philosophy, and society as they pertained to and established ways in which Chinese culture would produce environmental issues—from Paleolithic and Neolithic cultures to the Qin Dynasty. Between these periods is when Chinese national tradition and identity seems to have mostly been set, as major Chinese philosophies and ecological relationships developed in the early kingdoms and dynasties and became a part of the Chines national identity under Qin unification. In this way, the first several hundred years of Chinese history will be able to serve as a backdrop of action and belief for future environmental issues brought on and faced by the Chinese people in subsequent dynasties. This is an imperative concept to acknowledge from a modern perspective because, firstly, environmental issues are not something that have only just arisen in post-industrial revolution societies but instead a culmination of thousands of years of practices that have mostly benefited humankind instead of her surroundings. Secondly, early humans changing their environment was often something done out of necessity rather than malicious intent, and modernly this way of thinking and action still exists. In many ways, modern reasoning do not entirely differ from ancient ones, and therefore there is opportunity to learn from ancient decisions.

In the context of Paleolithic and Neolithic ancient cultures, “Chinese” should really be considered in a broad sense since the existence of national identity under the unification of a

dynasty does not occur until around 2,000 BCE with the Xia dynasty, and likely more so during the Shang dynasty in roughly 1,700 BCE. However, the fact that the Paleolithic humans and Neolithic cultures such as the Yangshao and Longshan eventually comprise the future "Chinese," I believe it is appropriate to begin with these cultures—especially considering their cultural contributions to the identity of China.

The First Inhabitants

Beginning in 1929, a Canadian professor named Davidson Black from Peking Union Medical College would lead a new project that would enlighten the world on the humble origins of a species that began roughly four million years ago. This project became situated near Zhoukoudian (周口店), in the country's capital of Beijing. And if the caves Zhoukoudian, commonly referred to then as *Dragon Bone Hill*, were a stage, then the world was its audience, as "40 hominid individuals" were unearthed, identified, and named *Sinathropus pekinesis*—commonly referred to as the Peking man.[1] Although pinning down the exact date of *Sinathropus pekinesis'* existence has proven difficult, many anthropologists place the date somewhere in the lower Palaeolithic era, between 3.4 million years ago up to 300,000 years ago. This discovery placemarks the beginning of the Chinese story, as many believe *Sinathropus pekinesis* to be the earliest resident of East Asia.

These predecessors to modern humans did not undertake large scale changes to their environment as future humans would with mass deforestation, Neolithic-style agriculture, irrigation, canal building, animal breeding, inducing animal extinction, and so forth; however,

[1] "Peking Man," in *Cassell's Peoples, Nations and Cultures*, ed. John Mackenzie, (London: Cassell, 2005), http://ezproxy1.allegheny.edu:2048/login?url=http://search.credoreference.com/content/entry/orionpnc/peking_man/0

Sinathropus pekinesis likely made a massive contribution to the preservation of mankind and the future modification of the environment: fire. Where Davidson Black's team first excavated the various bones of *Sinathropus pekinesis*, elemental carbon was found—an indicator that China's oldest known ancestor utilized fire within the caves they lived.[2] Concerned primarily with survival, it is unlikely that *Sinathropus pekinesis* ever considered that their ability to wield and control fire would forever alter the environmental landscape for thousands (possibly millions) of years to come. *Sinathropus pekinesis* likely never imagined that it would give their descendents an advantage over their co-inhabitants and habitat.

Early Innovations and the Move Towards an Agricultural Society

Around 100,000 years after the existence of *Sinathropus pekinesis*, the early Chinese began forming "clan-based societies," as opposed to small bands of primitive cave-dwellers, with communities spread further and further southward from Shanxi, to Hubei, all the way to Guandong.[3] Around 10,000 B.C.E the Neolithic era began in many parts of the early world, but it was not until around 5,000 BCE that the early Chinese began making the advancements in early manmade technologies that typically characterize the period. The setting in southern China was a perfect backdrop for the beginning of societies that somewhat resembled contemporary existence due to southern China's less harsh climate. Throughout the Neolithic era, the ancestors of the

[2] C. Shen, et. al, "Concentrations of 'elemental carbon' in samples from the peking man site at zhoukoudian and the possibility of their application in the development of evidence for the use of fire by humans," *Chinese Science Bulletin* 49, no. 6 (2004): 612-616, doi:10.1360/03wd0209.

[3] R.L. Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection,* (London: New York, 1994), 27.

Chinese people began to, "...establish more or less permanent settlements, to build walled cities, and to develop pottery, writing, and, eventually, bronze technology."[4]

Agriculture was another innovation originating in this time period that would forever revolutionize Chinese history, and it became prominent in China around 10,000 BCE.[5] Although it is difficult to pinpoint the reasoning behind the shift towards agriculture from previous hunter-gatherer type livelihoods, many communities around the world during this period all independently shifted to an agricultural society, where they not only began farming but also began keeping livestock. Some historians attribute the shift to potential global changes in temperature, which made agriculture a slightly more favorable option for compiling food. In the north, the ancient Chinese's primary crop was millet; in the south, rice. It is commonly thought that early agricultural endeavors would have not produced as nourishing of a diet as hunting and gathering, that primitive farming would not have allowed for adequate production of food, and that the knowledge of farming and animal husbandry (primarily dog and pig) was not readily available so crops may not have been likely to produce as much or may have died. However, "...the change [from hunter-gatherers to farmers] represented a new and powerful relationship of humans to their environment, and created possibilities for new and more powerful or coercive forms of social organization."[6] The transition from hunter-gatherer subsistence to agricultural subsistence occurred over the course of a long period of time. Therefore, hunting-gathering and small-scale agriculture or gardening coexisted until another factor made agriculture as opposed to hunting and gathering become a more attractive option for the ancient Chinese peoples. There

[4] Harold Tanner, *China: A History*, (Indianapolis: Hackett Publishing Company, Inc., 2010), 17.
[5] David N. Keightly, *The Cambridge History of Ancient China*, (Cambridge University Press, 2008), accessed 28 January 2015, http://dx.doi.org/10.1017/CHOL9780521470308.003, 45,
[6] R.L. Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 23.

is a possibility that population growth played a role in this change. The need to nourish expanding families, villages, and eventually kingdoms is also a likely cause of the early Chinese's shift towards an agrarian society. Similarly, it is possible that the development of a primitive hierarchical social system based on owning and controlling agricultural goods began to emerge, as this type of social system would gain traction in subsequent dynasties. Regardless of the cause, this agricultural shift would play a leading role in environmental changes for years to come.

Eventually, with agriculture acting as a rationale for adopting stationary lifestyles, larger cultures began to thrive in the area that would later become one of the most culturally rich societies in human existence. Regional cultures existing in China around roughly 5,000 BCE included the Yangshao (5,000-3,000 BCE), the Dawenkou (5,000-3,000 B.C.E), the Majiabangand Hemdu (5,000-3,000 BCE), the Daxi (5,000-3,000 BCE), and the Dapenkeng (5,000-2,500 BCE).[7] These small-but-substantial farming societies would set the framework for eventual larger civilization and ecological cultivation to make an appearance within pre-modern China. During the later Longshan cultures, which came to gain significantly more power than the Yangshao and eventually became the primary culture from 3,000 to 2,000 BCE, clear hierarchies and political power began to materialize and "ritual [religion] and war" began to mark everyday Chinese life.[8]

A likely cause of the decline of the Yangshao was an environmental one, due to the fact that the disappearance of the Yangshao accompanies a time period in which natural cooling over the north China region began to occur, which reduced the availability of hunter-gatherer

[7] Keightly, *The Cambridge History of Ancient China*, 49-54.
[8] Keightly, *The Cambridge History of Ancient China*, 64.

resources and necessitated an even stronger reliance on agriculture.[9] Interestingly, mother nature herself in this case seems to have been equally guilty of influencing in the transition to agriculture, as the Longshan began to thrive following the demise of the Yangshao due to their stronger dependence on farming. This success in sustaining the culture meant that the Longshan people must have had developed a culture that significantly relied on farming as opposed to hunting and gathering. Advances in technology, such as axes, allowed the Longshan people to cut down more trees for farms. From the Longshan culture of farming arose social organization, indicated by difference in burial rituals and the opulence of items found in Longshan tombs.[10] These social orders eventually flourished into more kingdom-like communities than had been previously seen in China up until this point.

Early Belief Systems and Developed Relationships with the Natural Environment

The importance of agriculture and environmental control is similarly reflected in the ancient Chinese mythology that arose surrounding early Neolithic cultures and the Shang dynasty. A deity named Shennong 神农 is said to be the founder of agriculture in ancient China, having bestowed upon Chinese farmers the knowledge of how to farm, grain preservation techniques, and the inventions of the plow, the hoe, and irrigation.[11][12] Shennong is one of the most important "hero" figures in Chinese culture, perhaps only being second in prominence in historical textbooks to the Yellow Emperor, but likely only because the Yellow Emperor is

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[9] Tanner, *China: A History*, 24.
[10] Tanner, *China: A History*, 26.
[11] Jinzao Cheng and 程金造, *shi ji suo yin yin shu kao shi* 史記索隱引書考實 [Textual Analysis of the Records of Solitude] (Beijing: Zhonghua shu ju, 1988).
[12] Paul U. Unschuld, *Medicine in China: A History of Pharmaceutics* (University of California Press: Los Angeles, 1986), 11.

credited with establishing a central government system which more or less lasted until 1912 C.E.[13] Within the early stages of Chinese civilization, the process of changing the natural environment to better support both human life and human convenience finds itself perpetually tied to religion—as it will with some later Chinese religions, as well.

The deity Shennong demonstrates the importance of agrarian society to early Chinese belief systems. Mythology and modifying the environment in the interest of human life seems to be tied at the very beginning of Chinese religion. Shennong is also believed to be the father of Chinese medicine, suggesting that the desire to live longer and more healthier lives was present amongst the early Chinese people. However, this sentiment is not exclusive to any one culture and is present in most religions and philosophies developed throughout the world. This desire would be one that led to humankind's endeavors against the environment in the first place. The early mild destruction of the environment offered the opportunity for humans to live longer, healthier, and more fulfilling lives, and early humankind took that opportunity.

The concept of the natural world being controlled by deities and spirits took a stronghold during the Shang dynasty. If mankind did something wrong, the heavens would retaliate against the human world via disasters that threatened human life. This belief not only portrays mankind and his natural surroundings inherently at odds, but similarly... Eventually, this concept would metamorphose into a component of the Mandate of Heaven established by the Western Zhou; the heavens would retaliate against poor leadership.

During the Shang dynasty is also when the usage of animals in early socioreligious structures became more prevalent. Not only were animals used as sacrifices during this period of

[13] Xiuyuan Chen, *shen nong ben cao jing du* 神農本艸經讀 [The Divine Farmer's Materia Medica], (1903), http://babel.hathitrust.org/cgi/pt?id=mdp.39015070289239;view=1up;seq=1.

time, but the control of animals also increased over time. Initially, before the Shang, animals which could be easily controlled such as pigs, dog, and cattle were mostly the types which animals in sacrificial practices were comprised of.[14] However, during the Shang Dynasty, humankind made strides in environmental control in the name of tradition due to the inclusion of horses and sheep later in animal sacrifice.[15] As time continued throughout the Shang dynasty, humankind began capturing more and more varied types of animals to utilize in the practice, suggesting an increased amount of dominance and ability to control domesticated large animals.

Beginning a Dynastic and Ideological Tradition

Longshan culture was largely dispersed across the entire "China proper;" however, the consecutive notable kingdoms that arose from the Longshan were situated on the Central Plains were the Shang and the Western Zhou.[16] Early Chinese man-made environmental transformations became more and more entangled with the social and religious practices around 12,000 BCE during the Shang dynasty. The earliest form of found written Chinese belongs to the Shang on turtle and ox bones used for religious divination, exhibiting the early importance of animals and the extermination of animals to ritual. Additionally, one of the defining characteristics of the Shang kingdom is the introduction and development of religion centered around deities, spirits, ancestors passed. These actors, "...could affect crops, the weather, child

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[14] Jing Yuan and Rowan Flad, "New zooarchaeological evidence for changes in Shang Dynasty animal sacrifice," *Journal of Anthropological Archaeology* 24, no. 3 (2005): 252, doi: 10.1016/j.jaa.2005.003.001.
[15]Jing Yuan and Rowan Flad, "New zooarchaeological evidence for changes in Shang Dynasty animal sacrifice," 252.
[16] Note: Although the Xia is also typically discussed when mentioning existing kingdoms following the Longshan, I chose to exclude them simply because there is disagreement about the existence of the Xia kingdom. The uncertainty of the existence of the Xia (despite recent archaeological evidence pointing to their presence at the time) makes it difficult to accurately discuss any environmental history in the Xia kingdom.

birth, the king's health, and so on," therefore entangling early Chinese religion even further with the Chinese environment.[17]

The fall of the Shang came when its neighbor, the Western Zhou, attacked and overthrew the early Chinese kingdom. Despite this information, there is other evidence to suggest that nature had a hand in the downfall of the Shang, as it did with the Yangshao. The Shang's placement in the north combined with a period of cooling that occurred around 1,000 BCE caused instability in the Shang region, because dryness of the soil and lack of water made growing crops difficult. The early Chinese society was still in many ways at the mercy of the earth.

The Shang was overthrown by King Wu of the Western Zhou kingdom in 1,045 BCE and his successors toiled to unify the Central Plain region. In order to achieve unity, the new Western Zhou rulers and philosophers introduced the concept of the Mandate of Heaven, where rulers were given the right to rule through heaven. An indication that a ruler had lost the Mandate of Heaven would include the overthrowing of a kingdom, rebellions, economic instability, environmental disasters, and so on. The collection of the feudal states unified by the Zhou similarly assumed a unifying title: Zhongguo, 中国, or China.

Modern studies have linked developing countries and problems with environmental sustainability, and if China during the Zhou dynasty could be considered a developing country after the kingdom's unification under the title of China with efforts to economically and socially develop, then there would be expected levels of environmental degradation. As is evident with cases in modern Egypt, Nigeria, and various others, in order to achieve cultural and social

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[17] Tanner, *China: A History,* 43.

development (especially in the form of urbanization) governments must utilize and sometimes overexploit their natural resources.[18][19] China around 1,000 BCE by no means had the technological resources that today one would consider a developing country to have, and modern studies on developing countries and environmental health have typically shown city-building, large-scale irrigation projects, and basically any developments pertaining to the transition from an agricultural society to an urban society to be factors in ecological degradation. Yet, while the Zhou kingdom was not transitioning to a modern urban society from an existent agricultural one, the principle of environmental degradation as a facet of societal development still applies in the transition of a previously hunter-gatherer or Neolithic society into a sedentary, agricultural one. Sure enough, the birth of the new dynasty called for the establishment of a new domain, and much of the land in the Wei River valley—which was described as "full of thorns and bushes,"—consequently was subject to woodland clearing campaigns by the Zhou dynasty in order to establish the capital.[20]

The Western Zhou founded their capital in Xian, then called Chang'an 长安 until officially changed during the Ming dynasty. The Zhou similarly established a capital in Luoyang 洛阳—near the Luo River and the Yellow River—due to the fear of uprising from peoples on the central plains. Due to this, the Zhou was able to establish a larger dominance over the region than if they had only one established capital, not only politically but also environmentally. With two separate headquarters, citizens would have been able to establish themselves in a larger variety of

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[18] M. El Araby, "Urban growth and environmental degradation: The case of Cairo, Egypt," *Cities* 19, no. 6 (2002): 389-400, doi: 10.1016/S0264-2751(02)00069-0.
[19] Roy Maconachie, Ms. Kathy Baker-Smith, and Mr. Robert W. Bradnock, *Urban Growth and Land Degradation in Developing Cities,* (New York: Routledge, 2016): 136.
[20] Robert Marks, *China: Its Environment and History*, (Lanham: Rowman & Littlefield Publishers, Inc., 2012), 65.

places instead of remaining condensed around a single capital for security reasons. Therefore not only would human societal formation be able to occur near either Chang'an 长安 or Luoyang 洛阳, but additionally anywhere between these capitals or along the Yellow River within the government's reach, and all of these would be secure places in which to settle and utilize the land for economic gain.

Despite the new consolidation of peoples and emergence of a more cultivated way of governance and existence, the majority of China during the Western Zhou remained agricultural (millet, wheat, hemp, rice, beans, and peas being the majority of crops at the time) with some reliance still on hunting-and-gathering. In regards to meats, the common people often ate fish, while the people at the top of Zhou Chinese society ate, "...beef, mutton, rabbit, poultry, and game."[21] Yet, the growth of agriculture during the Western Zhou dynasty caused the availability of meats from animals that relied on grassland to decrease to make way for farm development. In some ways, this development acts as a testament to the tenacity of the establishment of agricultural society in pre-modern China, and demonstrates how as early as the Western Zhou there is a tradition of agricultural society. Some historians argue that China, at various points throughout history, had the opportunity to shift to a market economy, and argue further that this switch would have caused less environmental stress than sticking solely to an agro-economic system. However, if China could easily shift from an agrarian society to any other type of society, it would have been done in the Western Zhou.

Nutritionally, citizens in the Western Zhou would have likely had greater benefit to eating increased amounts of meat, as studies suggest that lean red meats lower disease risk amongst

[21] Tanner, *China: A History*, 50.

citizens, "…animal protein improves maternal and infant health globally," and, "…meat and livestock contribute to nutrient and food security."[22] While, of course the Western Zhou would not have had the science to back what humans know now regarding the importance of meat in one's diet (especially in developing societies, which one could likely make the case for in regards to the Western Zhou), citizens likely would have felt the nutritional and developmental causes and effects over several hundred years of eating more meat versus eating less meat. There certainly were economic and social importances placed on meat consumption already, as in Neolithic cultures large amounts of societal significance was held by those who owned animals for usage and consumption versus those who did not. And yet, still, societally there was a shift in the Western Zhou to consume less meat in order to make way for more agriculture, and thusly increased consumption of grains which—while important to the diet—hold less nutritional value than meats. This could have likely been for many reasons, perhaps it was due to a skewed ownership of power where those who had power favored agricultural practices, or a perceived security of agricultural goods over livestock goods, or maybe it was simply based in the tradition and mythology surrounding agriculture which overrided nutritional benefit. Regardless of the true reasoning—of which there are likely several—the shift itself undoubtedly demonstrates how agriculture would remain steadfast in pre-modern China in spite of environmental issues, even in spite of humanitarian issues such as population nutrition.

Agriculture similarly had a massive effect on Chinese social lifestyles—rituals and celebrations surrounding agricultural seasons arose during the Western Zhou dynasty. The establishment of Zhou ritual, tradition, and beliefs also established an environmental tradition

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[22] Shalene McNeill and Mary E. Van Elswyk, "Red meat in global nutrition," *Meat Science* 92, no. 3 (2012): 166-173, doi: 10.1016/j.meatsci.2012.03.014.

that would be prominent for centuries to come. Much of the literature arising from the Western Zhou dynasty, although questionable in authenticity, describes Chinese thinking as desiring to dominate their surroundings for the advancement of mankind and the new unified nation. The idea of humans as emperors to their environment, with the natural license to alter nature around them, began infiltrating Chinese thought and action.[23] The cultural significance of agro-socioeconomic systems in ancient China meant that the clash between environmental health and agriculture would be a severe one, and additionally suggests that mankind will likely have to abandon many cultural and social norms in order to truly become a more sustainable species.

Environmental calamities eventually led to the downfall of the Western Zhou, although the concept of the Mandate of Heaven gave new meaning to these environmental disasters, rather than simply a drought, flood, or plague creating difficult or impossible living conditions under the standing government. During the regime of King You (r. 781—771 BCE), "...the Wei Valley experienced a severe earthquake and eclipses of the sun and the moon. The earthquake is said to have dried up the three river systems of the Wei valley."[24] It is indicated that this meant that King You had lost the Mandate of Heaven, and the heavens therefore retaliated. The Mandate of Heaven puts the responsibility of rebelling against unjust rulers on the people of the kingdom, and this is exactly what happened when the feudal lords in the Western Zhou kingdom allied with surrounding nomads to overthrow the king.

[23] Robert Marks, *China: Its Environment and History*, 66-67.
[24] Tanner, *China: A History*, 55.

The Eastern Zhou, Confucianism, Daoism, and the Environment

Following the fall of the Western Zhou, China—which had previously enjoyed a moderate form of central unification—fell into a state where the monarchy was unable to establish complete order at the Eastern Zhou capital of Luoyang 洛阳, where the kingdom had officially relocated following the demise of King You's reign. Thus began what is commonly referred to as the Eastern Zhou dynasty, which is further subdivided into the Spring and Autumn period (770—475 BCE) and the Warring States period (476 BCE—221 BCE).[25]

Like in philosophy, the Eastern Zhou saw many advancements in agricultural technologies and practices that allowed the Eastern Zhou peoples to modify their natural surroundings. Iron tools allowed for easier farming during the Warring states period, and iron plows attached to oxen further guaranteed increased farm fertility. Irrigation transformed the natural landscape and additionally aided in the expansion of farming and agriculture, since farmers now could access water for their crops which they had not been able to previously. The weak nature of the central government at the time allowed for elite wealthy families to begin to exercise land ownership, which had not previously been the case during the Western Zhou. While private landownership would cause many political and social issues in the future, in the short-term it, "...probably contributed to increased productivity in the Warring States period by giving farmers greater incentive to increase production."[26] Simply, privatized land ownership caused farmers to exploit the land in larger ways than if land was not privately held. The mixture of new technology and increased family wealth meant that land-owning families more easily transform

[25] Tanner, *China: A History,* 59.
[26] Tanner, *China: A History*, 65.

their individual plots of land than the disorganized central government could public land holdings. While certainly this established a precedent of private land transformation that would be followed in later periods of time, there was also large incentive for wealthy, land-owning families in environmental transformation. The Eastern Zhou is typically viewed as a period with a weak central government, therefore there was an increased motivation for families to establish for themselves some sort of financial security and stability.

Agricultural advancement, while incredibly relevant, was not the most influential thing regarding environmental control that arose from the Eastern Zhou period. The rise of systemic philosophies would create more uniform thinking in regards to the environment, and additionally merge attitudes of the past, present belief systems, and future treatment of the natural world. The lack of central influence over the dynasty led to a setting where many different peoples—such as, "...feudal lords, aristocrats, statesmen, philosophers, and strategists"—had hands in many different aspects of the kingdom, creating a chaotic situation during the Eastern Zhou.[27] It appears that this climate sparked deeper philosophical thinking, as important traditional Chinese religion and philosophy arose during the Eastern Zhou dynasty. Specifically, this project will focus on the thoughts surrounding Confucianism and Daoism (which appeared during this time period) and consider their influences on environmental factors in later analytical sections.

The tumultuous period of the Eastern Zhou dynasty was an oasis to philosophical thinkers. Laozi 老子 (ca. 400—ca. 300 BCE) and Confucius 孔夫子 (551—497 BCE), Daosim and Confucianism respectively, began philosophical movements during this time period. Because Confucianism and Daoism act as leading philosophical influencers throughout much of Chinese

[27] Tanner, *China: A History*, 59.

history, each maintains a role in Chinese and environmental relations. However, describing the intricacies of these philosophies is an entirely different project in itself and therefore below will be a brief summary of these philosophies in regards to ecological consciousness.

Confucianism really could be considered more a philosophy rather than a "religion" in the Western sense. The major Chinese ideology emphasizes the societal, political, and familial relationships of men within various social structures and accentuates the cultivation of the self in order to achieve these ideal relationships. In doing so, one can achieve the ideal "self." In achieving the ideal self, Confucianism, "…is grounded in a desire to transform the larger world."[28] Having been adopted later in the Han dynasty, Confucianism as a state ideology became immensely influential in shaping ideas and beliefs in regards to humans and their environment. Firstly, because Confucianism emphasizes "benevolence" and "morality," it could be said that, "it would be easier to establish a suitable human society with an appropriate obligation to nature."[29] Next, the attention in Confucianism on attaining a natural social order could be extended ideologically into environmental relationships because there is a necessity of, "the harmony of humans with the environment."[30] Ultimately, while many philosophies are up to the interpreter of said philosophies, Confucianism would seem to advocate anthropogenic environmental changes *only if* they do not disturb the laws of nature.[31] Perhaps this is why during the Han dynasty, when Confucianism would be truly embraced, the creation of laws for natural

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[28] John Grim, "The Roles of religions in activating an ecological consciousness," *International social science journal LXII* 3, no. 4 (2011): 256, doi:10.1111/issj.12008.
[29] Ji Li et al., "Environmental Protection of Panda Habitat in the Wolong Nature Reserve: A Chinese Perspective," *Environmental Ethics* 36, no. 2 (2014): 190.
[30] Ibid., 191.
[31] Ibid., 191.

conservation would arise—what if rulers at the time perceived the laws of nature as having been upset and thusly strove for rectification of the problem?

Like Confucius, Laozi does not mention "ecology" or "environmental ethics" in a way that would satisfy one's desire for understanding between the complicated relationship between Daosim and the environment.[32] Despite this, Daoism may have inspired Daoist thinking in regards to the human-environment dynamic, making the religion equally important. A key component of Daoism is *ziran* 自然, which could be understood as having natural implications by supporting "all things in their natural state," without taking, "any action."[33] Another important concept of Daoism is *wuwei* 无为, which is typically seen as a path of non-action or, "refrain[ing] from coercive policies and practices."[34] Therefore, Daoist thinking in relation to the environmental mitigation could be understood as maintaining principles coherent with *ziran* and *wuwei*, allowing, "…the environment to evolve and develop by itself without human intervention and coercion."[35] Undoubtedly, the relationship between anthropogenic environmental changes and predominant Chinese philosophies are much more complex than the broad analysis offered above; however, these overarching concepts undoubtedly shaped Chinese ecological treatment in some way or another.

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[32] Eric Sean Nelson, "Responding with Dao: Early Daoist Ethics and the Environment," *Philosophy East and West* 59, no. 3 (2009): 297, doi: 10.1353/pew.0.0061.
[33] Karyn Lai, "*Ziran* and *Wuwei* in the *Daodejing*: An Ethical Assessment," *Dao* 6, no. 4 (2007): 332, doi:10.1007/s11712-007-9019-8.
[34] Ibid., 332.
[35] Ji Li et. al., "Environmental Protection of Panda Habitat in the Wolong Nature Reserve: A Chinese Perspective," 192.

The Spring and Autumn Annals and the Mandate of Heaven

During the Zhou dynasty, the Spring and Autumn annals suggests the occurrence of natural droughts throughout the text, recording that sacrifices for rain occurred throughout the services of Duke Saeng, Duke Chou, and so on.[36]

An incredibly significant detail arises out of the annals during the fifteenth year of Duke Xuan, when the Duke mentions locusts infesting the kingdom during the winter. Although this may seem like an inconsequential detail when hidden alongside other various happenings of the kingdom year by year, it differentiates from the other annual recountings. Infestations were not something typically mentioned throughout the Spring and Autumn annals, making this insertion strange. Additionally, during this year (594 BCE) the Duke Xuan had made changes to the tax system which were unfavorable, where taxes were based on the acreage of land held by landowners. A later commentary written sometime between the Warring States period and the Han dynasty called the *Tradition of Gongyang*, suggests this insertion in the Spring and Autumn annals was due to the fact that the new tax system was introduced, and the heavens expressed their displeasure via environmental havoc. The following year, the system was reversed, and it is said that bountiful crops grew.[37]

This introduces an interesting concept that remains relevant until the fall of the dynastic system—the idea that a ruler's actions and the environment are invariably tied. If a ruler made a troublesome policy, then the land would experience various environmental disasters. If a ruler made consistently good policies, harvests would be bountiful, there would be plenty of rainfall,

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[36] James Legge, *The Chinese Classics, Volume 5*, Parts I and II, (London: Trübner, 1872), https://archive.org/details/chineseclassics01legggoog.

[37] Andrew Gosling, *Asian Treasures: Gems of the Written Word*, (National Library of Australia, 2011), 49.

and other environmental conditions would remain relatively good. Therefore, if environmental conditions were poor and natural disasters occurred, the ancient Chinese would believe the ruler to have lost the Mandate of Heaven that was established during the Zhou dynasty. This demonstrates the importance and prominence of the Mandate of Heaven as a ruling ideology throughout pre-modern Chinese history, as the relationship between ruler and natural world affects practically all subsequent dynasties.

However, it is also difficult to ignore this relationship from a simple scientific standpoint. The generally held notion of "before-current-era-peoples" is that they were not advanced (comparatively to modern peoples, of course) and they utilized mythology to explain phenomena in which they had neither the intelligence nor technology to understand. But this concept is challenged when considering the early Chinese's "Mandate of Heaven" in regards to the ruling elite and the environment. Ancient Chinese philosophy may or may not have had an in-depth and scientifically backed understanding of the relationships between political policy and environmental damage, but their "mythology" seems to hold as much truth in this regard as anything scientific. For example, Zhou Chinese philosophers probably did not understand evapotranspiration—the process in which water is released into the atmosphere via vegetation, soil, and other impermeable surfaces. This is especially so considering that research on the kinetic theory of fluids was not first published until 1926, which is an essential component in understanding how the evaporation of water plays a role in the earth's water cycle.[38] However, a ruler that supported deforestation endeavors would likely see a lack of rainfall in directly affected regions due to the forest's lack of ability to recycle rainfall into the atmosphere without

[38] Villiam Novák, *Evapotranspiration in the Soil-Plant-Atmosphere System*, (Springer: New York, 2012). 3.

balanced vegetation. Similarly, because rainfall would not be absorbed by plants in deforested areas, underground water runoff would be greater, potentially causing flooding in rivers where runoff lets out.[39] Thusly, in some manner, policies that disregarded the environment could potentially cause a ruler or ruling family to lose the Mandate of Heaven via "natural" disasters such as floods or droughts.

Of course, this concept likely more applies to dynasties in later periods where massive deforestation endeavors took place, and less likely that they occurred during the earlier periods of Chinese history where much natural vegetation remained. But the concept that an emperor could lose the Mandate of Heaven because environmental disasters indicated the disapproval of an Emperor by Heaven was an influential product of this time period. Perhaps ancient Zhou philosophers understood the complicated relationship between a ruler and environmental disaster and their scientific ventures in the topic have been lost to history; perhaps, it is merely happenstance that their philosophy was a correct one despite not being scientifically explored. Despite these uncertainties, in the eyes of the people the ruling elite had a responsibility bestowed upon them by heaven to maintain societal and environmental order. If the environment showed signs of unbalance and distress, it was more often than not believed to be a consequence of poor policymaking by the ruler and in many ways, that philosophy holds true.

The Inauguration of Chinese Imperialism and Unification

The Qin government was a western neighbor to the Zhou kingdom, having existed since before the Zhou dynasty ever overthrew the Shang kingdom to begin the dynastic system. Due to

[39] Luiz E. O. C. Aragão, "Environmental Science: The Rainforest's Water Pump," *Nature* 489, (2012): 217-218, accessed January 31, 2015, http://www.nature.com/nature/journal/v489/n7415/abs/nature11485.html.

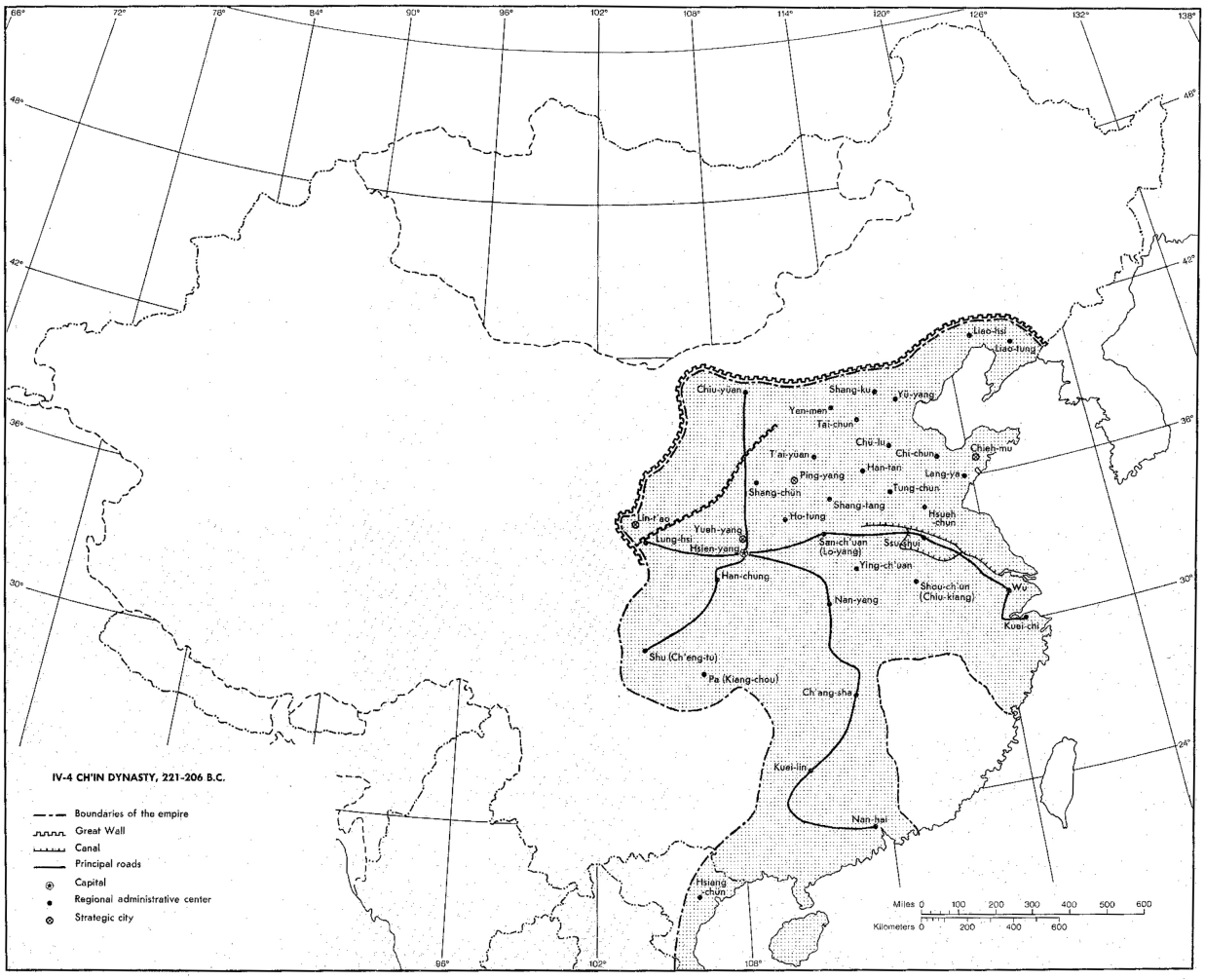
their proximity, much of their history is incredibly similar when it comes to agricultural advancements, philosophies, economies, governments, and so on. However, Qin laws were relatively more severe than those of the Zhou dynasty because the Qin kingdom ascribed to legalism, a philosophical system that was a product of Eastern Zhou philosophical advancement.

The reason the Qin achieved political dominance over the China Proper region was due to the extent of the kingdom's efficiency, standardization, and good land acquisition. Before the Qin dominated China, they existed as a state in the Wei River Valley at the old Western Zhou capital. The Qin's environmental surroundings played no small part in the kingdom's ascension to political relevance and ultimately Chinese unification. The land was good for agricultural advancement, which assisted the government in remaining strong and stable. Additionally, Qin irrigation advancements allowed for even better land development. As the Qin conquered more and more territories in China proper, the kingdom began to gain more and more resources—like land, water access, etc.—that were necessary for maintaining a strong kingdom. Without a strong grasp on resources and control over those resources, the Qin may not have been able to overthrow existing kingdoms and unify China. This demonstrates the necessity of environmental control to political stability from a nation-building perspective.

In 256 BCE, the Qin unified China and King Zheng ascended to rulership with the new title of Qin Shi Huang 秦始皇. With a truly unified China under his supervision and control, Shi Huang transformed the Chinese environment—physically, socially, and politically. Recalling on the shortcomings of the Zhou kingdom, the Qin recognized the importance of unification in order to maintain defense and further expansion.[40] Qin leaders also recognized history and dissenting

[40] Tanner, *China: A History*, 93.

Map 1: Qin Dynasty



Ch'in Dynasty , 221-206 B.C. [map]. 1:400 miles. In: Chiao-min Hsieh. *Atlas of China*. New York: McGraw-Hill, 1973, 226.

philosophy as creating complications in this unity, and therefore crusaded against Confucianism (which challenged the Qin's strict adherence to legalism). Qin strength, establishment, and standardization allowed for greater territorial expansion of the dynasty, which eventually would allow the Chinese people and government more influence over the natural environment. Qin Shi Huang eventually established dominion over the south, well into Guangdong and Guangxi.

Additional advancement during the Qin dynasty established future Chinese cultural security. By expanding upon roads and building canals, Qi Shi Huang equipped the nation for the

ability to more easily travel for generations to come. The ability to travel by boat via canal allowed for greater expansion, discovery, expeditions, and economic advancement. However, in the construction of canals there was the creation of a tradition of controlling water which would be pursued to a hefty extent in later dynasties, such as the Sui. Along with the creation of these canals would come increases in flooding which would in turn encourage larger land transformation in order to prevent these floods from occurring.

The Qin dynasty's military rule and hasty ascension to power eventually led to its demise after Qin Shi Huang's death. Without Qin Shi Huang, the government could not maintain a tense grip on the land holdings; however, these land holdings similarly put a massive strain on the Qin economy which led to discontent and rebellion. A battle for sovereignty occurred between many different people, until Liu Bang gained control of the throne and began the Han dynasty in 202 BCE[41]

The unification of China under the Qin dynasty established a precedence that would be looked back upon for dynasties to come. Although the Qin dynasty borrowed much of its customs and environmental habits from its neighbors and its tradition from preceding kingdoms, by establishing a national unity the Qin similarly established a national tradition. All of the practices and beliefs that had previously been utilized by these early dynasties merged into one "Chinese identity" under the Qin's unification. Perhaps different cultures or kingdoms with different practices and beliefs could have potentially arisen and changed Chinese national identity and tradition—as had occurred several times previously. However, with Qin unification

[41] Tanner, *China: A History*, 93.

all aspects—good and bad—became a part of a Chinese history that would shape the nation forever.

Environmental Background

木. Despite the distance in history, the natural physical features of modern-day China are relatively similar to the ones that existed prior to the presence of *Sinathropus pekinesis.* Edmonds in his book *Patterns of China's Lost Harmony*, claims that although the topography is comparable to China's modern topography, "The climate… was warmer and moister and there was a greater forest cover. The hilltops were covered with coniferous trees [trees with needles or scales for leaves] while lower down the slopes deciduous trees [trees that lose their leaves each fall] predominated."[42] One factor (of which there are many) that may have led to this "warmer and moister" climate was that prehistoric china obviously pre-dated mankind's agriculture, architecture, and war; thusly, it similarly pre-dated mass deforestation undertaken by both time and governments. Several studies throughout several regions (monsoonal, tropical, etc.) have shown that mass deforestation can lead to reduced precipitation and desertification of connected regions; therefore, it is possible that this difference in climate between pre-historic china and modern china is not a natural occurrence but instead manmade.[43]

However, another explanation of this difference may be that during the later Paleolithic period northern China underwent environmental changes that transformed some of the northern landscape from relatively forested to more grassland-like, due to a gradual cooling in the area

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[42] R.L. Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 26.

[43] N. Devaraju, Govindasamy Bala, and Angshuman Modak, "Effects of large-scale deforestation on the monsoon regions: remote versus local effects," *Proceedings of the National Academy of Sciences* 112, no. 11 (2015): 3257-3262, accessed 25 January, 2015, www. pnas.org/cgi/doi/10.1073/pnas.1423439112.

that took place between 3000 and 1000 BCE[44] These changes were likely natural ecological metamorphosis, but "...hilly areas in Shanxi and Henan were more forested than today."[45] Indeed, there is evidence of natural deforestation in Shandong mountain forests occurring after 2500 BCE, causing the broad leafed trees which dominated the forest to decrease in numbers.[46] However it is still very likely that both mother nature and mankind worked in conjunction to create the arid environment of northern and central China that exists modernly, despite the natural changes in environment that occurred during the later palaeolithic and Neolithic period.

During the beginning of the Neolithic era, a natural warm period developed over the north which caused broadleaved trees to replace coniferous trees near modern-day Beijing. During the presence of the Yangshao, "it is thought that the climate of East Asia turned cold and warm on four occasions."[47] This exhibits the sheer versatility and strength of the early Chinese, who—aided by the strengths of agriculture and pre-modern technology—managed to survive the despite the troublesome circumstances.

During the beginning of the Western Zhou, an increase in population disrupted the balance between people and available land, making land an economic commodity and a promising investment for wealthy families.[48] Due to the increase in worth of farmland, motivations to clear forests increased, adding human authority over forests, other flora, and the fauna that lived within these forests. Population increases and advancements in technology in the

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[44] Harold Tanner, *China: A History*, 17.
[45] Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 27.
[46] Li Jihua 李计划, "Shandong Senlin De Lishi Yanbian" 山东森林的历史演变 [Historical Evolution of the Shandong Forest], *nongye kaogu* 农业考古, no. 1 (1987): 221.
[47] Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 26.
[48] Robert Marks, *China: Its Environment and History*, 65.

Zhou offered an economic rationale for the large scale forest clearing that encapsulated dynasties for thousands of years to come.The Beijing area during the Eastern Zhou dynasty (770-221 BCE) is reported to have have had an abundance of, "...fruit and nut trees such as dates and chestnuts as well as other trees."[49]

水. During the late Paleolithic and Neolithic era the Chinese certainly did not have control over water to the extent that they later would with irrigation and canal building. Despite this, water in the early Chinese environment is important to note due to the fact that the water landscape in the north was a significantly different image than if one were to explore the northern territories of China today. Where modernly one in northern China would find very little to no vegetation whatsoever, "...there were dense forests and many bogs, marshes, and lakes, supporting such animals as tapir, elephant, water deer, elaphure, crocodile, and other species that are now found in South China and Southeast Asia but no longer in the north."[50] Where freshwater lakes used to once exist in the north, so did root vegetables which needed a moist and warm environment to flourish that could have once fed the early proto-Chinese.

Although most of this project will focus on the Yellow River, there were three other important rivers that were essential to ancient Chinese civilizations: the Huai, Yangtze, and Pearl rivers. While each of these acted as a source of life and economy for both the early and the modern Chinese, "all of these river basins were - and still are - prone to flooding, having massive water catchments [in their basins] which receive abundant quantities of rain brought by monsoon

[49] Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 30.
[50] Keightly, *The Cambridge History of Ancient China*, 43.

winds during the summer and spring."[51] Flooding was such an issue in early Chinese society that it shaped both societal standards and mythology in pre-modern China. Water and silt with some frequency in these regions buried homes, businesses, and families, truly necessitating control over water for social, political, and economic stability.[52]

The Yellow River during the early period of Chinese history was relatively different than the Yellow River modernly. The presence of the Yellow River in the young pre-modern China was a crucial asset that aided human survival, as it provided extensive opportunities for agricultural progress. Although the river would later suffer increases in both alkali and salts in the soil surrounding it—which can make agriculture incredibly difficult or completely impossible — the Yellow River during the Neolithic era and throughout most of Chinese antiquity nurtured early human life and expansion.[53] The early Yangshao transformed the environment near the Chang River Delta, as rice began to become a more and more a staple crop in the south, the excessive farming loosened the soil and marked the beginning of the Yellow River becoming truly yellow.[54]

During the Western Zhou dynasty mankind began governing water movement, building canals to access water in regions where the water table was too deep in the earth to rely on wells.[55] Later, The Qin undertook irrigation projects to create even more lush land for development— "...between 277 and 267 BCE, Qin engineers diverted the Min River in Shu to

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[51] Steven Mithen, *Thirst: For Water and Power in the Ancient World* (Cambridge: Harvard University Press, 2012), 153.
[52] Steven Mithen, *Thirst: For Water and Power in the Ancient World*, 160.
[53] Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 30.
[54] Ibid., 27.
[55] Ibid., 30.

irrigate farmland on the Chengdu Plain".[5657] This extensive irrigation undertaking still exists today as the Dujiang Yan Diversion. An additional project took place in 246 BCE on the Zheng Guo Canal in order to irrigate the land near the old Western Zhou capital.[58]

动物. In regards to animals living prior to the existence of *Sinathropus pekinesis*, archaeological evidence indicates that "sabre tooth tigers, elephants…, rhinoceros, water buffalos, otters," and various other fauna comprised the main inhabitants of the natural landscape.[59] Many of these animals that traversed the landscape would go extinct before humankind had even organized into societies. However, others would find their populations largely affected by both human harvesting and human encroachment on typical animal habitats. In some of these cases, certain species' (such as the South China Tiger) habitats have been encroached upon to such an extent that these species are now critically endangered.

The massive amounts of oracle bones from cows and turtles that have been excavated not only indicate the Shang kingdom's devotion to religious practice and mythological tradition, but additionally indicates the degree of domination the Shang and later dynasties had over non-threatening animals. To date, several thousand oracle bone remnants have been unearthed and there are likely thousands more that have yet to be discovered.[60] Religion was reason enough for the early Chinese to begin exercising control over their environment other than for agricultural and food purposes, specifically animals.

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[56] Tanner, *China: A History*, 84.
[57] Tanner, *China: A History,* 86.
[58] Tanner, *China: A History,* 86.
[59] Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 26.
[60] Keightly, *The Cambridge History of Ancient China*, 237.

As time progressed, early humankind began further employing the animalian resources that surrounded them. The *Spring and Autumn Annals*, a court record written during the Zhou dynasty of the occurrences throughout the dynasty, suggests that the Asian Elephant was utilized to carry heavy loads.[61] But the usage of animals for economic purpose did not stop at just utilizing them for labor; silkworms at this time were similarly utilized for China's budding silk industry. By the Qin dynasty, China maintained a major silk industry—which many environmental activists modernly criticize due to the harm and killing of silkworm larvae during the production of silk. Typically, in the production of one gram of silk, fifteen silkworms are killed.[6263]

Chapter 1 Conclusion

As evidenced by the fact that the Longshan eventually outlived the Yangshao, farming and agriculture was absolutely essential to survival in the early years of ancient China. It has been proposed that retroactive or adaptive laws are more likely to be passed in regards to the environment as opposed to preventative ones, but perhaps we can reassess this to imply that humans will collectively do what, at the best time, offers them the best outcome.[64] In the context of pre-modern China—and especially Neolithic cultures and early dynasties—the best outcome would have been longevity and survival, therefore making the development of an agricultural society a promising collective action in which to achieve that goal. Unfortunately, modernly, it

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[61] Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection*, 29.
[62] Tan Chung, *Rise of the Asian Giants: The Dragon-Elephant Tango* (London: Anthem Press India, 2009), 16.
[63] Margherita Stancati, "Taking the Violence Out of Silk," *The Wall Street Journal*, Jan 4, 2011, http://blogs.wsj.com/indiarealtime/2011/01/04/taking-the-violence-out-of-silk/.
[64] Peter Burnell, "Democracy, democratization and climate change: Complex relationships," *Democratization* 19, no. 5 (2012): 828, doi://dx.doi.org/10.1080/13510347.2012.709684.

often seems that economic benefit outweighs environmental benefit; however, I would argue that in ancient times it would be appropriate to change out "economic benefit" with "survival benefit." Despite the fact that in a modern context one's livelihood and the economy is inseparably entwined, it would seem that during the period of mankind's unification and expansion that we see occurring during the Neolithic and later periods of Chinese history, survival held priority status over economic advancement.

If a kingdom in pre-modern China could establish control over nature, could it potentially produce stability in the short-term? As we can already see in early Chinese civilizations, without a good system of resistance to the environment, societies had problems with longevity and survival. Those who are not prepared for "extreme weather events" and "climate instability" are typically those whose societies decline in the face of ecological changes.[65] Today, it is more often than not developing nations who face instability in the event of climatic change or natural disaster; therefore, if the development of society and government in pre-modern China could fit under the classification of "developing" (even though modernly the country would not earn that title, and pre-modern development is admittedly in some ways different although the concept remains the same) then it would follow that the more that China as a country could develop, the better equipped the country could be against natural disaster and in protecting its constituents.[66]

Thusly, *why* did environmental changes occur in ancient China? Ecological relationships and behavior were initially developed in these early dynasties and carried throughout much of the rest of pre-modern Chinese history, despite retroactive attempts at ecological mitigation at

[65] Ibid., 813.
[66] Ibid., 813.

times. The rise of an agricultural empire that occurred as early as Chinese Neolithic cultures seems to have been the beginning point of environmental degradation and is perhaps one of the most important actors in ecological destruction throughout future dynasties. However, it was clearly not done out of malicious intent but instead in pursuit of the economic and social benefits of establishing a stable empire and thusly protecting citizens. Through this establishment of the agro-socioeconomic system came belief systems of the ancient Chinese based around their environment, including utilizing domesticated animals in sacrificial rituals during the Shang, the relationship between the ruling elite and ecological crisis during the Zhou, and so forth. Paired with this was a propensity for innovation—especially in the agricultural sector—that came with the ancient stability offered by the government and consistent food source (products brought forth from agricultural practices). Therefore, technological and societal innovation and ecological beliefs stemmed from the necessity for stability which produced an agricultural tradition. And, finally, the unification of China under the Qin dynasty was the first step in solidifying these traditions and belief systems in what would be considered traditionally "Chinese." Throughout future dynasties one can see these traditions underlying environmental action as the society further cemented its agricultural heritage and ultimately dominated the natural landscape.

CHAPTER 2 Gaining Environmental Control

This section will cover the periods between the Han Dynasty and the Tang Dynasty, therefore the Early Imperial Period through the Middle Imperial Period. This part in history is an interim period between establishment of Chinese identity, behavior, and environmental tradition and the environmental deterioration brought on during later dynasties. During these periods, one is able to see how the traditions and customs set as early as Paleolithic and Neolithic cultures have shaped the Chinese thoughts and actions surrounding their environments. During this time it is also clear, however, that the ancient Chinese in the Han through Tang dynasties still did not have the control over their environments necessary to guarantee political, economic, or social stability, and environmental disasters still had the potential to have a large hand in toppling governments.

This chapter, in some ways, acts as a bridge between the establishment of environmental tradition and ends before one can see environmental domination undertaken by the Chinese society. This is evident as the Tang Dynasty may have faced instabilities and eventually downfall due to climatic changes which the society could not overcome, but still operated in relation to the environment with traditions set in the early Chinese societies. The next big established national dynasty was the Song Dynasty, where population increases and agricultural increases gave mankind the advantage over the environment, especially in the face of natural disaster. That is not to say, of course, that natural disaster and ecological changes did not have effects in the Song dynasty; rather, it is that these ecological changes and natural disasters no longer created

longstanding periods of disunity as was the case when ecological disaster occurred in previous dynasties.

Continuation of Tradition

Liu Bang 刘邦 (~250-195 BCE) founded the Han dynasty and appointed himself emperor in 206 BCE. The Han Dynasty, while separate from the Qin, still continued many of the Qin's governmental precedences such as maintaining a standardized written language and currency. However, Liu Bang also discarded the the severe legal and authoritative systems which were characteristic of the Qin dynasty in favor of a more subdued approach that more closely reflected the government of the Zhou. Despite this, for the many highlighted differences between the Qin and Han means of ruling, there appears to be just as many similarities between the two. As will be discussed later, the Han continued many established Chinese traditions and projects following the unification of China under the Qin.

A significant problem that presented itself to Chinese dynastic longevity were nomadic societies present in China's periphery on the Steppe. At the time of the Han, the major group of nomads that threatened Han security were the Xiongnu. However, under Han Wudi 汉武帝 the Han dynasty began the undertaking of solving its struggle with the nomad civilization. Initially, the Han emperor sent a diplomat named Zhang Qian 张骞 (d. 113 BCE) into the steppe region in 139 BCE, hoping to form alliances with nomad kingdoms in order to protect the kingdom.[1] Yet, when this approach failed, Han Wudi instead approached the Xiongnu problem with ferocity that would ultimately lead to the desertification of the Steppe. When Zhang Qian travelled through

[1] Harold M. Tanner, *China: A History*, 97.

Xiongnu territories, he relayed to the Han government the ways in which the nomads survived within the grasslands. In doing so, Zhang Qian provided the emperor with a perfect strategy for eradicating the Xiongnu—destroying the environment in which they and their herds thrived and colonizing Xiongnu territories. After a lengthy period of campaigns against the Xiongnu beginning in 129 BCE, the Han began the process of claiming Steppe land for agriculture. This strategy, called tun tian 屯田, was a war policy created by a Chinese general named Zhao Chongguo 赵充国 (137-52 BCE). There is debate amongst historians whether or not these military-run agriculture systems were developed in order to supply food to Han soldiers on the Steppe or as a war strategy for eliminating the Xiongnu; however, considering that in Zhao Chongguo's correspondence with the Han government he specifically outlines tun tian as a military strategy, the latter is somewhat more compelling.[2]

As can be seen in the map below, Han territory expanded significantly due to this action compared to it's Qin predecessor (whose territorial map is in the first chapter). Not only did this invasion seriously detriment a nomadic culture, it also posed a threat to the environment. While nomadic tribes were not entirely benevolent in their treatment of their surroundings and utilized much of the natural land in their territories to allow their animals to graze, the Chinese tradition of natural resource utilization and exploitation was much more prevalent and much more destructive. As had been seen in earlier dynasties, the tradition of the agricultural society had already been established, and upon the expansion into Xiongnu territories the Chinese had simultaneously obtained a large amount of land in which to inflict that tradition upon. Thusly,

[2] Edward L. Dreyer, "Zhao Chongguo: A Professional Soldier of China's Former Han Dynasty," *The Journal of Military History* 72, no. 3 (2008): 665-725, http://search.proquest.com/docview/195631261?accountid=8268.

while the policy was beneficial to the Chinese government as it eradicated two problems—(1) the threat of war and (2) the threat of not having enough land to support a growing population—at once, it introduced the problem of land exploitation in future dynasties and the desertification of the delicate ecosystem via agricultural practices. This expansion therefore can be seen as a historical bridge between ancient Chinese traditions and ideas about their environment and future treatment towards the environment which ultimately ends in the desertification of the north.

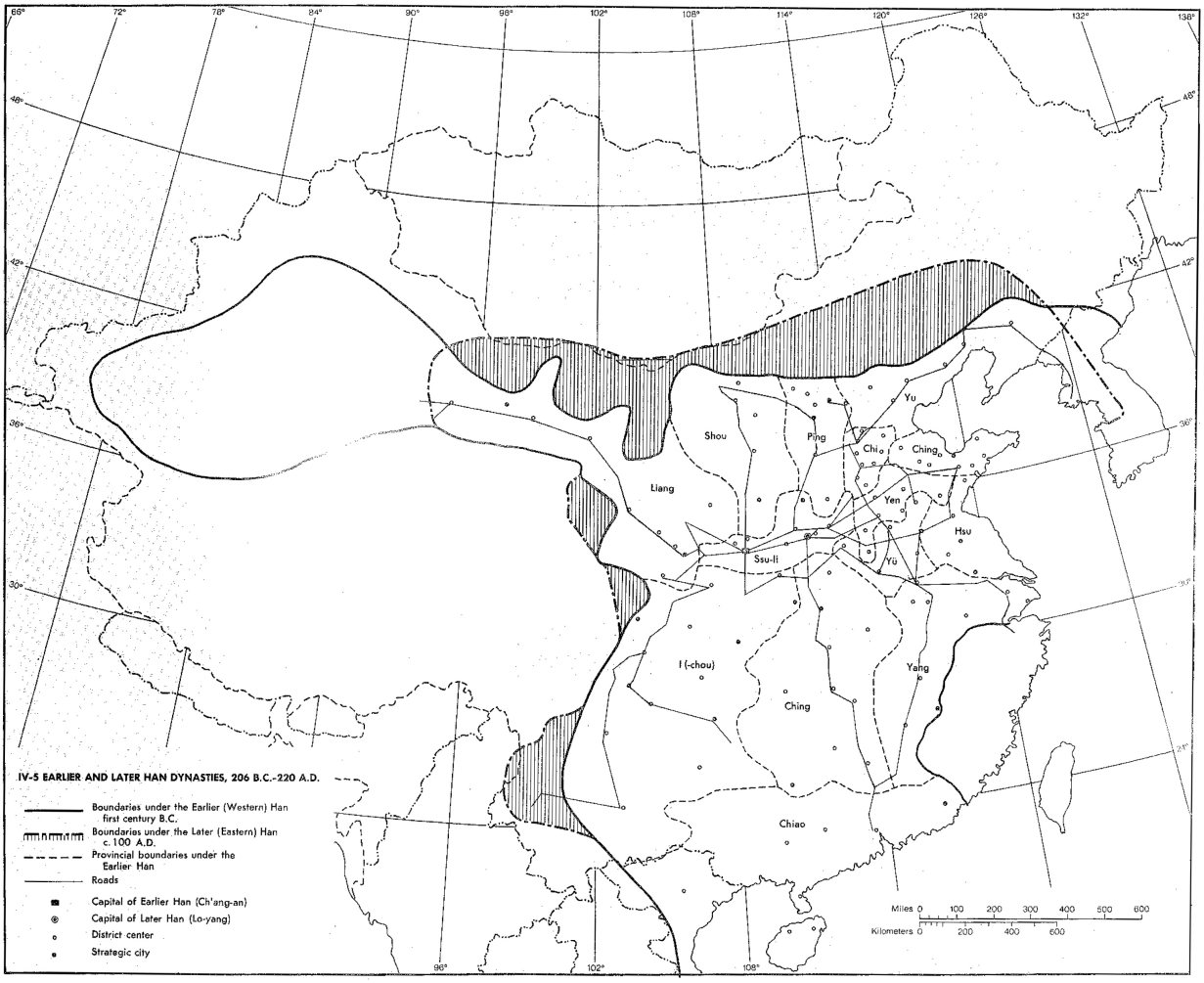
The Qin, before their fall, had established a road system that was later adopted as well in the Western Han dynasty. The Qin had created a road called the zhidao which traversed through much of the Chinese country at the time and acted as a unifying landmark for the Chinese. Picking up where the Qin government had left off, the Western Han government expanded the road system, "...from five to seven the major arteries flowing from the capital to every corner of the empire."[3] This allowed for the development of larger trade of agricultural products, an expansion and solidification of cultural practices with an expansion of contact capabilities, and the emergence of societal advancements and conveniences (such as a postal system).

Qin and Western Han Dynasty empire expansion not only allowed for the growth of their economy and social system but similarly expanded their grasp over their environment. Roadbuilding allowed human relocation into areas which had previously not been inhabited or been under kingdom control, which in turned allowed agriculture to sprout in previously untouched areas. The Han road expansion made available areas in the south, southwest, and northwest by carving through mountains and laying down roads of hundreds of miles.[4] Roads gave the emperor and future emperors access to regions that they previously had not. Roads

[3] Robert B. Marks, *China: Its Environment and History*, 82.
[4] Robert B. Marks, *China: Its Environment and History*, 82.

allowed for easier and cheaper transportation of agricultural products, creating more production possibilities for agricultural growth overall and likely boosting the agricultural industry. Increased agricultural possibilities incentivized growth in the industry and the seizing of new agricultural lands, which as we know is one of the underlying factors of poor environmental health in ancient China that continues modernly.

Map 2 : Han Dynasty



Earlier and Later Han Dynasties, 206 B.C.-220 A.D. [map]. 1:400 miles. In: Chiao-min Hsieh. *Atlas of China*. New York: McGraw-Hill, 1973, 228.

An additional development that occurred during the Western Han period was an expansion of both agriculture practices and agricultural products, which is potentially responsible for a boom in the population at the time, and perhaps also a consequence of road expansion. Agriculture supported almost every aspect of Western Han Chinese life, as the Han developed a system where small farmers would support the state via taxes. Just as the Qin had enforced an agrarian economy over a market economy, so did Emperor Wu, "...who monopolized major industries (iron and salt in particular), suppressed trade, and taxed merchant wealth out of existence."[5]

While in later dynasties there would be an increase in agricultural technology and production caused by an increased demand for agricultural products, in this early kingdom it appears that population growth was instead a product of agricultural advancement. Without the tumultuous times that occurred during the Warring States period, some several million people enjoyed the unification that the Qin dynasty had brought to China. In Chang'an 长安 alone (the Western Han capital), the city boasted "...close to a half-million residents (maybe more), with lively commercial, manufacturing, and educational districts."[6] Naturally, increases in population caused increased stress on the environment, as more farmers were able to farm more land, as more people required more food and agricultural products, as more people produced more waste, and so on. Additionally, increases in population would incentivize further expansion and resource exploitation in later dynasties. Certainly, throughout Chinese history there appears to be a tradition of population growth and ensuring population growth and ability to achieve population

[5] Robert B. Marks, *China: Its Environment and History,* 84.
[6] Robert B. Marks, *China: Its Environment and History,* 90.

growth, so it would seem that China's modern population issue has precedence in Chinese history time and time again.

As would be anticipated, with the expansion of territory during this period, came economic opportunities that maintained the new, bustling population. It is important to note that land consolidation brought new people into Chinese national territory which would have also accounted for increases in population. However, the central government's focus on these economic opportunities such as development and expansion stretched the government's resources thin, causing powerful, land-owning families to eventually develop greater powers than those of the government itself. This weakness culminates in the division of the Western (or former) Han dynasty, when Wang Mang 王莽—a nephew of the Empress—led a coup against the standing emperor and began the short-lived Xin dynasty in 10 CE.[7] Following the fall of the Xin dynasty, the Han dynasty was re-established in 25 CE, beginning what is typically called the Eastern (or later) Han dynasty in Luoyang 洛阳.

During the Eastern Han, much of the advancements in agriculture that had been innovated in the Western Han became increasingly more commonly used. Agricultural practices became exponentially more productive as, "...iron tools, iron ox-drawn plows, brick-lined wells, and the seeding, weeding, fertilizing, and irrigation techniques of intensive agriculture," became more and more conventionally used by Han dynasty farmers. Innovation in the agricultural sector portrays the heavy reliance on and the tradition in agricultural practices and society. The wheelbarrow is said to have been invented during this period of Chinese history for easier and quicker transport, giving farmers a technological boost which likely would have increased

[7] Harold M. Tanner, *China: A History,* 106.

production capabilities.[8] As would continue throughout the next several thousand years and as had been determined by Chinese tradition, innovation often supported overexploitation of land (ultimately the cause of deforestation, siltification, and destruction of animals and animal habitats alike) due to the basis of Chinese society on agro-socioeconomic systems.

However, these small farming families did not enjoy the fruits of their own labor. More so than during the Western Han, a system had developed during the Eastern Han dynasty where wealthy families owned large plots of land, and multiple farming families would live on and farm the land to the benefit of these few wealthy families. To add further to the unfortunate circumstances faced by farmers, government overextension led to a lack of government aid to poor farming families, so that especially in the face of natural disaster these farming families were left largely to fend for themselves.

The system of Han dynasty farming eventually led to the dynasty's downfall—the exploitation of the poor for the prosperity of the families who owned the land and state catalyzed the fall of the Eastern Han. The similarly overextended military ultimately took advantage of the instability created by the peasant revolt, and divided the kingdom amongst themselves, creating the Wei, Shu, and Wu kingdoms. China remained divided until a short reunification under the Jin dynasty in 280 CE, and a more successful unification under the Sui dynasty in 581 CE. Until then, China was thrust into what is sometimes referred to as the, "Age of Disunity." Therefore, it would seem that while economically prosperous in the short run, the over-expansion of both Han territory and resources, and additionally the profitable system of farming was neither societally nor environmentally sustainable. This demonstrates an interesting facet of the relationship

[8] M. J. T. Lewis, "The Origins of the Wheelbarrow," *Technology and Culture* 35, no. 3 (1994): 453-475, doi: 10.2307/3106225.



Fig. 2: Remains of the Edicts at Zhangjiashan

"丝路上的世界遗产," 今日头条, last modified March 18th, 2015, <http://toutiao.com/a4093120506/>.

“si lushang de shijie yichan,” jin ri tou tiao, last modified March 18th, 2015, <http://toutiao.com/a4093120506/>.

between societal growth and ecological growth—economic growth in some ways threatens them both.

Conservation during the Han Dynasty—The Edicts of Zhangjiashan

Under Han Wudi 汉武帝 there was a reorganization of the state so that a large amount of landownership was centralized and held by the government, not by private parties or families. While Han Wudi's initial intention in this land annexation was to gain an increasing amount of spendable capital for the government, it put large amounts of land in the hands of the government, who had the money and power to transform it to better suit the kingdom's needs.[9] This shift is an important one, as it feeds the the debate regarding private or publicly held land as a component of ecological stress alleviation.[10] While it is easier to produce good environmental mitigation and conservation policies when land is in the hands of a government with the desire to assist in ecological benefit, it is simultaneously easier for a government to exploit the resources that this held land has to offer. Luckily, in this specific situation, the new land was in the hands of a government who wished to protect it.

It is presumed that by the time the Han had existed, there had been a noticeable decline in environmental health which eventually prompted the emergence of conservation tactics and conservation law. We can speculate this due to the emergence of statutes and laws during the Han dynasty that explicitly outlawed certain ecological practices typically associated with environmental degradation. A recent archeological discovery at Zhangjiashan recovered Han

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[9] Robert B. Marks, *China: Its Environment and History*, 76.
[10] Peter M. Morrisette, "Conservation easements and the public good: preserving the environment on public lands," *Natural resources journal* 41, no. 2 (2001): 373-426.

statutes on the environment painted onto a wall, called tian lü (田律) or "Statutes of Fields."[11][12] There is uncertainty surrounding whether their nature is truly one of conservation or rather ritualistic or philosophical, but given the destructive circumstances of Han dynasty expansion in Xiongnu territory, there is certainly an argument to be made for a Han stride towards conservation.[13] This is especially considering that with poor environmental performance following the destruction of lands, the ruling family may have felt it within their best interest to attempt to conserve resources and reverse damages in order to maintain the Mandate of Heaven and keep civilians from revolting.

Some recoverable edicts from the Zhangjiashan wall include:

> ""Do not encroach on waters or marshes, [or] drain ponds [...] . Only then will people everywhere be able to catch fish. This is constantly forbidden until the end of the [...] month" (line 26).
> "Do not burn mountain forests. This refers to setting forests on fire for hunting, as that harms fowl, beasts [...] snakes, insects, plants, and trees [...] month until the end of [...]" (line 27).
> "Do not kill fetuses. This refers to wild and domestic animals that are pregnant and bearing fetuses. [Killing them is] constantly forbidden until the end of the twelfth month" (line 12)."[14]

Additionally, larger trees were given restrictions against being cut, although this could have also possibly been a measure that reserved the best trees for the dynasty rather than a conservationist one.[15] Regardless, the Zhangjiashan edict combined with other, earlier historical texts create a strong case suggesting both the Qin and Han attempted to protect their forests.

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[11] Charles Sanft, "Environment and Law in Early Imperial China (Third Century BCE—First Century CE): Qin and Han Statutes Concerning Natural Resources," *Environmental History* 15, no. 4 (2010):701-721.
[12] E.N. Anderson, *Food and Environment in Early and Medieval China* (Philadelphia: University of Pennsylvania Press, 2014), 132-133.
[13] Charles Sanft, "Environment and Law in Early Imperial China (Third Century BCE—First Century CE): Qin and Han Statutes Concerning Natural Resources," 706.
[14] Ibid., 709-711.
[15] Charles Sanft, "Environment and Law in Early Imperial China (Third Century BCE—First Century CE): Qin and Han Statutes Concerning Natural Resources," 709-711.

Certainly, with expansion occurring at rapid paces and the economy becoming more and more reliant on wood, wood had a large economic value that would be within the dynasty's best interests to protect.

Yet, it still should be mentioned the economic perspective of these edicts. Although Sanft in his article "Environment and Law in Early Imperial China…" leans towards a conservationist interpretation of these edicts, it is undeniable that maintaining habitats for fish and saving younger, easier-to-catch animals for a later hunting season when they would be more grown would both be in the best interest of their respective economic values. And, certainly, preserving young animals in order to hunt them later in the same year still would not likely preserve their numbers in any discernible amounts. Simply, if individuals did not encroach on China's resources in non-allowable periods, it may have saved these resources for later use by the central government when these resources had higher economic value. Regardless, the fragmented nature of the remnants of this wall seem to suggest heavily Sanft's interpretation, although there are certainly other interpretations to be had.

Unfortunately, it appears that environmental degradation from the Han onward continued to occur despite the central government's best efforts, and that the beliefs laid out by the Zhangjiashan edict were not pervasive enough to affect subsequent dynasties and laws effectively. While, "...it is possible that these laws slowed damage to the environment in ways that are no longer perceptible to us," other issues existing within the dynasty created a climate where these laws could not be properly addressed and enforced.[16]

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[16] Charles Sanft, "Environment and Law in Early Imperial China (Third Century BCE—First Century CE): Qin and Han Statutes Concerning Natural Resources," 715.

Interestingly, this instance parallels with attempts at enacting environmental policy today. Modern environmental policy still can be just as ineffective as environmental policies established during the Han dynasty, mainly due to the difficulty of establishment and enforcement, and additionally the difficulties governments face in balancing economic, political, and social goals and environmental benefit.

Issues Surrounding Traditional Chinese Medicine

What is commonly referred to as "traditional Chinese medicine" can be traced back to the Shang Dynasty with acupuncture practices, but has many roots in Daosim which truly took hold during the later part of the Han dynasty around 100 CE. Therefore, it would follow that traditional Chinese medicine became an increasingly important part of traditional Chinese culture around the time of the Han dynasty. Traditional Chinese medicine typically utilizes herbal and animal products in its creation, and served as a remedy to various ailments afflicting the body.

Due to traditional Chinese medicine's usage of animal products, it becomes a large ecological issue, especially because many of these medicinal concoctions utilize animal parts that the animal cannot survive without, and similarly condone the capture of non-domesticated animals for medicinal purposes. Around 13% of traditional Chinese medicine uses animal derivatives in order to heal the human body.[17] Parts from tigers, bears, rhinos, the Giant salamander, sharks, deer, seahorses, antelope, cattle, goats, dogs, geckos, pigs, turtles, snakes, buffalo—just to name a few—are all examples of animals whose parts are utilized in traditional

[17] J. Still, "Use of animal products in traditional Chinese medicine: environmental impact and health hazards," *Complementary Theories in Medicine* 11, (2003): 118, doi:10.1016/S0965-2299(03)00055-4.

Chinese medicinal creations. Many of these, however, have not withstood the test of modern science for having actual medicinal properties, creating even further moral ecological problems surrounding the usage of animals for human medicinal purposes.

Further ethical issues surround traditional Chinese medicine due to the usage of animals that are endangered or nearly extinct in certain products. The expansiveness and prevalence of traditional Chinese medicine to not only Chinese culture but other various cultures throughout the world create a market and desire for parts such as rhino horns, tiger bones, and salamander skin—all of which are belonging to endangered or nearly extinct species and similarly cannot be retrieved without certain death to the animal. Even in animals bred explicitly for the purpose of their usage in traditional Chinese medicine, it is difficult to ascertain whether or not their parts are harvested humanely or not.

While modernly, many laws regarding the usage of medicine that have roots in traditional Chinese medicines regulate or outrightly ban the sale of medicines utilizing animal products, traditional Chinese medicine still harbors many ethical and ecological problems. It has affected animal populations since its birth in Chinese society, and still only recently in the expanse of human history has been regulated at all. However, it is imperative to remember that its usage was in the interest of preserving human life, not in the interest of destroying animal life. This acknowledgement is important because humankind still utilizes animal products modernly in order to enhance the living experience of humans, and it is critical to consider the trade-off between animal life and human life in this way and in a modern context. Today, one can look at the chemical properties of the part of an animal and ascertain whether or not it will help the human body, the ancient Chinese only had the ability of examining the physical effects of a

medicine, which may or may not have worked solely due to placebo effects on the body. Therefore in many ways it is easy to criticize these practices, especially from a Western perspective where tradition is not rooted in these types of therapy. Yet in many ways modernly, even in the West, humans still utilize animal parts for various consumption practices. In some of these usages there is little scientific backing towards the individual benefit of consuming a good, which may even outweigh the social marginal benefit of consuming an animal product. Even in Western culture there is a adherence to tradition in ways which counteract both the environment and personal health, such as the consumption of red meats.[18]

The take-off of Chinese traditional medicines and usage of animals for bodily well-being may stem from the usage of animals in the Shang dynasty, as animals then would have been utilized for spiritual-wellbeing via sacrifice. Additionally, acupuncture—a component of Chinese traditional medicine—began somewhere around the Shang dynasty, giving traditional roots in early pre-modern China to this medicinal practice. This medicinal practice continues modernly, the creation of it still even threatening some threatened species such as the rhinoceros, making the practice of Chinese medicine one of the oldest traditions in China (having likely begun around the same time sedentary, agricultural lifestyles came about) that—unlike an agro-socioeconomic system—continues today.

Solidification of an Agricultural Empire

Marks suggests that the Han period acted as a pivotal time in which the Chinese could have shifted to a market-based economy, but unfortunately remained on the path of an agrarian

[18] Alessandra Tavani et. al., "Red meat intake and cancer risk: A study in Italy," *International Journal of Cancer* 86, no. 3 (2000): 425-428.

society which continued to inflict damage on Chinese natural surroundings.[19][20] However, the central government's support for agro-economic growth and market economy discouragement via harsh taxation caused a larger reliance on and tradition in an agrarian society. Throughout the next several thousand years, imperial China would continue an agrarian culture that was not only the support and basis of the nation, but also the bane of environmental well-being.

However, there is actually societal incentive in maintaining a socioeconomic model that relies on agriculture. For example, if agricultural goods and lands were essentially the most reliable and secure source of long-term income for upper-class citizens—which they were in ancient China—then lawmakers and citizens would be incentivized to preserve this system in order to achieve long-term financial, economic, social, and political stability.[21] If a multitude of citizens were able to profit from land ownership and continually profit off of land ownership for generations to come, and this means of income is a more stable means of income than any other means of income, then an economy based off of this stable product would likely be a stable economy. This is especially important considering ancient China would have relied heavily on local economies, which have intense reactions to shocks in production if a good was not a stable good (such as natural disaster, which we have already seen as being a large issue in ancient Chinese culture).

Of course, this likely was not a thought-out decision made by lawmakers or upper-class citizens, but instead the product of thousands of years of seeing what worked versus what did not

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[19] Robert B. Marks, *China: Its Environment and History*, 84.
[20] Note: This belief reminds me, however, of Robert Frost's "The Road Not Taken" in which the narrator chooses a path between two and assures themselves the path must have been the better one. However, there is no way of knowing which would have produced a better outcome. One can argue either way.
[21] Dennis P. Kehoe, *Investment, profit, and tenancy: the jurists and the Roman agrarian economy*, (Ann Arbor: University of Michigan Press, 1997), 22.

in terms of profit-earning and ensuring the security of one's family. Even in Neolithic cultures present in China, there is early evidence of an economy based on the ownership of both agricultural land, agricultural products, and livestock. Perhaps if policies supporting a more market-based economy were not squashed by early rulers in the Han and Qin, there is a chance that the destructive agrarian society present in China throughout its history would have not existed to the extent that it did; however, with tradition based in agriculture there is no doubt that an agriculture-heavy society would have still *existed*, and would have still caused environmental degradation through soil degradation, soil nutrient depletion, soil erosion, destruction of natural ecosystems, destruction of animal habitats, siltification, and overexploitation of natural resources.

When a secure human society did *not* exist is when one saw the emergence of environmental growth, such is the case with the migration of Chinese people from north to south after the fall of the Han and the pause and regrowth to some extent of northern environment occurred. This is because humans at this period in history gained stability through the destruction of the environment, which was one of the few viable options available to them at the time. This is a tradition that has carried over even into recent generations, and is a way of thinking and operating that will likely be incredibly difficult to rid human society of.

North and South China in the Era of Disunity

Although there was an increase in the value of human life during the fourth century after the fall of the Han, this increase in value was not by any means humanitarian. Proceeding the Han dynasty, the lack of unified military guarding citizens against nomad peoples caused a mass

exodus southward towards security. China has a history of large internal migration, in fact, the largest history of internal migration in the world, and this pattern is ever present in post-Han dynasty population movements.[22] However, when the Chinese people relocated southward, this created a divide of a large amount of workable land in the north and few individuals to work it. Nomad civilizations began capturing leftover Han Chinese, sometimes by the thousands or even tens-of-thousands, and forcing them to return to their settlements and work as slaves.[23] The usage of men as slaves to work agricultural land demonstrates the lack of dynastic control over the north during the 4th century, and additionally displays that the environment in the north was more or less left alone during this period of time.

Following the end of the Han dynasty and into the "Era of Disunity" (the Jin, Northern, and Southern dynasties), southern China experienced a heavy monsoon period.[24] There is potential for these atmospheric disturbances and disasters to have contributed to the level of disunity under this period of discord. The political impacts of natural disaster are community conflict and dissatisfaction with civil government institutions, which would make the creation of a steady kingdom rather difficult.[25] Additionally, especially in periods without strong government control, natural disaster has the potential to cause new groups to gain influence and potentially create societies under their own ruling elite.[26] Therefore, it appears likely that the chaos experienced during these tumultuous years after the fall of the Han had at least some initiation

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[22] Wei Shen, "China in the global migration order—historical perspectives and new trends," *Asia Eur J* 8, (2010): 25-43, doi: 10.1007/s10308-010-0246-y.
[23] Robert B. Marks, *China: Its Environment and History*, 107.
[24] Pingzhong Zhang et. al, "A Test of Climate, Sun, and Culture Relationships from an 1810-Year Chinese Cave Record," *Science* 322, no. 5903 (2008): 940-942, doi: 10.1126/science.1163965.
[25] Michael K Lindell, "Disaster Studies," *Current Sociology Review* 61, no. 5 (2013), 802, doi: 10.1177/205684601111.
[26] Michael K Lindell, "Disaster Studies," 802.

grounded in climatic change which caused disasters. Although it may just be a coincidence, the normalization and decrease of the Asian Monsoon also corresponds to the end of the Era of Disunity and the beginning of Sui unification.[27]

While many people still remained in northern China, a sizable amount had fled to the south. Of course, with the massive migration came massive environmental effects in the Yangzi River Valley and other southern civilizations. The origins of wet-rice cultivation are somewhat unclear, but recent studies done by natural scientists suggest that it began in the lower Yangzi region near the coastline some 7,700 years ago around 6,000 BCE.[28] Neolithic civilizations had settled in the south during the period, and collected soil samples suggest the usage of fire to clear land for rice agriculture and the subsequent establishment of wetland vegetation and crops. Yet, the establishment of rice paddies near the China-pacific coastline caused problems for early Chinese farmers. Coastal change and flooding marine waters forced an end to the specific paddy studied by Y. Zong and his colleagues. Although this specific coastline agricultural endeavor ultimately failed, it clearly clustered some influence because this style of farming still existed when Han Chinese migrated southward into the Yangzi river valley after the fall of the Han dynasty some 7,000 years later.

Whereas in the north Chinese farmers made their livings off of the growth of grains such as millet, relocation to the south forced farmers to face the problem of the significantly more swampy, marshy, and wet land. South China experienced much more rainfall during the spring, summer, and fall than in north China, particularly due to monsoon seasons. With the difference in

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[27] Pingzhong Zhang et. al, "A Test of Climate, Sun, and Culture Relationships from an 1810-Year Chinese Cave Record," 940-942.

[28] Y. Zong et al., "Fire and flood management of coastal swamp enabled first rice paddy cultivation in east China," *Nature* 449, no. 7161 (2007) : 459-462, doi:10.1038/nature06135.

weather and the difference in land, the dry-land crops that had typically been grown by Han Chinese civilizations were no longer viable options. Thusly, rice cultivation in the south became a goal of Han Chinese migrants from the north. It took very little time for immigrant Han Chinese to grasp wet-rice cultivation in the Yangzi valley, and ultimately they utilized these techniques and crops to rebuild their economies, societies, and governments. However, the construction of technologies to truly make these rice paddies productive would not be invented until the Song Dynasty, still several hundred years down the road.[29]

Despite this, because rice farming required a different way of farming than dry-land agriculture, it consequently created a different way of life and farming for Chinese settlers in the south. The highly-specific requirements of rice farming (such as level land and water encapsulation) meant that rice farms were significantly smaller than grain farms in the north. Therefore, large scale-farming was a less viable option, thusly creating a structure of farming much different than existed in the previously in the north where wealthy landowners held a large expanse of land where many farming families could live and work. Instead, farming families could grow *and* reap the fruits of their labors. Rice-based agriculture also required thoughtful and constant cultivation of the land for years without high rice yields, due to the fact that rice growth primes the land for future rice growth and beginning the process of it can take many small yields before producing any large ones. It furthermore had larger economic benefit to the families that grew rice comparative to those that grew wheat or millet, because rice agriculture yields more grain which allowed farmers to sell more than they had previously been able to when growing crops in the north.[30]

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[29] Robert B. Marks, *China: Its Environment and History*, 114.
[30] Robert B. Marks, *China: Its Environment and History*, 115.

Ultimately, the differences between the dry land cultivation in the north and the wetland cultivation in the south produced different effects upon their effects on their respective ecosystems. Each transformed their environments, but wetland cultivation developed a new ecosystem based on agriculture due to the usage of water. Birds, fish, and frogs all began to flourish on rice paddies, each offering different benefits to rice cultivation (i.e., fish could eat bug larvae in the water).[31] Dry land cultivation was rather exhaustive to the surrounding environment, contributing to the desertification of northern China, deforestation, and species extinction; Wetland cultivation at least in some ways allowed humankind to interact symbiotically with their environment. This is not to say that wet-land cultivation did not have its own shortcomings ecologically, but it seems to be a less destructive alternative to dry-land farming.

Although there had already been an existent practice of rice-farming in southern China since Neolithic periods, it is still easily seen the northern tradition of agriculture projected onto the southern environment via rice farming. While southern China already had a history of agriculture—even possibly predating and inspiring northern agriculture practices—the influx of people from the north created more large scale endeavors and increased cultural dependence on rice as a traditional crop.[32]

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[31] Ibid., 116.

[32] Zhang Chi and Hsiao-Chun Hung, "The Neolithic of Southern China-Origin, Development, and Dispersal," *Asian Perspectives* 47, no. 2 (Fall, 2008): 314, http://search.proquest.com/docview.199452613?accountid=8268.

Reunification under the Sui in the Middle Imperial Period

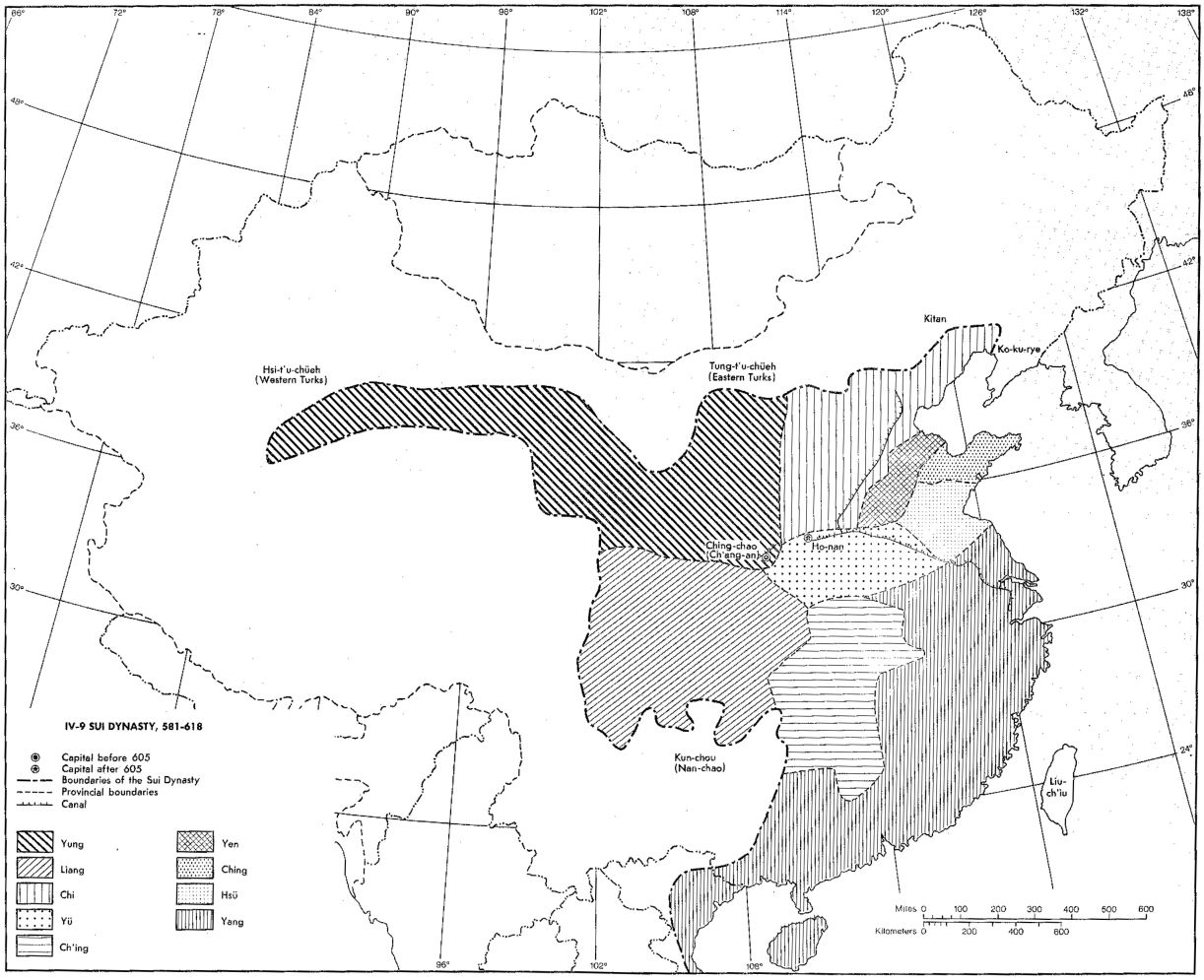
The reunification of China under one dynasty occurred under the Sui during a period of declining monsoon rains, perhaps allowing for easier control of agriculture and the potential re-emergence of a large economy based on agriculture, which typically marked the ability for a unified China. One of the grandest accomplishments in China during the middle imperial period was the construction of the Grand Canal. Due to the highly populated nature of the Sui Dynasty's capital, Chang'an 长安, grain became a highly sought after commodity in order to feed the expansive population. Citizens paid high prices for northern grain due to its unavailability.[33] In order to alleviate this issue, the first Sui emperor re-dug an old Han canal so that there would be more grain access via the Yellow River. His son, the subsequent emperor, expanded that canal system far into the south. On the map on the following page, the canal systems can be seen traversing a large portion of the country.

Marks points out that the construction of the Grand Canal is a large economic and political unifier in Chinese history. By maintaining control over the canal, the government of China at any point in subsequent dynasties following the Sui could control transportation, merchandise, trade, and travel in the country—essentially maintaining a more centralized grasp on the economy instead of being third-party to the large farming entrepreneurs that dominated in earlier dynasties. Therefore, the canal had economic and political significance and acted as further solidification of Chinese traditions, as it exemplifies Chinese dynastic attempts at economic and political unity ever since the Qin dynasty.

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[33] Harold Tanner, *China: A History*, 168.

Map 3: The Sui Dynasty



Sui Dynasty, 581-618. [map]. 1:400 miles. In: Chiao-min Hsieh. Atlas of China. New York: McGraw-Hill, 1973, 235.

Similarly, the Grand Canal seized territories and incorporated them into what was considered Chinese. It allowed dynastic control during the later dynasties such as the Yuan, Ming, and Qing. And, considering the expansiveness of the canal system, that capital could be anywhere along the banks of the canal, making future capital establishments and relocations easier in that power would be able to be maintained from these areas as long as the dynasty could keep control over the canals and other waterways. As occurred in the Han dynasty with expansion, this made more territories that had previously been less or completely inaccessible that could thusly be overburdened with either human populations or agricultural practices. It

connected the north and the south, cementing each territory's role in future Chinese ecological histories. Whereas, perhaps, if the Grand Canal had not been constructed, these territories would not have been solidified for the rest of history and perhaps agricultural tradition would not have been so heavily inflicted upon them. However, by constructing the canal the Sui sealed the country's expansive territory and similarly ecological future.

However, the expansion of the canal was not without its humanitarian costs, and contributed to the short-lived-ness of the Sui Dynasty. During the construction of the canal southward, undertaken by Emperor Yangdi 隋炀帝, Chinese citizens were taken from their homes and farms in order to assist with the digging. Combined with citizens being relocated to fight a losing war in the north to obtain territory in Korea, "...farmers, powerful local families, scholars, and even officers of the Sui armies," rebelled in 613 CE, ending the dynasty finally in 615 CE.[34] Old Sui generals—the Li 李 family—eventually became the founders of the Tang Dynasty, which would later be considered one of the most culturally rich periods of Chinese history.

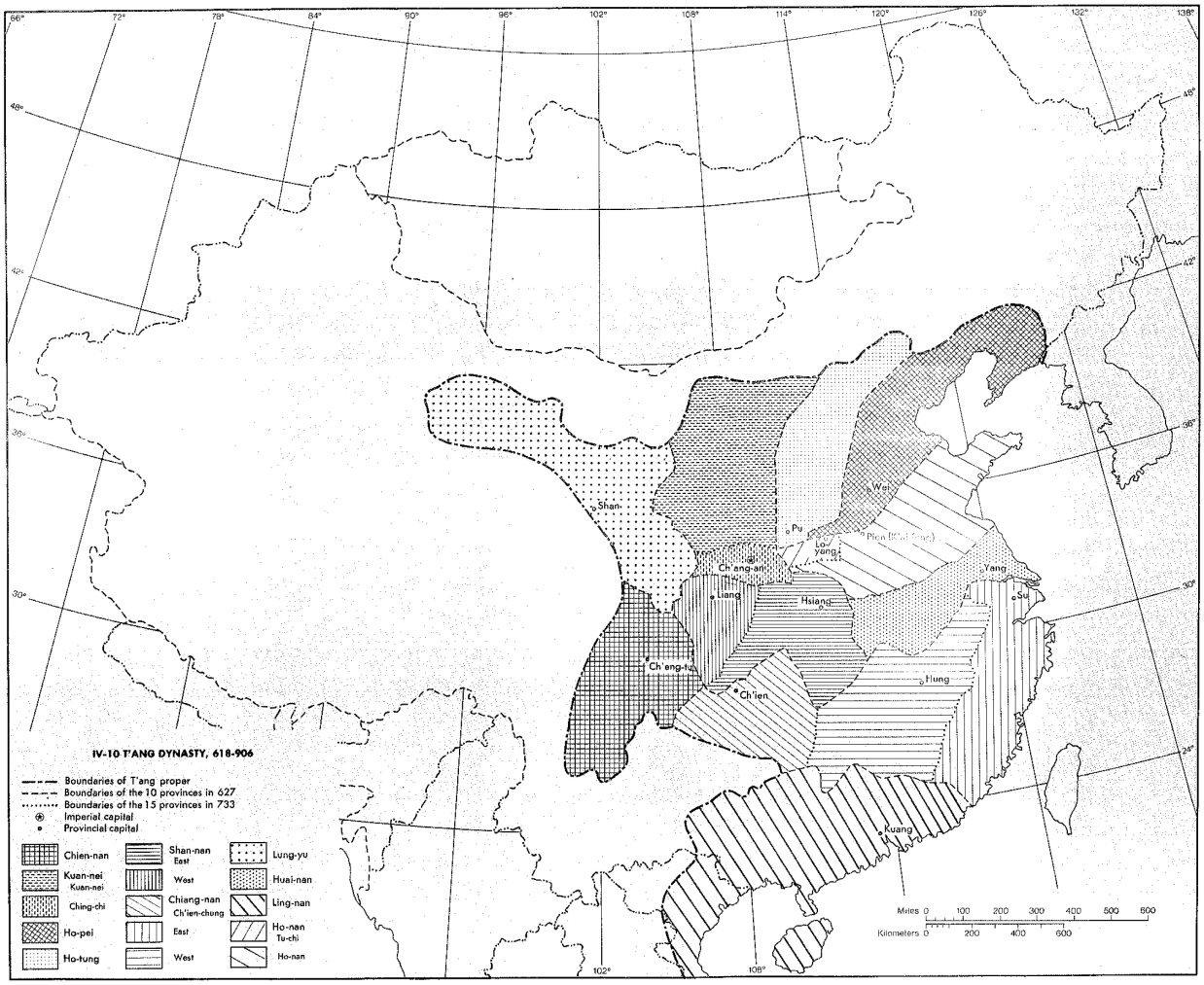
The Tang and Climate Change

The Tang dynasty is frequently regarded as one of the greatest ages in China, culturally speaking. The first emperor was a man named Li Yuan 李淵, who strived for the political and social unification of China under the moniker "Tang." It is estimated that somewhere around 50 million people lived within the dynasty's boundaries, partaking in tradition as the Tang

[34] Harold M. Tanner, *China: A History*, 170.

determined and solidified what it meant to be socially, politically, and culturally Chinese.[35] This was a historical period demonstrating not only the further reliance on Chinese tradition in dynastic ecological identity, but also still under the heavy influence of climate and environmental factors as they likely had a hand in the downfall of this dynasty.

Map 4: The Tang Dynasty



T'ang Dynasty, 618-906. [map]. 1:400 miles. In: Chiao-min Hsieh. Atlas of China. New York: McGraw-Hill, 1973, 237.

As seen on the map above, the Tang territories were relatively similar to that of the Sui. The south was still comparatively less populated than the north, and thusly its natural

[35] Patricia Buckley Ebrey and Anne Walthall, *East Asia: A Cultural, Social, and Political History*, (Boston: Houghton Mifflin, 2006), 91.

environment still flourished despite having some extent of human interaction.[36] Additionally, the south's was probably ecologically less delicate than the north due to the lack of threat of desertification. The construction of the grand canal further solidified the cultural importance of rice-based agriculture due to the large availability of rice from the south could now be transported to the north. Additional parts of Tang dynasty diet were elephants, monkeys, snakes, and many more.[37] However, in the case of the Asian elephant, while most parts of the animal were utilized for consumption its consumption in general likely assisted to its modern endangered status. Because the Asian elephant's birthrates are less frequent and in less amounts than other various animals, hunting them had a large effect on their populations.

During the Tang most of the population was involved in agrarian activities—around 80 to 90%.[38] With a population recorded at almost 80 million people towards the end of the Tang dynasty, this would mean that anywhere from 64 to 72 million people where in some way or another involved in the agro-socioeconomic system at the height of Tang dynasty population.[39] To put these numbers into perspective, in 2010 the percentage of people employed in the agricultural sector globally was 19.8%—while a larger amount of people when adjusted for global population numbers, this is still a much smaller percentage overall when compared to the Tang dynasty.[40] This demonstrates the peak of agrarian tradition which took place in the Tang, ultimately also demonstrating the importance of agriculture

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[36] Charles D. Benn, *Daily Life in Traditional China*, (Westport: Greenwood Press, 2001), 120, accessed March 31, 2016, ProQuest ebrary.
[37] Ibid., 122.
[38] Ibid., 32.
[39] John King Fairbank and Merle Goldman, *China: A New History* (2nd enlarged ed.), (Cambridge, MA: The Belknap Press of Harvard University Press, 2006 [1992]), 106.
[40] "Employment in Agriculture (% of Total Employment)," The World Bank, accessed April 03, 2016, http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS/countries?display=graph.

Despite the cultural and social advancements that took place in the Tang, the environment maintained some degree of control which likely had its hand in many problems throughout the dynasty. During the Tang natural disasters affected daily life radically as, "floods as deep as forty feet inundated as many as sixty prefectures, or one-sixth of the empire," destroying thousands of homes and, "forcing people to live on boats or nest in trees."[41] However, perhaps the most intriguing and important environmental occurrence during this period of history can be found within the composition of, "a 1.2-meter-long chunk of stalagmite from a cave in northern China."[42] By measuring the stalagmite's oxygen isotope composition researchers were able to successfully determine the dates of rainfall in ancient northern China dating all the way back to the end of the Han dynasty.[43] From this natural historical informant, researchers found that a dry period in the Asian Monsoon cycle struck during the Tang dynasty in the 9th century.[44] However, this dry period likely did not only affect China, as the Mayans are thought to have also been a victim of the dry period during this period in history.[45] Changes in the Asian monsoon cycle, as well as those in the "Mesoamerican climate," have been attributed to changes in the brightness of the sun; however while, "the solar influence on the monsoon was more like a 'weighting of the dice'—it influenced the net result, but did not dominate."[46] This suggests while sun activity has a hand in changing the Asian Monsoon season, other environmental factors likely also produced an effect. Manmade environmental changes could have additionally had a hand in the change, as

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[41] Charles D. Benn, *Daily Life in Traditional China*, 33.
[42] Richard A. Kerr, "Chinese Cave Speaks of a Fickle Sun Bringing Down Ancient Dynasties," *Science* 322, no. 5903 (2008): 837, doi: 10.1126/science.322.5903.837a.
[43] Ibid., 837.
[44] Pinzhong Zhang et. al, "A Test of Climate, Sun, and Culture Relationships from an 1810-Year Chinese Cave Record," 940-942.
[45] Ibid., 941.
[46] David Rind, quoted in Richard A. Kerr, "Chinese Cave Speaks of a Fickle Sun Bringing Down Ancient Dynasties," 838.

these changes such as desertification, deforestation, and so forth would have changed rain patterns over the course of hundreds of years. Also, while this discovery adds to the conversation regarding the connections of the climate and culture, there is still the matter of continued attacks against the dynasty which is typically though by historians to have been the cause of the downfall of the Tang. There is potential that even though the government was ultimately brought down due to continued raids, that the dry period also made recuperation difficult after these raids and led to the loss of the dynasty.

Environmental Background

沙漠. The process of desertification is marked by, "...the degradation of dryland ecosystems that can result in a loss of biological and economic productivity," and may be one of the largest future problems that humankind must confront due to the fact that it, "diminishes the Earth's capacity to support human beings as the global population increases steadily."[47][48] Therefore, the process of desertification which largely began when the Han dynasty overtook the Xiongnu lands and eventually turned them into agricultural lands—likely as a military tactic—poses not only an environmental issue but additionally implications as far as human livelihood is concerned. Without human intervention, in the conventional climate of north China already existed conditions which would make the region susceptible to desertification, such as, "…sparse vegetation, continental climate, sandy soils and water deficiency."[49] However, throughout future

[47] Jennie Stephens, *Climate change: an encyclopedia of science and history*, (Santa Barbara: ABC-CLIO, 2013), 428.
[48] Y. Chen and H. Tang, "Desertification in North China: Background, Anthropogenic Impacts and Failures in Combating it," *Land Degradation and Development* 16, (2005): 367, doi: 10.1002/ldr.667.
[49] Y. Chen and H. Tang, "Desertification in North China: Background, Anthropogenic Impacts and Failures in Combating it," 368.

years this area would face more and more anthropogenic environmental issues and increased desertification due to both the agricultural tradition existent in ancient China and various population spikes over the course of certain dynasties concurrently. “Overgrazing, over-cultivation, excessive firewood gathering, irrational use of water resources and environmental neglect from industrial mining,” were all factors which led to the current condition of the north China plains—some practices of which continue well into modern times. [50]

木. The building of roads during the Qin and Han dynasty not only incentivized the destruction of forests in order to create pathways for these roads, but additionally made possible the introduction of new agricultural crops into the Chinese scope of food products. The roads allowed for the transfer of food items between North and South China, as well as out of China and into China. Two agricultural items introduced to the Chinese empire during this time was alfalfa and grapes.[51]

Population growth during the Han dynasty combined with the expansion of agriculture led to the rapid deforestation on the North China plain. The vegetation that had previously existed on the North China plain and around the Yellow River were cleared to make way for agriculture. Additionally, the emergence of a thriving economy based on agriculture further set the fate of Chinese forests, as more and more land would be cleared to make way for agricultural land in order to increase profits.

As Chinese civilization developed, so did the desire for wood and wood products. By the Han dynasty, there was already distinction between different types of trees which placed value on

[50] Ibid., 371.
[51] Robert B. Marks, *China: Its Environment and History*, 83.

certain woods over others. Essentially, the economy surrounding wood and items made of wood began becoming more and more complex. An example of this is present during the Han dynasty, where it is said that Emperor Wu had a tower built out of a fragrant wood that was likely imported from either Japan or Taiwan.[52] The fragrance of the wood made it more valuable, which made it in turn a valuable kingdom expenditure despite its foreignness and transportation cost. This demonstrates the value of wood to the Han Chinese people, and similarly the importance of wood to Chinese imperial culture. In addition to situations such as these, Elvin also points out that different types of wood are extremely important to Chinese burial customs originating around this period, as certain varieties of tree would be utilized given burial circumstances.[53] Of course, the pressure on these species of trees would increase as populations increased and the sheer number of deceased needed burial increased. Other than the two aforementioned uses, by the Han dynasty wood was used in almost every facet of daily Chinese life, such as eating, sleeping, fighting, and music.

Following the fall of the Han dynasty and the entrance into the Era of Disunity, deforestation efforts by the Chinese kingdom in the north decreased due to a lack of organization, a lack of security, and a lack of population. Without a strong government available, large deforestation campaigns could not be undertaken. Even in more southern kingdoms during this period, inadequacies in economic control and unity by the ruling governments created a lessened need for wood from the north.[54] Similarly, without a strong standing army Chinese citizens in the north would have been more concerned with protection rather than expansion,

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[52] Mark Elvin, *The Retreat of the Elephants*, 53.
[53] Ibid., 53.
[54] Harold M. Tanner, *China: A History*, 146-151.

lessening the need for wood significantly. Finally, without as many people residing in the north, The vast depopulation that occurred created a need for slaves to work on agricultural lands, implying there was already plenty of available land and no need to create more.

Despite this, Marks and Edmonds both suggest that there likely was not a re-emergence of northern forests during the Era of Disunity, despite the absence of mass human intervention in the ecological landscape. Rather, there seems to have simply been a halt in deforestation efforts. Although the true reason that the northern forests did not begin to re-flourish during this period remains a mystery, speculations include the lack of seed source, the foot traffic by armies over potential growth land, and pastoral grazing by the herds of nomadic tribes.[55] Regardless of the fact that this area of land did not see the resurgence of its once lush forests, the transition from agricultural land to grassland did assist in keeping the silt levels in the Yellow River from increasing further.

水. By the time the Western Han had established their empire, the Yellow River became truly yellow and muddied as a consequence of considerable deforestation that had begun with the imperial period. Similarly, problems with serious flooding plagued the dynasty during this period, possibly also related to deforestation as runoff water was not being absorbed by the flora that previously covered much of the land.[56]

The Zhengguo Canal, which had been built during the Qin dynasty, began posing ecological problems as early as the subsequent dynasty, the Han. While initially silt in the Jing River (which the Zhengguo Canal connected to the Luo River), "...served as both irrigation and

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[55] Robert B. Marks, *China: Its Environment and History*, 109.
[56] R. L. Edmonds, *Patterns of China's Lost Harmony: A survey of the country's environmental degradation and protection,* 30.

fertilizer," for surrounding farmers, it similarly eventually "...raised the level of the Luo river, which had to be dredged, and the Jing River eroded its bed, lowering it below the intake level on the Jing river."[5758]

During the Spring and Autumn period, a large canal connecting the Wei River and the Yellow river was constructed; however, it was later lost due to the lack of upkeep following the period of disunity that was the Jin and Northern and Southern dynasties.[59] Several hundred years after it was first completed, the first emperor of the Sui (Emperor WenDi of Sui) saw the re-digging of the canal as an opportunity to better transport food from the north via the Yellow River to the capital, which rested on the Wei river.[60] In 605 CE, Emperor WenDi of Sui's son and successor to the throne undertook the expansion of his father's project, expanding the canal southward towards Hangzhou—which would later allow transport of rice to the north—and northwest towards Beijing. These waterway systems promised expansion and wealth for dynasties in the future due to the new, easy transport of not only grains but also taxes to capital. The grand canal—probably more than any ruler ever could—geographically unified China.[61]

During the Sui dynasty, Yellow River flooding had disastrous effects on the young dynasty. In 611 CE—two years before the citizen revolt and four years before the end of the dynasty—the Yellow River flooded and created unrest amongst displaced people, inducing "unrest and banditry" in the regions directly affected.[62] While this may have indicated a loss of

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[57] Mark Elvin, *The Retreat of the Elephants,* 22.
[58] Robert B. Marks, *China: Its Environment and History*, 87.
[59] Biao Deng, "Remote sensing detection and verification of disappeared reservoirs along the Grand Canal of China," *International journal of digital earth* 6, no. 3 (2013) : 219-232, doi: 10.1080/17538947.2011.625048.
[60] Robert B. Marks, *China: Its Environment and History*, 119.
[61] Mao Feng, Nie Yueping, and Chen Shupeng, "Great Ecotypic and Cultural Project—Re-cognition of Grand Canal," *Geo-information Science* 4, (2008) : 511-519.
[62] David Graff, *Medieval Chinese Warfare 300-900,* (New York: Routledge, 2001), 117.

the mandate of heaven and nature retaliating against the dynasty, the flooding may have been a direct result of over digging. As aforementioned, similar flooding issues took place during the Tang dynasty.

动物. As the grand forests of oak and maple trees that covered the North China plain began to disappear, so did the fauna living within these ecosystems.

During the Han dynasty, emperors established large "hunting parks" for entertainment, agriculture, military training, and—of course—hunting. While hunting parks had existed during the Qin dynasty, the vastness of the hunting parks created during the Han were undoubtedly unique. They encompassed, "...wild animals, mountains, rivers, exotic flora, and many palaces."[63] Ritual hunting occurred within these parks, demonstrating the importance of animal bloodshed to ritual, sprouting from ritual and religion present during the Shang kingdom. Similarly, the emperor was expected to ratify mankind's empire over nature, establishing at an early point that fauna is to be naturally controlled by man—whether that be for their protection, commodification, or demise.

The *Huainanzi* 淮南子, compiled by Liu An 劉安, offers insight into perceptions and behaviors regarding animals existent during the Han dynasty (and possibly earlier, given that these perceptions and behaviors did not simply appear in a single dynasty). The *Huainanzi* urges readers, firstly, to be sure to make the "correct categorical distinctions," in regards to animals, suggesting the existence of some type of practice of animal study was present in Han dynasty China.[64] The attention to on correctly calling animals by their proper names may also have roots

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[63] Robert B. Marks, *China: Its Environment and History,* 91.

[64] John S. Major, "Animals and Animal Metaphors in 'Huainanzi'," *Asia Major* 21, no. 1 (2008), Academia Sinica, 135, http://www.jstor.org/stable/41649944.

in Confucianism—popular during the Han dynasty—which emphasized calling things by their proper name in what was called the "Rectification of Names." However, the *Huainanzi* also has roots in Daoism, discussing in length the naturalness in animals and suggesting humans learn from this naturalness and abstain from unnatural tendencies.[65] Ultimately, both of these demonstrate the importance of Chinese philosophical or religious thinking in human-environment interactions. In *Huainanzi*, the observation of animal behavior is recorded throughout; therefore, while most animal behaviors are correctly ascribed, the wrong ones indicate the infrequency in which the animals were interacted with during the Han dynasty. Two examples of these are the elephant and the leopard/tiger—the elephant was thought to shed its tusks, and the leopard was thought to be unable to climb trees like the tiger.[66] Sightings of these animals would increase in later dynasties, and predators such as the tiger would begin to pose threats to human life; therefore, it can be assumed that during the Han dynasty, lack of massive population increases and technological advancements kept humans from vastly encroaching on the territories of these large animals, as they later would in subsequent dynasties. Finally, in *Huainanzi* there is also evidence of the belief of human dominion over and differentiation from animals despite, "the animal's superior physical attribute," due to the human usage of language.[67]

By the time of the Tang dynasty, as previously mentioned Chinese society was to some extent consuming elephants, suggesting that the interaction with them was not as rare as had been in the Han. This may have been due to territorial growth that occurred between the Han dynasty and the Tang dynasty, as well as population increases and innovations in technology

[65] Ibid., 138.
[66] Ibid., 136.
[67] Ibid., 143.

(such as poison darts) which would make capturing and consuming elephants simpler. Furthermore, even in walled cities animals often still found their way into these areas during the Tang dynasty—in Changan 长安, tigers and bears were reported to have entered the city several times, causing problems internally and sometimes ending with the animal having to be slain in order to guarantee citizen safety.[68] The Tang government also raised animals for transportation and other various uses. In one area, in a district north of Changan, there was reported in 754 CE, "a total of 605,603 animals, of which 325,792 were horses… 75,115 were cattle… 563 camels, 204,134 sheep, and one donkey."[69]

Conclusion for Chapter 2

These time periods solidified treatments and perceptions of the surrounding environment, which eventually act as a gateway into the next few dynasties. This was done firstly through the expansion of territory, determining for future dynasties and kingdoms what could be considered possible Chinese "territories" (although they may have not been in Chinese possession such as was the case just before the Yuan dynasty). An example of this was the invasion of the Xiongnu territory during the Han dynasty, in which the Han seized a massive amount of Steppe land; another example of this was the construction of the Grand Canal in the Sui, which gave dynastic control to whichever government at the time controlled that canal of the territories which the canal was expanded into. These actions not only secured land but additionally provided acreage in which the Chinese could inflict their agricultural tradition upon, as it similarly allowed for expansion of the magnitude of the agricultural practice and strengthened reliance on agriculture.

[68] Charles D. Benn, *Daily Life in Traditional China*, 47.
[69] Ibid., 180.

Perhaps if the Han or the Sui had not been able to obtain the land in which to expose their agricultural tradition to, the reliance on agriculture may have faltered and created new socioeconomic tradition instead. Perhaps this would not be the case. Regardless, it is undeniable that these acquisitions and expansions helped to create the degree of environmental setback which existed in later dynasties and continues currently.

Throughout this period it is also important to note the attempts at environmental protection, such as the edicts at Zhangjiashan, which suggests the society had noticed the change in environmental quality by the Han. However the traditions set in the past were already too strong, introducing new arrays of ecological problems that would have been difficult for the central government to address, if they chose to address these problems at all. One example of this was traditional Chinese medicines, which utilized animal parts in its creation; however, the perceived benefit to human health and life created a situation where the concoctions were still desirable to people. This is especially so considering the perceptions of human life over animal life which seems to have arisen during the Shang dynasty within Chinese society due to the value of ritualistic sacrifices (less important people typically only had animals sacrificed in their name while the wealthy and important sometimes had humans sacrificed in their name, implying the greater significance of human life over animal life).

However, despite the environmental changes undertaken within this period, humankind and their societies were still very much so at mercy to environmental changes and ecological disasters. For example, the flooding in the Sui—which was partially due to the changes in the river system—left many people displaced and ultimately led to the downfall of the dynasty. In this case, the civil unrest perpetrated by the citizens of the Sui who had been severely affected by

the floods likely saw the dynasty has having lost the Mandate of Heaven, a tradition begun during the Zhou. In the case of the Tang, as discussed earlier, the decline of the Asian Monsoon season led to a dry period which affected crop output, making stability difficult especially in the face of the political insecurity due to territorial disputes already existent during the Tang. The livelihood and longevity of dynastic governments was not only threatened but actually ruined by ecological traumas.

The Tang dynasty was the last of its kind—the innovation and population increases in the Song dynasty which followed the Tang were a period where human existence became much more dominant over the human-environment relationship. Due the the large increases in population, these later dynasties took an increasingly larger toll on the environment than these earlier dynasties. Periods of instability likely caused by environmental changes such as the Five Dynasties and Ten States period after the fall of the Tang due to the dry period, or even the earlier Era of Disunity, would be less frequent in later dynasties as opposed to earlier dynasties. This is not to say that the Song, Yuan, Ming, and Qing dynasties did not suffer at the hands of their respective ecological disasters—in the Qing dynasty a drought would cause individuals to revert to cannibalism in the face of a growing food crisis in the north. However, these climatic changes were not as influential in creating long periods of instability following their downfalls and other groups were able to quickly come to power and create longer and stronger governments the subsequent dynasties. Technological and economic advancements additionally aided the human hand in controlling the environment. In a sense, during the dynasties following these periods of time, modernity becomes the enemy of ecological progress. Thusly, it is the Han

through Tang dynasties that act as architects constructing this modernity, using tradition from earlier dynasties and kingdoms as a foundation for it.

This chapter will discuss the Song Dynasty to the Qing dynasty. However, because in the later imperial period the Chinese became much more internationally involved, it is difficult to separate the processes of Chinese dynastic ecological destruction and change from complicated international contexts. Therefore the scope of this chapter will end just before the Opium War in the Qing dynasty—especially considering that war is a major destructive force against a country's environment, but this project for the most part focuses on governmental and societal changes made within the Chinese societal, political, and economic scope and international involvement complicates this. Typically, it is around 1800 that "pre-modern" China becomes what is considered "modern" China.

Despite the distinction of "modernity" on the basis of Western intervention, there is plenty of reason to consider that modernity in China began as early as the Song dynasty. Mark Elvin defines modernity as, "power over other human beings… practical power over nature in terms of the capacity for economic production…[and] intellectual power over nature in the form of the capacity for prediction," which is a definition that truly marks this period of Chinese history.[1] During the following dynasties, population growth and innovation created new ways of environmental interaction for the Chinese, and additionally new perspectives on the environment and environmental degradation. The human capacity to survive ecological changes and natural disasters increased over the course of these periods. Ultimately, throughout the Song, Yuan, Ming, and Qing dynasties, it becomes clear that mankind established an increased dominion over

[1] Mark Elvin, "A Working Definition of 'Modernity'?" *Past and Present* 113 (1986): 209, doi: 10.1093/past/113.1.209

the environment, and that dominion was densely based in the traditions of previous generations such as the agricultural society, human-animal interaction, and so on.

Medieval Revolution in the Song Dynasty (960-1279 CE)

The Song dynasties are often characterized by great innovations, transformations, and growth alongside a perpetual danger and threat coming from surrounding nomadic kingdoms. Mark Elvin coins the term of "medieval revolution" in describing the Song period, considering that many aspects of the Song dynasty reflect changes experienced in revolutionary periods in other dynasties throughout the world. Similar to other kingdoms that had gained power during the Five Dynasties and Ten Kingdoms period (909-979 CE), the Song dynasty was created under tumultuous circumstances after the fall of the Tang dynasty (618-907 CE). However, following a coup led by Zhao Kuangyin 赵匡胤 (927-976 CE) against the later Zhou--one of the existing kingdoms during the Five Dynasties period--in the north, slowly consolidating territory and power in the north and establishing the Northern Song Dynasty in 960 CE.[2] Zhao Kuangyin then assumed the name of Emperor Taizu 太祖, the first emperor and alleged successor to the Tang dynasty.

Although often contested, population increases during the Song dynasty were a driving factor in adjusting production and economies. The contestation of this comes in deciding whether or not population increases spurred the need for changes in lifestyle (i.e. agricultural production and local economies) to suit the needs of a larger population, or if population increases were made possible *due to* the advancements in technologies and changes in production. However, it

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[2] Harold M. Tanner, *China: A History*, 209.

is suggested that the nuptial system in traditional Chinese society would have led to a steady increase of population as it left childbirth entirely up to biological factors in parents, not whether or not marriage and childrearing was a good economic decision for either individual involved, meaning population growth likely preceded other advancements.[3] During the beginning of the Song dynasty, there is estimated to have been 32 million people under the rule of the Song; yet, due to shortcomings in Song government census measurements there was potentially many more inhabitants of the Song kingdom at the time (not to mention the inhabitants in various other kingdoms existing in China during this period). In 750 CE, censuses indicate 75 million people inhabiting the Song kingdom.[4] By the end of the Song, up to 120 million people lived under Song control.[5] Although the dramatic change of this number could be due to issues in census taking in either the early or later parts of the period, or perhaps a product of land and people consolidation, it nonetheless likely also demonstrates an increase in population due to security under Song dynasty government. Population growth during the Song can be seen as the beginnings of Chinese tenacity in survival against the climate—with advancements in medicine, agriculture, childbearing processes, and so forth, humankind was eventually able to overstep the balance point between man and nature, threatening population sustainability in future generations.

With dramatic increase in population would come an increase in environmental destruction. This is intuitive, for the more individuals there are with a desire to reproduce and the social structure and tradition in which to do so, then the more the population will increase. The

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[3] Kang Chao, *Man and Land in Chinese History* (Palo Alto: Stanford University Press, 1986), 27-31.

[4] Robert B. Marks, *China: Its Environment and History*, 143.

[5] Kang Chao, *Man and Land in Chinese History*, 41.

larger population there is, the larger amount of stress is put on the environment. The Song period was not a period of land consolidation creating population spikes in annual censuses, but instead true and dramatic spikes in population—regardless of whether they were causal or effectual. Later population regulation measures would be undertaken under the famous (and often contested) one-child policy introduced between 1978 and 1980 until 2015 CE; however, during the Song dynasty, no effective measures for population control existed. During the Song dynasty, child production was not only traditional under the arranged marriage system, but additionally having children was optimal as they offered free labor on farmlands. Furthermore, because children did not have to be educated in order to provide for the family as they do modernly, childbearing was less of a financial burden than it is considered to be today. Therefore, while the negative implications of having a population producing large amounts of children consistently are obvious in the modern context, from the historical context—and not very far back in the historical context—childbearing was incentivized not only socially but economically. Yet, in future dynasties and modernly, generations began to and continue to feel the harsh overpopulation effects of their ancestors traditional and economic incentives; but, often in the recent era there are difficulties in addressing these problems due to moral values within societies and various other factors.

Agriculturally, new ways of farming had to be introduced into the existent system in order to support the rapidly growing population; not only did this make changes in agricultural practices important, but these changes also paved the way for innovation in other various industries. It is suggested that Song Dynasty leaders at this time emphasized the necessity for innovation in order to better utilize their surrounding environment, leading to the introduction of

new crops, ways of farming, and industries in China.[6] During Song Dynasty China around 1012 CE, a massive drought plaguing Zhejiang and surrounding areas further affected rice production in the kingdom, ultimately leading to the introduction of early-maturing rice varieties.[7] The usage of champa rice allowed for greater production due to the shorter fallow times required for growth; however, decreasing the fallow time in rice production naturally had its toll on soil nutrition. If rice crops were not rotated with crops that helped re-nurture the soil environment (such as chickpeas would, for one example), then soil conditions would rapidly degrade due to the depletion of various components in the soil required for growth. This would not only affect the crops of farmers, but similarly surrounding natural ecosystems and agro-ecosystems that rely on healthy soil composition for sustainability and life. Additionally, soil nutrient depletion does not create beneficial conditions for the environment of the fields after the Song dynasty farmers had long left and stopped tilling, an issue which recurred in future dynasties and still lingers in the present-day.

Developments in agriculture fostered advancement in Song iron, steel, and also coal industries. The emergence of large-scale ironwork operations became more and more apparent, but was also so popular that even small-scale farmer iron smelting done during "agricultural off-season."[8] Regions such as the Liguo Industrial Prefecture, Dengzhou, and Hancheng all economically relied heavily on iron mining and smelting. In 1078 CE alone, government records

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[6] Randolph Barker, "The Origin and Spread of Early-Ripening Champa Rice: Its Impact on Song Dynasty China," *Rice* 4, no. 3-4 (12, 2011): 185, accessed February 5th, 2016, http://search.proquest.com/docview/918073804?accountid=8268.

[7] Ibid., 184-186.

[8] Harold M. Tanner, *China: A History*, 218.

indicate that the imperial government utilized 3,367 tons of iron.[9] Although Tanner claims that Northern Song iron production was around 125,000 tons in 1078 CE, there is debate on the actual number given that the number lacks "quantitative evidence" and is based more so on assumption than historically-proven fact; however, we can still assume that given the demand for iron farm tools during the Song period, the spike in population, and the increase in farm tools needed to sustain this population increase, that Song dynasty iron production was significantly higher than it had been in previous years and higher at the time than anywhere else in the world.[10]

Coal is a complementary good to iron, specifically iron-smelting. Perhaps because it was economically cheaper and easier than utilizing wood, or perhaps from a rising awareness of the dangers and realities of deforestation—or perhaps due to both—in the steel industry there was a shift from using wood for smelting to coal for smelting (alongside a larger reliance on coal during the Song dynasty overall). Instead of utilizing the charcoal created from trees, iron-smelters and farmers with small-scale smelting operations began using more and more coal for melting iron. While in some ways beneficial to forest preservation, employing coal in order to sustain the growing steel and iron industries was not without its own environmental detriments, many of which are currently ongoing. Coal mining requires cutting away large parts of the earth in order to retrieve coal from coal seams; however, many of these coal seams do not simply reside on the surface of land but instead deep inside the ground or mountains. Thusly, one massive ecological issue facing coal mining is subsidence, which can malform the earth's natural

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[9] Donald B. Wagner, "The Administration of the Iron Industry in Eleventh-Century China," *Journal of the Economic and Social History of the Orient* 44, no. 2 (2001), 175-197, http://www.jstor.org/stable/3632326.

[10] Donald B. Wagner, "The Administration of the Iron Industry in Eleventh-Century China," 191.

landscape and change moisture migration patterns and the way in which soils absorb water.[11][12] Ultimately, this causes changes in the groundwater environment and the greater ecological landscape, including the flora and fauna that rely on that groundwater in local ecosystems. However, this process *did* allow the Chinese to escape from such a reliance on trees, which had been heavily deforested at this point and were a concern to citizens and leaders alike. Not only that, but the usage of coal was in the interest of creating better living conditions for the larger population characteristic of this time (or even just maintaining existing living conditions under population increase pressures).

During the Northern Song dynasty, environmental law became more and more common. There began to arise a science behind environmental degradation, and a keen observance of certain occurrences that instigated statutes and laws against environmental destruction. However, governmentally instituted policies were not all quite as helpful in alleviating the anthropogenic environmental problems existent at the time. The lack of private property rights—or the lack of well enforced property rights, considering that in some way ancient Chinese had *some* rights to their individual property—likely assisted in rapid deforestation. Typically, decreases in forestation, "...occurred mainly in areas characterized by insecure property rights, while areas with well-defined property rights showed either regenerating or stable forest cover."[13]

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[11] Zhang Fawang et. al, "Changes of Precipitation Infiltration Recharge in the Circumstances of Coal Mining Subsidence in the Shen-Dong Coal Field, China," *Acta Geologica Sinica* 86, no. 4 (2012), 993, doi: 10.1111/j.1755-6724.2012.00723.x.

[12] Jinquan Wu and Renduo Zhang, "Analysis of Rainfall-Infiltration Recharge to Groundwater," *Hydrology Days Publication,* (Fort Collins: Colorado State University, 1994): 420-430.

[13] Per Pinstrup-Andersen and Derrill D. Watson II, *Food Policy for Developing Countries: The Role of Government in Global, National, and Local Food Systems,* (Ithaca: Cornell University Press, 2011), 220.

In 1126 the Jin, a Jurchen kingdom on the periphery of the Northern Song, took the Song capital of Kaifeng 开封. This forced the Song to retreat southward and establish the new capital at Hangzhou 杭州, this time period being typically referred to as the Southern Song. The dynasty was eventually overthrown by the Mongols, creating the Mongol-ruled Yuan dynasty in 1271 CE.[14] Thus marked the disappearance of the Song and an entrance into an era where nomad influence affected the Chinese environment.

Cyclical relationships between urban life and ecology

As both rice and grain agriculture became a larger and larger stress on the environment in order to support the ever-increasing Chinese populations, there became a demand amongst farmers to produce more crops more quickly than before. While loess soil had a good amount of capillary action—meaning that the soil was fine enough to allow the movement of water that goes against the pull of gravity—which ultimately allowed repeated usage and harshness via grain growth, and while rice is typically less harsh on the soil environment than grain growth altogether, there still was a need for increased nutrients to support agricultural production.[15][16] Thus was advent of night soil, where human feces and urine were collected from urban areas in order to support the need for a soil conditioner by reason of land overuse and consistent

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[14] Yongang Hu, "Song Dynasties, North and South: Prehistory to 1200: East and Southeast Asia,", In Cultural Sociology of the Middle East, Asia, & Africa: An Encyclopedia, edited by Andrea L. Stanton, Edward Ramsamy and Peter J. Seybolt, III74. Thousand Oaks, CA: SAGE Publications, Inc., 2012. doi: 10.4135/9781452218458.n472.

[15] Robert B. Marks, *China: Its Environment and History,* 166.

[16] Michael E. Bridges, "capillary action," *Encyclopedia of Environmental Change,* ed. John A. Matthews, (Thousand Oaks: SAGE Publications, Ltd., 2014), 126, doi: 10.4135/9781446247501.n538.

population growth.[17] It is estimated that on average the annual production of nutrients in adult populations (say in an area with one million people) by collecting night soil is, "5,794,300 pounds of nitrogen; 1,825,000 pounds of potassium, and 775,600 pounds of phosphorous carried in 456,250 tons of excreta."[18] However, n his book *Farmers of forty centuries; or, Permanent agriculture in China, Korea, and Japan,* King remarks that however much nitrogen, potassium, and phosphorus was (and is) put back into the earth via night soil fertilization was once stripped from the earth through extensive agricultural practices, siltification of rivers which carry these nutrients to sea, and many of these nutrients are exclusively found in natural minerals and thusly are simply irreplaceable by human waste.[19]

By utilizing animal and human waste in agricultural production, there is some symbioticness present in the relationship of humankind and the environment after years of crippling ecological behavior. In many ways, the usage of night soil seems to be a means of giving back to the environment some of what cannot be entirely returned (soil health), however still done in the interest of human life and economy. King, having visited China during the early 20th century, comments upon a Chinese man who grows cucumbers in his garden who utilizes waste for the growth of his product, "...bringing in $400, Mexican,--$172, gold."[20] The relationship between the Chinese, night soil, and their environment thus comes as no surprise, considering that economic growth is an enticing incentive for ecological change and benefit.

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[17] Ting Liu, Zhu-Lei Chen, and Lie Yang, "Urban Night Soil Transportation and Treatment in China," Paper presented at the Proc. of Int. Symp. on Geoenvironmental Eng., ISGE2009, *Huangzhou, China,* September 8-10, 2009.

[18] F.H. King, *farmers of forty centuries; or, permanent agriculture in China, Korea and Japan,* (Ledien, NLD: Global Oriental, 2011), 194, accessed February 25, 2016, ProQuest ebrary.

[19] F.H. King, *Farmers of forty centuries; or, permanent agriculture in China, Korea and Japan,* 197-198.

[20] Ibid., 203.

However, even night soil is not without its environmental detriment; in fact, while assisting agro-ecosystems, the usage of waste for fertilizer causes complications in both natural ecosystems and human life. The seepage of night soil into water systems causes sanitation and quality concerns while creating a system in which disease is easily transmitted to flora, fauna, and humankind alike.[21][22] Despite this, perhaps this method of fertilization was better than the alternative of seizing and cultivating more land in order to support the growing population, of which the central government had the best interests to protect as emphasized by social welfare programs in the face of famine such as was done in the north in later dynasties. Regardless, the agro-ecological benefits of night soil appear to be a secondary benefit to its usage, as likely farmers' initial incentivization for utilizing fecal matter was both economic and social.

The utilization of fecal matter as a fertilizer in order to increase agricultural production is certainly an interesting intermingling of human society and environmental health, especially in regards to humankind's authority over the ecological system at this time. The increased usage of fecal matter is also an indicator of the increasing nutrient depletion present in the soil after years and years of agricultural tradition and the increased awareness in the society of past environmental degradation and therefore current environmental shortcomings. Seemingly, with population growth and humans' prior treatment of the environment, this is a retroactive approach to helping the agricultural environment rather than a proactive one; unfortunately, however, as seen in previous dynasties with laws such as the Zhangjiashan edicts, even if the Chinese society

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[21] Ting Liu, Zhu-Lei Chen, and Lie Yang, "Urban Night Soil Transportation and Treatment in China," 857.

[22] Elizabeth J. Carlton et. al., "Associations between Schistosomiasis and the use of Human Waste as an Agricultural Fertilizer in China," *PLoS Neglected Tropical Diseases* 9, no. 1 (01, 2015), doi: 10.1371/journal.pntd.0003444.

had taken a stronger proactive approach to environmental mitigation it may not have had much effect.

Nomadic Influences and the Yuan Dynasty

Prior to the overthrow of Song Dynasty territory and declaring it the Yuan Dynasty in 1271 CE, the Mongolian Empire lived life with strong inheritance of nomad tradition, and controlled much of northern Asia before seizing the Chinese empire as well. For nutrition, they relied mostly on food products produced from their herds and additionally hunted and fished.[23] They traditionally were not sedentary and did not depend upon agriculture as their Chinese neighbors did, but instead moved from season to season and relied strongly on lifestyles of traditional nomads. However, upon seizing power, the Yuan officials did not maintain a form of governance that closely resembled the Mongolian Empire, but instead adopted traditionally Chinese methods of agriculture where farmers grew, "millet, sorghum, and wheat in the north, rice and winter wheat in the south."[24] Not only was Chinese-style agriculture preserved despite the shift in rule, but the Yuan actually taxed via grain portions. In 1299 CE alone, it is reported that the Yuan government collected, "...12 million *shi* (1.15 billion liters) of grain in taxes."[25]

The utilization of previously Chinese techniques and culture comes as somewhat of a shock considering the disdain for the sedentary lifestyle experienced in traditional Mongolian ecological identity; However, the usage of certain agricultural tools in the Mongolian empire that were modifications of Chinese agricultural inventions in order to better suit the Mongolian

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[23] Harold M. Tanner, *China: A History*, 240.

[24] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties,* (Cambridge, Mass: Belknap Press of Harvard University Press, 2010), 107.

[25] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties,* 107.

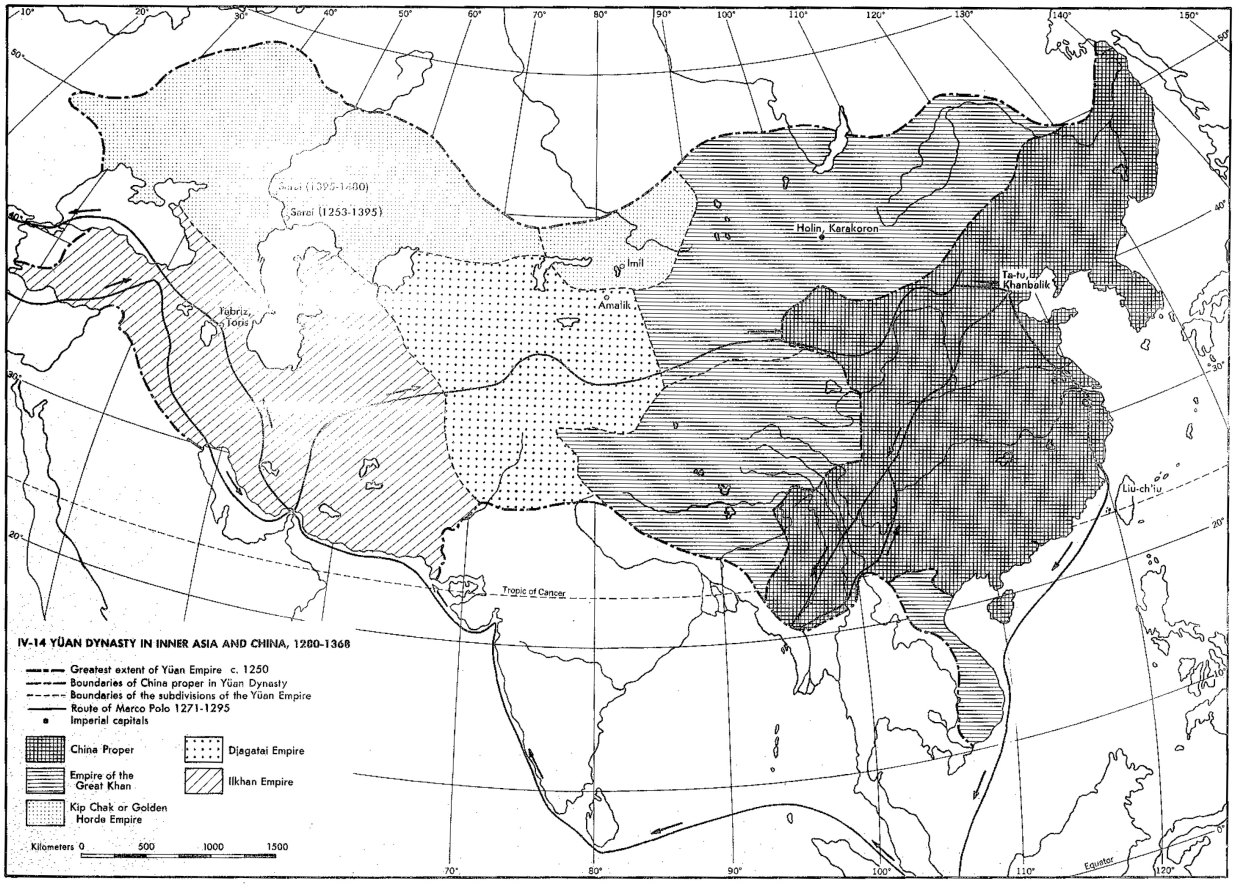
lifestyle and desire for personal identity are demonstrative of the desire for, "...the same cereal produce," alongside a, "...separate (dignified) identity."[26] Traditionally, Mongolians found the destruction of land caused by Chinese farmers to be detestable and even "savage-like" (opposite to the similarly negative view held by pre-modern Han Chinese about nomadic peoples). In Mongolian tradition, there was a presence of ecological awareness that dictated how the land should be treated: Mongolian herders should do to the land what is in the best interest of the farmer, and the farmer's best interest should align with the best interest of the land if he desires to see his herds alive in the spring.[27] While the early Mongolian rulers of the Yuan dynasty did not necessarily embrace Chinese culture, traditions, and so forth, they did not completely reject them either. In a broad sense, it appeared that Chinese society closely remained the same—at least, it remained more traditionally Chinese than it did Mongolian. This may suggest that, for a stable, stationary empire, a Chinese style of ruling was better suited than a nomadic style of rule. This thusly would imply that, although nomadic lifestyles had lesser ecological footprint, larger ecological footprints were necessary to keeping a kingdom economically and socially secure. As was demonstrated in the Song, then, the Mongolians would have to exercise greater dominance over natural resources and the environment during the times in order to maintain the dynasty, especially with the lack of sustainability technologies existing at the time.

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[26] Dee Mack Williams, *Beyond Great Walls: Environment, Identity, and Development on the Chinese Grasslands of Inner Mongolia*, (Palo Alto: Stanford University Press, 2002), 71.

[27] Ibid., 72.

Map 5: Yuan Empire



Yuan Dynasty in Inner Asia and China, 1200-1368 [map]. 1:400 miles. In: Chiao-min Hsieh. *Atlas of China*. New York: McGraw-Hill, 1973, 244.

Yet, the ecological identities of theMongolian government still affected the society. Thusly, given Mongolian attitudes about the environment it is no surprise that landscape painting as an art form escalated in cultural significance during the Yuan. The Yuan found beauty natural landscapes, exemplified in Yuan dynasty art, and this was likely due to Mongolian leaders' cultural tradition residing in the care and interest of the land. Mongolian herders had traditionally, "...been extremely attentive to the subtleties of landscape features, both as directional markers and as matters of practical concern."[28] Government patronage allowed for

[28] Dee Mack Williams, *Beyond Great Walls: Environment, Identity, and Development on the Chinese Grasslands of Inner Mongolia,* 72.



Figure 3: Ni Zan Painting

Ni Zan, dated 1372, Yuan dynasty; hanging scroll: ink on paper; 29 1/8 x 14 in. (74.6 x 35.5 cm). National Palace Museum, Taibei. In Masterpieces of Chinese Art. New York: Todtri Productions Limited, 1997.

the cultivation of many works of landscape-oriented art during the Yuan, due to the government's valuation of art and cultural activities.[29] The Yuan rulers, especially in the earlier half of the dynasty, still held tightly to Mongolian and nomadic ideals, and the aforementioned attitude towards their surrounding environments likely had some influence in spurring the art movement. In landscape painting, Yuan Chinese artists worked to reject movements of realism that were popular in the Southern Song Dynasty and instead took to painting representations of landscapes, some of which were only conceptual representations of them and others of which focused largely on brush strokes.

[29] Chen Gaohua, *Capital of the Yuan Dynasty,* (Enrich Professional Publishing: 2014), 98.

This may also be indicative of frustrations with past government ecological and societal attitudes, as well as additional frustrations with Han Chinese socioeconomic immobility due to the transition of the Song to the Yuan. The four great masters of the Yuan—the famous Chinese painters Huang Gongwang, Wu Zhen, Ni Zan, and Wang Meng—were not at all nomad descendent, but instead Chinese nationals mostly with bloodlines in Song Chinese elite. Therefore, while government support of landscape painting can be attributed towards traditional nomadic appreciation of the environment, it is in none of these four great landscape painters' lineage to exhibit such recognition. Each of their works can be attributed to the adoption of wenrenhua 文人画, or a method of painting that emphasizes the deep-inner visions of the artist rather than replication which could be easily done by professionals or scholarly individuals. In the rejection of professional court painters is where one can see the rejection of past government altogether, as well as imperial traditions and typical elite attitudes about not only art but other areas as well. It then seems that the environment as a subject of each's wenrenhua paintings has significance in demonstrating negative Chinese attitudes towards the past ecological actions of the government on the level of citizens. Combined with poor ecological performance by the previous dynasty due to massive ecological changes such as large population growth, increases in agricultural production and thusly decreases in natural land, and additionally coal mining which began to decay the Chinese landscape, these artists may have been rejecting the traditional Chinese ecological attitude as well.

Despite differences in attitude, there is still some similarity between Mongolian and Han Chinese environmental views, and perhaps this is why upon the adoption of a Chinese dynasty, there was not a major shift in agricultural practices that created better ecological standards but

instead a preservation of Han Chinese techniques. At its core, both Han Chinese and Mongolian farmers utilized the land in ways that guaranteed practical food procurement.[30] While the acquisition of natural land and transformation of said land into agricultural land was a necessity to nutritionally supporting the large Han Chinese population, the beneficial treatment of the land in order for the land to maintain enough nutritional value to support herds was necessary in supporting Mongolian nomadic lifestyles. While traditional Mongolian attitudes about land may have primed government officials on how to not overexert human environmental dominance during the Yuan dynasty, Han Chinese realities (such as a bustling population) kept any Yuan leaders from truly making a difference in terms of expansion of ecological change or even reversing ecological damage already present. This could be expressive of the Chinese situation at the time, and may also demonstrate the inescapability of environmental degradation despite Confucian, Buddhist, Taoist, and even governmental attitudes towards the natural environment. Simply, to support a large population, the earth will be heavily tolled.

The Ming Dynasty, Population Growth, and Environmental Change

The Ming dynasty was founded after the fall of the Yuan. Revolts against the Mongol-led dynasty exacted by Han Chinese rebel groups—such as the Red Turbans—which is eventually how the Hongwu Emperor 洪武帝 (1328-1398 CE) came into power and began the dynasty. As had been steadily occurring since the population boom during the Song dynasty, communities continued to multiply, demonstrating the propensity for growth and endurance present during these later periods of Chinese history, aided by technological and scientific advancements. By

[30] Dee Mack Williams, *Beyond Great Walls: Environment, Identity, and Development on the Chinese Grasslands of Inner Mongolia,* 72.

measuring populations in Lingnan 岭南, a region in the very south of China, one is able to see population changes reflected in the later imperial dynasties. Lingnan population declined after the end of the Yuan dynasty, as it had in many other places due to "wars, famines, and epidemics."[31] However, under Ming Dynasty rule and consolidation, Lingnan saw a growth in population that was similar in characteristic to other surrounding regions. Population fluctuations were not uncommon and changed dynasty to dynasty; however, what made the population growth in the beginning of the Ming significant is that this increase in people did not occur from land and the annexing of peoples in the kingdom's periphery but instead a, "...slow increase in the size of the existing population."[32] The period of modernity saw more steady increases in population size, and if population increases were to falter they were rather quickly regained.

Yet, with this increase of population came an increase of ecological trauma. Specifically, the escalation in amount of people caused an escalation in farmland that was desired, and increased the workforce which could expose thousands of years of Chinese tradition upon that newly obtained land. In 1393 CE, records indicate that the Ming state collected, "…24,729,450 *shi* (2.65 billion liters) or rice and 4,712,900 *shi* (446 million liters) of wheat."[33] These numbers are over double what the Yuan had collected in grain taxes in the previous dynasty, clearly indicating that the growth in population had subsequently increased grain production and worked land. Because war had left land unoccupied, the Ming administrations additionally, "made great efforts to stimulate grain production by relocation population," to these regions.[34] During the

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[31] Harold M. Tanner, *China: A History*, 303.

[32] Robert B. Marks, *Tigers, Rice, Silk, and Silt: Environment and Economy in Late Imperial South China*, (Cambridge: Cambridge University Press, 1998), 86.

[33] Timothy Brook, *The Troubled Empire: China and the Yuan and Ming Dynasties*, 107.

[34] Ibid.,108.

Ming, an effort was made to utilize all resources which were available in order to assist the dynasty in growth and fortification. Still, eventually the amount of land fell short of what was perceived as needed in order to maintain normalcy and durability, causing more harmful methods of agriculture to become an ordinary practice. An example of this is the growth of tea.

Tea had religious affiliations dating far back into Chinese history, and through the Ming this remained and became more and more intertwined with the economy as global markets opened. However, it still remained an important part of Chinese national character as Buddhist institutions across south China, "...were deeply invested in producing some of the most highly praised teas of the day."[35] Tea was also vastly culturally important to scholars, literati, and monks and, of course, the average everyday citizen. However, the consumption of tea during this time period became so prominent and important that the agricultural practices of tea expanded to growing on hillsides and mountain sides, causing the same environmental issues as other crops that had been grown on hillsides in previous dynasties (soil depletion, siltification, etc.), except to a larger extent given the high demand and the large population creating that demand.

Despite the problems environmentally with the flux tea planting, there were benefits to the different ways of planting as well. By planting tea on the mountainside as opposed to flatland, there were lessened chances of contracting malaria for the people working the fields, causing this method to be more suitable in terms of human life but less suitable in terms of environmental sustainability. Undoubtedly, the relationship between economic growth, humanitarian issues, and environmental mitigation cannot be unfastened, and each of these must be considered in future attempts towards ecological progress on the part of humankind.

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[35] James A. Benn, *Tea in China: A Religious and Cultural History*, (Honolulu: University of Hawai'i Press, 2015), 197.

By reconstructing the changes in various climatic events, there is evidence to suggest that climate change had its hand in the downfall of the Ming dynasty, perhaps simply due to unfortunate timing because of the alignment of events leading to dynastic downfall and weather changes. A cold period struck Ming dynasty China, causing aggravation to the northern China climate and exacerbating desertification (which, as was mentioned previously, was at least partially an anthropogenic environmental change). [36] This caused problems in the "military farm system"—due to the lack of agricultural growth, the government was forced to increase spending in order to provide food to troops in the north, intensifying fiscal problems already plaguing the dynasty.[37] Moreover, long-lasting droughts were a considerable component in the beginning of peasant revolts.[38] Weakened military and lack of civilian support coincided to create a weakened kingdom that could not appropriately brace against the invasion of the Manchu empire. Although the Ming had developed a "modern" society that was no longer as susceptible to natural disasters, climate changes still had a measurable hand in intensifying the downfall of a government.

The Decline of Pre-Modern China

The Qing dynasty was established in 1644 CE, and much like previous dynasties, the search for land to cultivate in order to satisfy population growth became a goal of the Manchu-led government. Reconstructions of cropland in the Zhili province done by utilizing gazetteer records which measure taxation and abandoned land data suggest a dramatic rise in untapped

[36] Jingyun Zheng et. al., "How climate change impacted the collapse of the Ming dynasty," *Climatic Change* 127, no. 2 (2014): 169, doi: 10.1007/s10584-014-1244-7.
[37] Jingyun Zheng et. al., "How climate change impacted the collapse of the Ming dynasty," 169.
[38] Ibid., 169.

land transformation into agricultural lands between 1677 and 1755 CE.[39] Following this period until 1884 CE, there was slight growth in lands used for agriculture but the amount remains relatively stable. Brook highlights that the absence of the mention of trees in this region during the end of the Ming in Tan Qian's *Zaolin Zasu*, indicating that the lack of notation could be due to the actual lack of trees in the South Zhili region.[40] Indeed, throughout Tan Qian's *gu mu* there is mention of tree growth in various regions such as Shandong, Henan, and Shaanxi, but Zhili is lacking in notation.[41]

Many of the problems existent during the Yuan and Ming continued into the Qing dynasty, therefore their repetition here would be redundant. Increases in population and expansions in agriculture caused increased ecological stress. However, a feature that arose out of the Qing dynasty was the beginning of arguments regarding resource use and the environmental degradation of China, which officials had realized was advancing at a worrisomely rapid pace throughout recent history. Hong Liangji 洪亮吉 (1746-1849 CE) was a statesman during the Qing dynasty under the rein of Jiaqing Emperor 嘉庆帝 (1760-1820 CE), and in his correspondence with the emperor at the time it is evident the extent of the population problem which was beginning to plague China during the Qing (despite having been a consequence of hundreds of years worth of population increases). In this correspondence he states, "…in the matter of population, it may be noted that today's population is five times as large as that of thirty years ago, ten times as large as that of sixty years ago, and not less than twenty times as

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[39] Xueqiong Wei et al., "Methods for cropland reconstruction based on gazetteers in the Qing Dynasty (1644-1911): A case study in *Zhili* province, China," *Applied geography* 65, (2015): 82, doi:10.1016/j.apgeog.2015.11.002.

[40] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties*, 130-131.

[41] Tan Qian, Luo Zhonghui, Hu Mingxiao 談遷 談遷著 ; 羅仲輝, 胡明校點校. 羅仲輝 胡明校, *Zaolin za zu* 棗林雜俎, (Beijing shi: Zhonghua shu ju 中華書局, 2006), 920.

large as that of one hundred years ago."[42] Hong Liangqi also argues that given the extent of the population problem, uncultivated land and places in which to live that were available to the generations of only a hundred years ago were now extremely unavailable. Due to the unavailability of lodging, citizens were dying from, "windstorm, rain, and frost, or from hunger and cold and the hardships of homelessness.[43] Ultimately he informs the emperor that "Heaven-and-Earth" cannot rightfully rectify the population problem on its own due to Heaven-and-Earth's purpose being in destroying these individuals via natural disasters, but these natural disasters are not able to destroy a large enough portion of lives for environmental relief, and urges the emperor to pursue policies which might alleviate the problem.[44]

While Hong Liangqi's efforts—which eventually would get him banished—seem to be based in a humanitarian concern for the Chinese citizens, his account certainly offers an interesting light into the Qing dynasty's struggles between environmental health and excessive population growth. Firstly, it displays not only an awareness by the people living within the dynasty of rapid population growth, but also the lack of sustainability of said population growth and the effects which had occurred and would continue to occur. Hong Liangqi mentions a lack of resources existent during the Qing dynasty, demonstrating the extent of the breach of the human-environmental balance which began with "modernity" during the Medieval Revolution in the Song dynasty. However, while the increase in population and technology during the tenth through the thirteenth centuries was a major factor in creating this problem, the fact that the Qing dynasty could not technologically advance enough to find a solution to the problem of population

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[42] Hong Liangqi, "China's Population Problem," in *Sources of Chinese Tradition* 2nd ed., vol. 1, eds. de Bary and Bloom (New York, NY: Colombia University Press, 2005), 174.
[43]Ibid.., 175.
[44] Hong Liangqi, "China's Population Problem," in *Sources of Chinese Tradition* 2nd ed., 175.

growth—and poor environmental health—was certainly a reason for its decline. Intriguingly, the effects of population growth finally began to take its toll on the general Chinese populace, rather than simply the environment itself. The Qing dynasty was one of the first dynasties in which humankind felt the the extent of the drastic effects of rapid population increases, which ultimately is what prompted scholars and statesmen like Hong Liangqi to urge the government to make policy changes.

Climate Change and Late Imperial Society

As seen in previous sections, climate change was a major factor in dramatically changing Chinese life. The changing of climate could affect almost every aspect of early Chinese life, as changes in temperature could disturb crop outputs, incite droughts or floods, and even assist in bringing down a dynasty as it did in the Tang. Despite dramatic changes in lifestyle between early Chinese civilizations and later imperial civilizations, and despite the evident control over nature that the later imperial Chinese possessed, mother nature was still a force which often brought havoc upon Chinese society.

During the Qing dynasty climate changes on the North China plain displaced large amounts of Chinese citizens, causing both a refugee problem and a food production problem for the Qing dynasty government.[45] This was due to what was called the "Little Ice Age," occurring after the Medieval Warm Period where intervals of time were notably colder, separated by slightly warmer periods. North China socio-agricultural systems typically relied heavily on

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[45] Lingbo Xiao et al., "Famine, migration and war: Comparison of climate change impacts and social responses in North China between the late Ming and late Qing dynasties," *The Holocene* 25, no. 6 (2015): 901, doi: 10.177/0959683615572851.

weather, and frequent changes in temperature often caused flooding and droughts in these climate-sensitive regions. An additional crux in the face of climate change was the Ming and Qing's reliance on northern grain production for a large portion of their respective economies, because if (a) weather created unfavorable conditions for agricultural growth and, (b) farming families in the face of destructive weather migrated elsewhere, not only would there be a decrease in goods produced, but also a decrease in the numbers of the labor force required to grow these agricultural goods.

However, changes in migration were not the only population-growth-induced dilemma in north China caused by climate changes in the latter part of pre-modern Chinese history. Cannibalism became increasingly common due to grain shortages caused by climate changes. Because of the relationship between environmental and humanitarian issues and the Mandate of Heaven, incidents of cannibalism were recorded presumably frequently in order to demonstrate the poor rulership of the Emperor and consequent problems during his reign.[46] Between 1470 and 1911 CE alone, in only five provinces in Northern China there were 1115 recorded incidents of cannibalism, and surely many other incidents that went unrecorded throughout other provinces.[47] These incidents further demonstrate the complicated relationship between humans, their environment, and their government. Without a government that had adequate dominion over the environment and/or sufficient preparation for climatic disasters in place, citizens would suffer --especially in agro-economic systems. When the citizens suffer with frequency, the commonly held belief is that it is by fault of the current ruler via the Mandate of Heaven, and while in some

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[46] Lingbao Xiao et. al., "Famine, migration, and war: Comparison of climate change impacts and social responses in North China between the late Ming and late Qing dynasties," 903.

[47] Ibid., 903.

cases this is certainly true, the nature of environmental problems are usually a culmination of many years of poor policy and practices regarding the environment. Regardless, the effects of some poor environmental policies can be seen within the reign of one ruler, especially in a society becoming more and more hyper-aware of the various problems produced due to mass deforestation. This ultimately causes social instability within a dynasty or region, threatening the current establishment if social dissatisfaction were to spread too widely. Therefore, for a stable government and social system, adequate control over the environment is in many ways necessary. However, environmental dominion does not necessarily mean environmental destruction perpetrated at the hands of the dynasty; there is likely an achievable and essential balance that must be struck between the two.

Environmental Background

木. During the 10th century, the discovery of coal caused individuals to have enthusiasm about future energy source perspectives as opposed to the utilization of wood. Elvin notes a poem by Su Dongpo which exhibits the "elation caused by the discovery of coal in what is today the northern part of the province of Jiangsu," where Su Dongpo 苏东坡 writes about how forests will be able to "rest, and return to life," with this discovery.[48] However, in this poem there is also reference to the "unlimited" nature of coal as a resource, which obviously is not the case.[49] Later, as mentioned earlier, coal mining would cause large environmental problems—as it does in many other countries, even in the United States. Perhaps this is demonstrative of Chinese (and human)

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[48] Mark Elvin, *The Retreat of the Elephants*, 20-21.

[49] Mark Elvin, *The Retreat of the Elephants*, 21.

attitudes towards natural resources, which is one of non-sustainability upon the introduction of the resource and retroactive conservation. This attitude is not exclusive to the Chinese, however. In society modernly, there appears to be a pattern of passing environmental mitigation laws reactively and adaptively as opposed to proactively.[50] Due to this, forest replanting efforts were made, but unfortunately failed to solve the problem.[51]

The need for wood, which was rapidly disappearing as deforestation continued, caused deforestation efforts to take place further from populations than previously had been.[52] Noticeable changes at this point in forestation had began to cause concerns, and thusly citizens took to blaming the dynasty for overly ambitious wood acquisition for the palace—although, the decrease in wood supply was not contained within these two dynasties, as this project has previously touched upon.[53]

By the Qing dynasty, deforestation became less and less of an action and increasingly a state of national ecological existence, due to there being less land in which to inflict the damage upon. Aforementioned population increases created a setting where individuals found it difficult to even *find* land in which to cultivate, as much of the land was either infertile or already owned by somebody else. However, while individuals may not have been cutting down as many trees, this was a larger problem than ever had been before. From the Song dynasty to the Qing, environmental damage had been frequently exacted in order to achieve economic growth and increases in human life. Without as much forested land, the water cycle was likely interrupted

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[50] Peter Burnell, "Democracy, democratization and climate change: Complex relationships," 827.
[51] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties,* 130.
[52] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties*, 129.
[53] Timotyh Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties,* 129.

which may have been the cause of increased amounts of droughts, floods, and various other environmental problems.

水. The lower Yangzi Delta saw large transformations beginning around the Song dynasty, as "...spacious polders, wide channels, and large locks," were created to take advantage of irrigation possibilities coming from Lake Tai.[54] Later, wealthy families would create their own channels and polders, and eventually there were flooding problems faced because of Lake Tai, which caused the siltification of the lake and flooding, making the original function of the channels and polders ineffective. By the Ming dynasty, there were large amounts of waterways with channels and irrigation ditches.

During the Song and Yuan dynasties, steep slopes began to be cultivated due to an increasing lack of farmable flatland and an exponentially increasing population. However, farming on slopes causes destruction of the loss of the vegetation cover on said slopes, ultimately leading to the loosening of the soil which in turn causes an expedition of soil erosion. On slopes that were cultivated for farming over 25°, the frequency of soil erosion increased dramatically. This lead to large amounts of silt deposition in the Yellow River. Additionally, there is a significant increase in silt levels in the Yellow river during this period of time comparative to periods from after the fall of the Han Dynasty--before the fall, silt deposit levels in the Yellow River were comparable to Song and Yuan dynasties.[55] Despite this, studies on sediment deposits show that very little sediment actually makes it to the ocean but instead remains within the

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[54] Cho-ying Li, "Beneficiary pays: Forging reciprocal connections between private profit and public good in hydraulic reform in the lower yangzi delta, 1520s-1640s," *T'Oung Pao* 98, no. 4 (2012): 393-395. doi: 10.2307/41725990

[55] Ren Mei'e, "Sediment discharge of the Yellow River, China: past, present and future--a synthesis," *Acta Oceanol. Sin.* 34, no. 2 (2015), 1-8, doi: 10.1007/s13131-015-0619-6.

Yellow River's proximal environment and contributes to the somewhat-natural construction of plains and deltas, which is ecologically preferable as opposed to having sediment flow released into oceans.[56] This is not to say that the Yellow River does not and did not deposit some of the highest levels of silt in the world into the ocean, and it is also not to say that high siltification of the river in its proximal regions does not affect the surrounding environment. In fact, increased silt in the Yellow River causes the water level to frequently rise, causing flooding and increased pressure on larger and larger dams built later and later into Chinese history. Modernly, the Yellow River has the highest levels of silt of any rivers in China, causing large scale environmental erosion.

River	Drainage basin area (square kilometers)	Silt per year (millions of metric tons)	Average silt (grams per cubic meter)	Erosion (millions of metric tons per square kilometer)	Years to erode a 1-meter depth
Amur	1,620,170	29.8	110	18	83,300
Sungari	436,000	25.6	315	59	25,430
Liao	116,760	29.0	7,305	249	6,000
Yellow	684,470	1,360.0	32,200	9,987	760
Huai	121,330	14.3	560	118	12,700
Yangtze	1,010,000	490.5	1,090	485	3,090
Ch'ien-t'ang	31,300	5.0	121	160	9,400
Min	54,700	8.0	114	145	10,300
His	330,000	86.0	406	266	5,640

Fig. X. The Comparative Erosional Force of Selected Rivers in China. *Source:* Caroline Blunden and Mark Elvin. *Cultural Atlas of China*. New York: Facts on File Inc., 1983. 45.

[56] Ibid., 6.

The tension between public and privatized water during the later imperial period is evident through the conflicts pertaining to the Xianghu lake, a small lake in Zhejiang utilized for irrigation and built during the Song dynasty.[57] Reallocation of lake ownership consistently occurred the Song, Yuan, Ming, and Qing dynasties from private families, to local and central governments, and to elite families. This was due to the desire to own resources in a growing lack of resource-rich area in pre-modern China.These occurrences demonstrate the fight for resources as early as the Song dynasty, when many other places in the world still had abundant land in which to utilize for resources (particularly, the untapped resources existent in North America at the time due to the fact that colonization by European countries into the area had not yet occurred). There is also a history of water control being directly related to power gains in pre-modern China, setting a precedent for battles over aquatic environments. Yet, lack of aquatic resources were not the only lack of resources that caused problems in the aquatic environment of China. With an increasing lack of easily farmable land, pre-modern Chinese farmers began to utilize the edges of lakes for farmland. By encroaching on the aquatic environment and building walled domains in order to dam the lake water, not only did affected lakes (such as the Dongting Lake) shrink in size, they also experienced a rise water levels due to both the decrease in allowable water volume but also an increase in agricultural pollution which often changed water density.[58]

In the Qing dynasty during the 1740's there is recorded evidence of both a great flood and tidal wave that adversely affected regions in the north. While this incident is typically viewed

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[57] Peter C. Perdue, Rev. of "Lakes of Empire: Man and Water in Chinese History," by R. Keith Schoppa, 125.

[58] Bao Maohong, "Environmental History in China," *Environment and History* 10, no. 4 (2004), 481, doi: 10.3197/0967340042772630.

from a humanitarian and governmental action perspective, the existence of the record also clearly portrays the havoc wreaked upon the north due to environmental stressors and additionally changes to the natural environment by the late Qing. Flooding began after heavy rains in the "fifth lunar month," thereafter causing lakes, rivers, and the Grand canal to overflow and similarly dams and dykes to become useless.

动物. In 1368 CE, an imperial law was put in place that required local governments to keep records of historical, economic, and political events occurring within given counties, regions, or provinces.[59] These are commonly referred to by English-speaking historians as gazetteers, although the word was not coined in China and did not exist even in Europe during the Ming dynasty. Local gazetteers allow historians an up-close perspective of occurrences in Chinese history on a localized level, rather than entirely relying on the national perspective of imperial historians. Thanks to these local gazetteers, human-animal interactions have become much simpler to examine beginning in the Ming dynasty. Specifically, the following will focus on both tigers and gibbons as a measure of fauna environmental health.

Although tiger-human encounters began to be recorded in gazetteers during the Ming, humankind and tiger populations had amalgamated for centuries, leading to accounts of tigers in Chinese mythologies and similarly tiger use in traditional Chinese medicines. By the time gazetteers were written, tigers seemed to have been a problem more so in the southeast, in Fujian, Jiangxi, Hunan, and Guangdong provinces. In fact, it is during the Yuan, Ming, and Qing dynasties that human encroachment on tiger territory began to rapidly cause an increase in

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[59] C. R. Coggins, *The tiger and the pangolin: Cultural ecology, landscape ecology, and nature conservationinchina's southeast uplands*, (Honolulu: University of Hawaii Press, 1999), 131.

human and tiger encounters. Whereas now tigers are sparsely found in south China, at one time they, "…could be found from south China to Siberia."[60] This was the case in both the Yuan and the Ming; however, by the Qing tiger numbers in the north began to dwindle.

Given that tigers posed a large threat to human livelihood, the immediate response of villages with tiger problems was to protect themselves from these creatures. Therefore, in 1410 CE it was recorded that in Huizhou prefecture there were, "314 tiger traps dug."[61] As time moved on and tiger encounters became more and more frequent due to humans entering their natural habitat, more and more campaigns aimed at their extermination began to appear. Unfortunately, the stress on tiger populations was never alleviated—during the Qing, tiger sightings became less frequent, and in modern times they are almost extinct. The strive for human preservation present throughout Chinese history left the South China tiger all but practically non-existent.

Conclusion for Chapter 3

The culmination of traditions, treatments, and perceptions existent throughout Neolithic cultures until the Tang blossom into widespread ecological downturn beginning in the Song and carrying through the Qing into modern times. However, due to the escalation in population, the tradition of anthropogenic environmental change becomes increasingly problematic. These population increases, as seen above, begin in the Song and steadily continue until becoming a humanitarian concern in the Qing. Simply, with more people present in China, a decreasing amount of land remained untouched by the shovel, hoe, or plow. Yet, while in retrospect population changes are easy to view as an obstacle to environmental mitigation, it is important to

[60] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties,* 131.
[61] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties,* 132.

consider the difficulties in controlling population sizes, especially when those population sizes are just developing and the science examining population increases and environmental problems did not yet exist. Even modernly, population control is a problem which many countries find difficulties in addressing.

The "modernity"—as defined by Elvin—present within these periods are what differentiate them from the previous periods. While previous dynasties certainly had control over their environments, it is within the Song, Yuan, Ming, and Qing that the "power over nature in terms of the capacity for economic production," truly rises, offering longer human periods of peace at the cost of environmental periods of disruption.[62] During the Song dynasty, new means of agricultural production were introduced in order to both support the growing population and economically benefit from cheaper, quicker means of food production. The forces of the society trampled the forces of nature as more and more land was taken up, more water was muddied, and more habitats were encroached upon for agricultural purposes. Furthermore, the discovery of coal as a resource gave the Song dynasty Chinese even *more* incentive to alter the natural landscape, as there was an awareness of a growing lack of wood and similarly the Song simply had the technology in which to remove coal from the earth. Even despite efforts at mitigation laws, economic incentive for environmental destruction led to the continued demolition of the traditional ecological climate of pre-modern China.

During the Yuan and Qing there seemed to be growing resentment for the given condition of natural surroundings, as painters appeared during the Yuan (funded by the Mongolian-led government) who created landscape portraiture as a social commentary against the late Song

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[62] Mark Elvin, "A Working Definition of 'Modernity'?," 209.

dynasty's system of governance and elite society. In the Qing, criticisms of the government's environmental policies by statesmen such as Hong Lianqi began to arise. Although these protests were not often taken into consideration by the dynasty leaders, it nonetheless demonstrates flourishing concerns present amongst citizens at the time.

However, despite advancements and new perspectives on environmental interaction, "modernity" as Elvin describes it is certainly not perfectly achieved during these periods of time. Humankind, while having control over nature in order to achieve economic production, was not necessarily able to maintain that control in periods where nature retaliated against humans. Therefore, we see mother nature's hand in the collapse of certain dynasties. Yet, even modernly there is little humans can do when the wrath of nature is thrust upon them.

Ultimately, this period of time was no doubt comprised of the traditions set forth during early pre-modern Chinese history. Throughout, underlying many actions, are the traditions set forth in early times such as the reliance on an agro-socioeconomic model, dominion over animals, and so forth. An additional determinant that may not have been as influential in past dynasties for anthropologic environmental modification was the added problem of population, which necessitated an economic growth (especially in food production) to match that of population growth. The problem was—as was realized in the Qing dynasty—however that the finite nature of available natural resources made it harder and harder to accommodate population increases, especially without technological advancements to match.

CONCLUSION

In his firsthand account of China during the early 20th century, Edward Alsworth Ross—then a professor from the University of Wisconsin—describes the severely deteriorated condition of the Chinese landscape, stating that,

> "Throughout the rice zone the roads are mere footpaths, one to three feet wide, yet the greedy farmers nibble away at the roads on both sides until the undermined paving-stones tilt and sink dismally into the paddy-fields. Pasture or meadow there is none, for land is too precious to be used in growing food for animals. Even on the boulder-strewn steeps there is no grazing save for goats; for where a cow can crop herbage a man can grow a hill of corn."[1]

The tradition of Chinese innovation, population growth, and agriculture had an alarming effect on the landscape. This perception of the landscape was certainly different than that of Marco Polo, who had visited the Chinese during the Yuan dynasty, describing his astonishment claiming that there were,

> "…so many towns, villages and scattered homes that one might say that the entire route is inhabited. Nowhere along the whole journey is there any lack of provisions, such as rice, wheat, meat, fish, fruit, vegetables and wine, and the like, all of which are bought very cheaply."[2]

Granted, perhaps the two were merely differences in tastes; however, the ecological deterioration and population expansions which took place following the Yuan dynasty certainly are undeniable and undoubtedly had a drastic effect on the landscape, not only ecologically but also aesthetically.

During Chinese Neolithic cultures and the beginning of imperial Chinese society there is a clear establishment of traditional values regarding the environment which would be followed

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[1] Edward Alsworth Ross, *The Changing Chinese: The Conflict of Oriental and Western Cultures in China*, (New York: The Century Co., 1911), 71.

[2] Timothy Brook, *The Troubled Empire: China in the Yuan and Ming Dynasties*, 106.

through in almost all later imperial dynasties and even modernly. During the middle imperial period is where the Chinese begin utilizing these traditions in their relationship with the environment as they began to gain more control, acting as a stepping stone for the next period. During the Song, Yuan, Ming, and Qing was the point where negative environmental interactions began to rapidly affect the landscape, and additionally when humankind began truly suffering from the effects of overpopulation and environmental destruction.

Ultimately, at the time it would seem most environmental changes in both the early and middle periods of Chinese history are rather unavoidable, as these changes were natural consequences of maintaining human life and stable society, not necessarily human convenience or overgrowth. In many of these cases—especially the earlier ones—environmental change such as agricultural innovation and irrigation was meant as a safeguard for human life against natural disasters. In fact, even in the later imperial period, many environmental changes can be seen as necessary in the face of population growth; however, one must wonder with modern advancement and technology present following industrial and technological revolutions, if humankind could rely less on traditions of the past and ascertain some way in which to assist environmental mitigation, as the issues existing in the past will continue well into the present and the future. Perhaps, if humankind can discover a way in which to address these problems not through the past but through future innovation, guided by history, then environmental progress is within our reach.

Connecting to the Future

Several conclusions and cautionary messages can be made regarding ancient China and its environmental history. Certainly, history offers a set of broad guidelines in which future generations can look to in order to move forward in their own respective societies. In this case, the environmental history of China offers not necessarily a handbook as to what humankind should aspire to in terms of human-environmental relations; yet, the history offers many important perspectives as to *how* and *why* environmental changes occur and will continue to occur modernly.

Firstly, as demonstrated in ancient societal development, the unification and establishment of an empire has the potential to cause environmental shortcomings due to the need of these societies to utilize and exploit the natural resources of the country's acreage for stability, security, and development. This was certainly the case in pre-modern China beginning in Neolithic cultures and continuing well into modern times, and was especially prevalent throughout the earlier periods in which the early Chinese empire had less stamina in battling environmental disaster. Even currently, although societal development is in many ways different —as modernly it typically applies to agricultural societies transforming into urban ones—the effects often remain the same, as societal development in modern countries create a difficult environment in addressing pertinent modern ecological problems. Modernly, when a country has more relaxed environmental laws, it helps its economy develop via "capital-intensive 'dirty' goods"—or, rather, goods with a negative impact on the environment.[3] I, personally, cannot offer a solution to the perplexing problem of development and resource use, but have no doubts that

[3] Ulla Lehmijoki and Tapio Palokangas, "Trade, Population Growth, and the Environment in Developing Countries," *Journal of Population Economics* 23, no. 4 (2010): 1351. http://www.jstor.org/stable/40925864.

this issue will need to be addressed as countries continue to develop and advance in the modern era of environmental deterioration and attempted alleviation of ecological stress caused by humankind.

Next arises the problem of laws which cannot be properly enforced, especially in a world with an increasing emphasis on the ideal of democracy. Authoritarianism is compelling to states in disarray caused by environmental degradation; it has been suggested that, "growing environmental crisis is likely to undermine the conditions under which democracy and political pluralism can flourish, producing 'environmental authoritarianism' especially if a previous history of such rule exists, as in some Asian countries."[4] Furthermore, there is large potential for instability in regions with poor environmental health and thusly deficiencies in natural resources and poor economic performance, making governmental control altogether difficult, as was a factor in the Qing dynasty. Regardless, a balance must be struck between human freedoms and environmental protection in order assist in assuaging current ecological traumas.

Finally, the relationship between human life and environmental health must be considered in future ecological mitigation. In many ways, human advancement and environmental advancement seem almost contradictory. When north China saw decreases following in human residency following the fall of the Han dynasty was when the environment flourished. Conversely, when populations of tigers dwindled, humans could exist more securely. When creating movements towards the betterment of the environment, there must be heavy consideration of this reality and understanding that the laws which benefit the environment may not similarly benefit human life, which ultimately makes them difficult to enforce in a

[4] Peter Burnell, "Democracy, democratization and climate change: Complex relationships," 818.

democratic setting. Such will be the difficult decisions to make—somehow ensuring environmental welfare and additionally incentivizing the adherence to environmental mitigation movements without encroaching on the rightful freedoms of the people. Another issue in human-environment relationship is the constant increase in population, which countries must continue to work against, as many have been for some time now by introducing family planning and birth controls into their respective societies.

Ultimately, we cannot change the past of mankind to revoke all the damage to the environment that humankind has caused. Assuredly, the traditions which have shaped thousands of years worth of anthropogenic environmental damage still operate many human-environment relationships and perceptions today, even in the West. However, we can look to the past not only to seek answers to modern problems, but also to seek ways in which we as a species have not changed and understand the economic, social, political, and religious confines we must work within to guarantee an improved future. Perhaps, even, we will be able to break those confines.

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