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America's Water, China's Milk
A Visual Presentation on Alfalfa Trade and Dairy Consumption in China

A thesis submitted in partial satisfaction of the
requirements for the degree Master of Fine Arts

in

Visual Arts

by

Yubin Kang

Committee in charge:

Professor Brian Cross, Chair
Professor Lisa Cartwright
Professor Teddy Cruz
Professor Gordon Hanson

2020

The thesis of Yubin Kang is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California San Diego

2020

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ARTIST BIOGRAPHY

Yubin Kang is a research-based artist working in photography and ethnography. Her projects focus on place, agriculture, and food and consumption infrastructures. *LocalFoodBiggerTable*, a project she began in 2015, focuses on markets and farms in and around Shanxi, China, where she was raised, and in East Sussex, where she accessed her sites by bus and on foot during her university years.

Yubin Kang's current project, started in 2018, uses both photography and ethnographic methods to visualize and understand natural or manmade “resources” that have been consumed, utilized and transformed in both local and global trade.

Currently pursuing an MFA in Visual Arts from the University of California, San Diego, she holds a BA from the University of Sussex and an MA in Cultural and Creative Industries from King’s College London.

PREFACE

December 13th, 2019.

“China and the United States have reached an historic and enforceable agreement on a Phase One trade deal...”

The Evening News, broadcast from Beijing, announced this tremendous news while I was engaged in thesis preparation in China.

I had been waiting for too long to hear good trade news between the US and China. Last year, at around the same time in December, I took a photo of my uncle’s ranch in my home town of Taiyuan, China, in which a worker was standing in front of some alfalfa bales. It was a big storage space, but was only around a third full of alfalfa. The worker was sweeping up alfalfa flakes when we arrived. Due to the trade conflicts between the US and China, they had not been receiving alfalfa for a while and what they had could only last about three to four days, according to the ranch manager.

On the other side of this alfalfa trade, in Imperial Valley, California, where alfalfa is produced, I saw a huge amount of alfalfa bales waiting to be sold. My friend Richard, an alfalfa exporter, always tells me that good times should arrive soon. Farmers believe, and hope, that this is now the case.

Beginning from March 2018, trade disputes, also known as a “trade war” between the US and China has lasted for over 20 months, which happened to coincide with my project on the alfalfa trade. Every month there was news released about the situation but nothing really suggested good news. While the US has limited high-tech exports, such as curbing chip exportation to China, China has

slowed its purchases of American agricultural products such as soya beans and alfalfa. The trade in alfalfa may not sound that advanced compared to, for example, exports of civilian aircraft parts, but in this trade war it is as comparatively meaningful as high-tech products. The significance for both the US and China cannot be ignored.

Initially, the idea of this project was to use alfalfa as a figurative object to represent the issue of water consumption. According to my field research, a pound of alfalfa costs approximately 76 gallons water to irrigate. Although, as I stated in my first-year review paper,

... this project is not going to pass moral judgement on farmers and alfalfa traders, or argue over whether the area should grow high-water-use crops; instead, it will document the transportation process of alfalfa from sites in Southern California across the Pacific to China in this global virtual water trade...

Virtual water flows are a common global phenomenon since the production and consumption of most commodities involves the use of water, and every country and region involved in trade can be categorized as a net water importer or exporter. However, it will never be the project's aim to focus on just the numbers of how much water has been consumed in alfalfa production; instead, it seems better to explore how resources can be utilized and transformed in the trade process and their further impacts. Water can be used to grow alfalfa, alfalfa used for cows to produce milk, and milk is demanded by an increasing number of Chinese consumers. Thus, looking into the flourishing Chinese dairy market is one way to talk about the alfalfa trade.

There are, however, always conflicts between local benefits such as between ecology and wider business structures. Once, on a field trip, I visited Coachella, located in Imperial Valley, famous planet-wide for a music festival that attracts

more than 100,000 visitors a year. When we drove by a green golf course, Naria, an undergraduate student in UC San Diego who is also a local resident of Coachella pointed at it and said in a voice shaking with emotion, “Let me tell you, this is the priority!” What Naria was referring to was the scarcity of drinkable water for local residents in Coachella, in contrast to the massive amount of water used to irrigate more than 120 golf courses for tourists and celebrities. Obviously, the use of water for commercial interests has been prioritized. On one hand, I was distressed to see that some of Coachella’s residents were struggling to have clean water; on the other hand, I was thinking whether this was simply the nature of a cruel economy? Would water used on golf courses be returned as other assets, such as economic capital, to Coachella Valley? Even if it were, was it relevant when this was not a society that aimed for common prosperity and in which not everyone benefited?

Naria’s concern brought me to relate to the way valley farmers are accused of making money by “selling” water through alfalfa to China. Water is much cheaper for valley farmers than in urban areas. How and why is water that cheap for irrigation? Who are the people who set up these policies? Who has the power to control the water? There are so many things that are worth questioning but that are also beyond my current capabilities. Therefore, this project will not touch upon issues such as conflicts between local residents, farmers and government in Imperial Valley, but it encourages those engaging with it to examine them further.

Furthermore, this project will also not involve how alfalfa has been affected by trade disputes, or pay attention to how foreign resources are utilized by locals and how this is affecting local consumption (from a certain perspective). However, this trade war shows us that trade is not simply the importation and exportation of commodities, or the exchange of commercial values, but also a competition in the

areas of technology and finance. The trade war is also an economic war, a scientific war, a knowledge war and a war of everything that is precious and rare to a certain place. Although this project will not deal with the US–China trade war, thanks to it, we are becoming aware of the preciousness of all kinds of resources and commodities, and feeling that the world is more connected than we had realized.

ABSTRACT OF THE THESIS

America's Water, China's Milk
A Visual Presentation on Alfalfa Trade and Dairy Consumption in China

by

Yubin Kang

Master of Fine Arts in Visual Arts

University of California San Diego, 2020

Professor Brian Cross, Chair

America's Water, China's Milk, uses photography to understand natural or manmade "resources" that have been consumed, utilized and transformed in local and

global trade. Although centered on the trade of alfalfa, a water-intensive crop exported from Southern California to Taiyuan, a city in China, it is not just about alfalfa, but the incredible amount of water that is used in its production and being virtually “sold” to China, and the requirement of fresh milk for every family in China as well. In this trade, water and fresh milk are seen as valuable resources for U.S. and China respectively, their values are profoundly measured by its local impacts. What has been overlooked, however, is resources that are also “virtually” engaged (such as labor, transportation etc.) and how they can be transformed, and therefore, bring significance to the other side of the world. This visual aspect of this thesis work consists of two parts, the first of which is named Flowing Boundaries, and the second is 52 Milk Stores. Viewers are encouraged to speculate regarding the fluid boundaries between the US and China that are formed by water and milk, to think about the utilization of resources with or without national boundaries, and to understand how individuals consume resources (water, labor, energy) within the environment of global trade.

Introduction

America's Water, China's Milk uses photography to visualize and understand natural or manmade “resources” that have been consumed, utilized and transformed in both local and global trade. Commodities and the values linked to them have reached unanticipated dimensions throughout the process. It is about the trade of alfalfa, a water-intensive crop exported from Southern California to Taiyuan, a city in China. It is not just about alfalfa, though, but also the incredible amount of water that is used in alfalfa production and being virtually “sold” to China, as well as the requirement of fresh milk for every family in China.

The project has lasted for two and half years. Initially, it tracked the journey of alfalfa, documenting its physical changes in locations and material forms as well as the narrative formed by people and places, both in the U.S. and China. As it developed, it started to look at the consumption end: the dairy market in China and its consumers. The artist found that resources are transferrable during the process and their values are hard to measure in numbers. The most significant thing about this transnational alfalfa business is not how much water it consumes and how farmers benefit from it; instead, it is how resources exist and are presented, and can be transformed and utilized in different ways. This thesis work consists of two parts, the first of which is named *Flowing Boundaries*, and the second is *52 Milk Stores* (See Chapter 5 and 6).

Through exploring a local dairy business in Taiyuan, the project would like to

demonstrate the impacts of an apparently unimpressive trade commodity, as alfalfa could affect the regions involved and the people living there. Viewers are able to speculate regarding the fluid boundaries between the US and China that are formed by water and milk; to think about the utilization of resources with or without national boundaries; and to understand how individuals consume resources (water, labor, energy) within the environment of global trade. When a consumer is purchasing milk from a local shop, it is not simply the matter of a 250ml bottle of milk, but also direct and indirect, local and international resources used to produce that milk.

Chapter1: The Story

It all starts with alfalfa, mostly cultivated as an important forage crop, primarily used for high-producing dairy cows because of its high-protein content and highly digestible fiber, and secondarily for beef cattle, horses and sows (University of Nevada, n.d.). Not many people know that California exports a huge amount of hay, and alfalfa hay in particular, to Asian countries. In 2017, the top five markets for US hay exports were Japan, China, South Korea, the United Arab Emirates and Saudi Arabia (US Trade Numbers, 2018, see Chart 1). The export rate of hay was ranked 201th in 2018 among the roughly 1,265 export commodity groupings classified by the US Census Bureau, with a value of \$1.41 billion, a 3.43 percent decrease from the 2017 total due to the trade conflicts between the US and China¹ (US Trade Numbers, 2018).

These figures may sound like a great deal if things are viewed simply, as California produces a huge amount of alfalfa and Asia needs it. Nonetheless, this trade has sparked huge controversies. The biggest criticism is about water. According to National Geographic, a gallon of milk from alfalfa-fed cows requires 1,182 gallons of water to produce. The water used annually to grow alfalfa for export to China is equivalent to the water used by 800,000 American families a year. In a field trip in Imperial Valley, a farmer calculated on his iPhone of how much water one pound of alfalfa actually costs. It came out as a pound of alfalfa consuming 76 gallons of water to irrigate. Speaking in a more practical, human way, that is:

¹ Ranked 189th among all commodity goods in 2017, with a value of 1,460,027,335 US Dollars

Around two full bath tubs, or
flushing a toilet 25 times, or
38 minutes showering, or
face washing 76 times or
1216 small glasses of water, which is the recommended amount of drinking water
for human beings over 4 months

just for a single pound of alfalfa. These numbers are more resonant when in
relation to everyday use of water.

Farming accounts for 80% of California's water usage, but it cannot simply reduce
water use by cutting agricultural allocations since agriculture is a pillar industry of the
state and the result would be major job losses and decreased food production. "There
are people in agriculture areas that are really suffering," according to Governor Jerry
Brown (National Geographic, 2015). One side of this argument is the criticism of
effectively exporting water while in drought conditions, especially considering that
alfalfa is a water-intensive crop. On the other side, there are seductive economic
benefits for the whole region and wider areas. "Everything is done for economics," an
Imperial Valley hay grower has said (Pacific Standard, 2009).

Although contentious, the history of the alfalfa trade can be dated to the mid-1980s,
when the arid border region of California began supplying hay for Japan's dairy cows,
cattle and Kobe beef (Pacific Standard, 2009). Different countries have different
reasons for importing alfalfa. Countries in the Arabian Peninsula have strict policies on

growing water-dense crops in terms of conserving local resources, while in China, a relatively new importing power, hay importing has increased dramatically over the past 10 years because of its booming dairy market demand. As the operational scale of dairy farms increases, there is a corresponding increase in demand for high quality alfalfa, especially of those large modern dairy farms. In 2017, 93.5 percent of alfalfa hay in China was imported from the United States, totaling 1.3 million tons. According to a governmental report, the domestic Chinese animal husbandry industry is expected to continue to need forage imports, especially alfalfa from the United States, due to its high quality and price competitiveness (USDA Foreign Agricultural Service, 2019). Another reason for this dependence is that Chinese domestic supplies are very limited by geographical environment (weather, sunlight, water, earth, ecological challenges) as well as political and administrative concerns (the use of land and water, policies). Comparatively, an area such as Southern California, which grows a huge amount of hay, is in the opposite situation. Furthermore, transportation of local alfalfa may cost more than shipping from the United States. A single container from the US to China only costs around \$260 and can load 25 tons of alfalfa (833 bales). Because the containers which bring furniture, auto parts and electronics to the US would otherwise go back empty, it is actually cheaper to transport alfalfa from Long Beach Port to Shanghai than to send it from Imperial Valley to Central Valley within California.

When I first heard that China is actually not producing any alfalfa and is very reliant on US exportation, I told my mother over the phone. I expected my mother to

be as surprised as I was, but in fact, my uncle's dairy business is one of those that uses US alfalfa. The company *Jiuniu* (translation: "nine cows") was established in 2009, serving local dairy needs within my hometown, Taiyuan. It has 52 chain stores which all located in communities with complete facilities, supplying pasteurized milk, UHT milk (ultra-high temperature processing milk) and varieties of baked goods. The map of its store locators covers most parts of the city. From ranch to community, the company aims to implement a "two hour policy" which means the whole process of milking, processing, leaving the factory, transporting and selling the milk should not exceed two hours to ensure its fresh quality. For a long time, I believed that my uncle's business was very localized, as it was based locally, with its milk produced locally, transported locally and consumed locally. Instead, its most important ingredients are all from thousands of miles away. Its cows are imported from New Zealand and alfalfa comes from California. My family connection with alfalfa caused me to think about how New Zealand cows and California alfalfa, along with other foreign goods, are meaningful to a Chinese brand and its market; how natural/manmade resources in global alfalfa trade are making significant impacts in local consumption.

Water, alfalfa, milk

In a loose but illuminating sense, water has been transformed into milk through alfalfa. Although there are many other resources involved in the process, water, alfalfa and milk are highly emphasized in this trade chain because they are resources that represent high value within a certain region. The "value" here does not refer to its monetary value, but to value in a political, social and cultural sense.

Trade is not merely transporting goods but is also about transforming their nature, which means that to understand trade impacts, one must not just look at the trade subject itself, but also examine key factors that are involved in its production and effects it may generate afterwards. It is important to look at both the origin and destination of a trade subject. For instance, through the alfalfa trade process, water becomes more than a natural resource owned and used by California, as it has been converted into another scarce resource in China: the milk that is a symbol of health, nutrition and the future to most Chinese.

Chapter 2: Study Sites

China is ranked No.1 among the United States' top trade partners in general terms (Imports from China, ranked No.1, 22% in 2017; Exports to China ranked No.3, 8.4% in 2017). The US and China, as the world's two biggest economies, have bilateral economic and trade relations that have direct effects on both countries' economies and other aspects. This thesis work, *America's Water, China's Milk* is going to look at the alfalfa trade which takes place between two towns in particular, on a comparatively small economic scale within two of the largest world economies. The documentation will mainly take place in Imperial County, California, U.S. and Taiyuan, Shanxi, China. These two places are not popular destinations and even people who live in both towns have only limited ideas regarding how they are connected to each other by alfalfa and milk, especially for the receiving side. However, what remarkable to me personally is, by photographing, writing and field researching both sites, I have been able to see how two seemingly unconnected locations are bridged by global trade. Secondly, this project would like to challenge one of the inherent impressions that trade products often travelling from the countryside to the city, from periphery to the center, from a low-wage to a high-wage country. In *Flowing Boundaries*, both Imperial and Taiyuan are areas that never tend to be big-time participants in the world and domestic economies, and as such, they are not compared in terms of developed and undeveloped; instead, it is their out-of-the-way nature that is relevant: they seem so insignificant but actually reveal the ways that global trade is not an unbalanced flow anymore.

The idea of exploring different locations is largely influenced by the collaborative exhibition *A Return to Elsewhere*, which focuses on Indian communities in two primary locations, South Africa and the UK. Studying a theme across different communities enables both the photographers and audience to explore different representations, understandings of belonging, histories, memory, and loss (Brighton Photo Biennial, 2014). Similarly, Yubin's project observes various locations across countries and cultures, and, as such, is able to present a broader understanding of the global trade process.

Reasons for choosing Southern California as a study site are: 1) I am based in San Diego, CA; 2) there are plenty of alfalfa production and export companies in the selected area. According to USDA statistics (2012),² the state contributes the largest amount of alfalfa production in the United States, followed by Idaho and Montana. A report by the California Department of Farming and Agriculture and the University of California, (Davis, n.d.) states that Southern California and the San Joaquin Valley are the major alfalfa producers in California.

Imperial County, located in Southern California, borders Mexico. To the south is the Salton Sea, into which drainage water from Imperial Valley farmland flows, while San Diego is about 120 miles to the west and draws its water from the Colorado River to the east, along the lifeline of the All-American Canal (Martin, 2001: 1). It is the place

² There are no more recent statistics available.

with the largest growing area (see Figure 1) for alfalfa, which has become one of the dominant crops, together with small grains, and was considered “the foundation of Imperial Valley agriculture” and “the basis of nearly all rotation schemes” (1918: 184–191). Imperial Valley’s agriculture is very dependent on imported water, the history of which can be dated back to more than a century ago:

In 1900 the California Land Company dug the canal from the Colorado River that brought the Imperial Valley to life; there were reported to be 100,000 irrigated acres in 1904, anchored by Calexico on the U.S. side and Mexicali on the Mexican side. Harry Chandler’s Colorado River Land Company imported Chinese workers into Mexico to dig canals to irrigate the Mexican side of the Imperial Valley, but a flood in 1905 diverted the entire lower Colorado River into the Imperial Valley, creating the Salton Sea. Chandler’s man-made canal is today called the New River; it begins in Mexico and flows about 60 miles north through Imperial County to the Salton Sea.

To relate the cheap water price in agricultural use, the diverted water from Colorado River and the water relations with Mexico and other issues, water always exists in relation to power. Similarly, fresh milk in China can also be associated with power, as fresh milk is not accessible to every Chinese person.

Coincidentally, Taiyuan has a similar landscape to Imperial Valley. I have displayed a series of landscape photos in my studio: one was taken at my uncle’s farm, where numbers of cows were hanging out in their playground in noon— a plain muddy piece of land with a long extended cowshed on one side. Another photo depicts a vast

alfalfa field in Imperial Valley, with uncountable alfalfa stacks arranged in neat rows. Both photos barely have redundant landscapes except sky and rolling mountains as background. Additionally, the cows and alfalfa lands are so naturally connected. The views always make my visitors feel they are looking at the same place. In this project, most photo shoots were done in Taiyuan, the capital and the largest city of Shanxi province in Northern China, which is also my hometown. The city is bounded on three sides by mountains. The Chinese characters of the city's name describe the geography, 太 (*tài*, "great") and 原 (*yuán*, "plain"), referring to the location where the Fen River leaves the mountains and enters a relatively flat plain.

Cities in China have been divided into different tiers based on their administrative level, city size, population size, economic development level and total GDP. Although the Chinese do not judge a city by its tiers, it is a general measurement of a city's power. In 2017, Taiyuan was one out of thirty-one second-tier cities. Even though Taiyuan is the capital city of Shanxi Province, its economy has been left behind compared to most capital cities in China due to Shanxi being hugely reliant on heavy industry like steel and coal. As an old industrial base of China, Taiyuan has many established state-owned enterprises such as Taiyuan Iron and Steel Group, Taiyuan Heavy Industry Co., Ltd. and Xishan Coal and Electricity Power Co., Ltd. It is too hard, almost impossible, to completely abandon heavy industry, but the need for transformation is looming.

The economy has the biggest impact on population and in return, the population

has further affected the economy. Taiyuan is, like most old industrial cities in China, facing an outflow of young people. A large number of young people have moved to other cities or other countries to live, while the majority of them stay in the city where they went to university. Most of my friends and cousins in my generation reside in Beijing, Shanghai and other big cities, even abroad, but their parents and older family members are all based in Taiyuan. Compared to coastal cities and other well-developed cities in China, which have significantly benefitted from the reform and opening up in the 1980s, Taiyuan has been largely forgotten by the rapid flow of China.

Although the economic picture of Taiyuan is not ideal, the city's commodity prices and consumption of power remain very competitive. I have heard people make fun of living in Taiyuan as being like "earning a salary like a 4th tier city but spending like a 1st tier city". Elements like raw food and catering are as expensive as in first tier cities. However, the price levels in Taiyuan are in a reasonable range compared to national standards, albeit without taking salary into consideration. According to data released by the National Bureau of Statistics, the average annual wage of non-private employees in urban areas in China is 74,318 yuan. Shanxi is behind the national average with 60,061 yuan, ranked as 18th among 20 provinces and cities. Inflated prices are not cheap for Taiyuan people, as well as for the larger population in Shanxi, to afford with their limited salaries. Nonetheless, the city also has a good number of billionaires enjoying the best gathered from around the world. At the beginning of the 21st century, with skyrocketing demand for coal, many villagers who lived around coal mines found

their first fortune and became extremely wealthy. Most of them moved to the capital city, Taiyuan, for a better life. This group of rich people has properties across the country but they usually live in Taiyuan, with which they are familiar.

When considering milk consumption, Jiuniu is not a cheap choice for many of the families in Taiyuan. Indeed, the majority of Taiyuan people think Jiuniu is expensive. A bottle of fresh milk is sold for 19.9 CNY (around \$2.80) and is enough for a family of three for one day. If the family drinks Jiuniu milk every day, it will cost a tenth of the average salary to do so. Compared to the U.S. and other countries where there is a long history of having fresh milk as a daily essential, spending this much on milk is unbelievable. In a conversation with an old lady my grandmother's age, she stated that she only buys fresh milk at Jiuniu when there's a 'buy one get one free' offer. She complained about the unaffordable price and lack of money for buying milk. In another conversation, a lady who was picking up her child from school said that she consistently buys Jiuniu one day and another, cheaper, brand the other because that is more affordable. The reason why fresh milk is expensive in China is the high production cost. Most important ingredients are imported, such as alfalfa, corn and other kinds of feed and even their cows and machines. For a ranch like Jiuniu, located in a city area, land, labor, gas and electricity will cost more than for rural production.

Another thing to consider is Jiuniu's development in a city like Taiyuan. As introduced above, Taiyuan is in the midst of a slow transformation from relying on

heavy industry to seeking alternative economics. In this environment, a fresh milk business is not easy as the brand's own innovative attempts have been trapped in a wider traditional economic structure and the great mass of a conservative population. This will be analyzed in depth in the section "*Project: 52 Milk Stores*".

Fresh milk has never been plentiful for Chinese people throughout history and this will be discussed in the next chapter.

Chapter 3: Dairy in China

Understanding how the dairy industry has significant meanings in China is the key to comprehending where alfalfa stands in this trade. “Why is alfalfa so important to the Chinese market?” is the question that I found myself asking at the beginning of the research and it was also the first question I asked when I first met the alfalfa dealer and ranch manager. The answer would be that a prospering Chinese dairy market with strong potential is very much in need of alfalfa. In 2008, the total sales of dairy products in 2018 were about 3700 billion yuan (approx. 530 billion USD). Meanwhile, in another huge dairy consumption market, the United States, sales of dairy products dropped by 8%, from \$14.7 billion (2017) to \$13.6 billion in 2018 (Dairy Farmers of America, 2019). The Chinese dairy market is about 38 times bigger than the US and is still developing. This expansion in the dairy industry precisely explains the intense, growing demand for alfalfa hay as well as other imports that are related to this business. For instance, there was a 600% increase in foreign cow imports to China from 2008 to 2011 (National Geographic, n.d.).

Milk was a real luxury in 20th century China. From October 1953, China entered its “ticket age”, as the government introduced the policy of unified purchase and marketing which lasted for 40 years. Commodities could only be purchased with tickets and there were tickets for a wide variety of goods such as fine grain, coarse grain, pastries, tofu, cotton, soap, gas and even holidays. Milk tickets were among the rarest. In many cities, milk tickets were even divided into three colors which were limited to

children, patients and the elderly. In Beijing, two milk tickets could even be exchanged for a bicycle, which was the main means of transportation at the time. The reason why milk tickets were so scarce was because the domestic dairy industry was very weak at the time. According to the China Statistical Yearbook (1980), in 1949 there were only four dairy factories in the country, with 120,000 cows and an annual milk output of only 200,000 tons, while dairy products output was only 0.1 million tons. In Shanghai in the year 1978, the per capita consumption of milk per year was about five to six kilograms, while it was less than one kilogram nationwide, which means that the vast majority of population in China had no milk in their diet or had even not seen milk before. Therefore, milk at that time was regarded as very rare, even mythical. The most impressive memory of milk for Zhang Aihua's family is that about 30 years ago, in order to secure enough nutrition for her mother in a time of poor health, Zhang's father bought bottles of fresh milk from a neighboring village and strictly served it to her mother to drink at 4 o'clock every afternoon (BJNews, 2019). In an environment of restricted availability, milk was seen as highly nutritious, even curative.

After China's economic reform and opening up in 1979, milk purchases became prevalent. I remember, in the 1990s, there were milkmen who rode bikes with big stainless-steel containers filled up with fresh milk. They bought milk from farms directly and transported it to local communities. Around six o'clock in the afternoon, people would hear the milkmen calling outside the community estates. People who would like to buy milk carried a pot or a bowl downstairs. The milk had to be boiled to

sterilize it. It used to be popular to purchase fresh milk in the 1990s, but it is rare to see these milkmen nowadays due to technical improvements in milk preservation. In a recent visit to an old community, even so, I luckily found a lady who still sold milk in this traditional way.

Small dairy processors began to disappear around 1995 because of the consolidation of major domestic dairy companies (San Yuan, based in Beijing, San Lu, Hebei, Guang Ming, Shanghai, Yi Li and Meng Niu in Inner Mongolia). In 2006, two years before the shocking dairy scandal, these companies accounted for close to half of all dairy sales, with more than 700 smaller companies splitting the other half (Sharma and Zhang, 2014). These big brands had ambitions to supply milk across China, but in reality there was a big national supply gap due to inefficient logistics and the short-term freshness of dairy products. In order to overcome the existing limitations, most products are pasteurized which means that they can be kept at room temperature for 21 days and can be purchased in supermarkets and small shops. The Vice President of Yi Li Group, Zhang Xiaopeng, recalled that preservation was the toughest difficulty at the time, “the short expiration date is like a curse, therefore, dairy business is limited to regional economy.” In order to break this barrier, Yi Li introduced TetraPak, a Swedish company for food processing and packaging, and was able to extend their products’ preservation for up to seven months. In 2000, Yi Li’s sales performance broke through 500 million Yuan. People from the dairy industry in China still see this as a tremendous breakthrough, as milk with longer life broke the geographical restrictions and brought

the Chinese dairy industry its first golden ten years. Areas with poor transportation or that are not suitable for raising cows can now have milk as well. Most Chinese people trust big brands and they see these technical progressions as improvements in quality.

Most Chinese started to abandon direct farm milk as it is not guaranteed, in many ways. Compared to farm milk, UHT milk is more convenient, with a longer shelf life, can be bought anywhere, is easy to carry, and does not have to be cooked. However, the majority of people did not realize they were not consuming high quality milk. The milk quality was questionable; even the best quality milk around 2008 tasted like milk mixed with a lot of water. Not just the taste had been diluted, so were the proteins and vitamins contained in the milk, but most Chinese had no better options. It was the best available at the time. Over a very long time, Chinese people got used to having impure and non-fresh milk, while imported milk products from the US, Australia and New Zealand became popular among middle-class consumer groups from 2010 on. They were sold in supermarkets with imported foreign goods. Even though they were still “long-life” milk, the quality was much better.

The Chinese version of “How are you?” used to be “Have you eaten yet?” Just as the British traditionally start a conversation with the weather, Chinese talk about food. Greetings related to food can be traced back to the Great Chinese Famine of 1959–61. After the starvation of that time, having abundant food to defeat hunger become the top priority for Chinese people. In the last 15 years, though, as people’s lifestyles have

changed profoundly with a rapid increase in income, there has been a shift in food philosophy, from the pure pursuit of “eating” to “eating healthily“. The demand for fresh milk has thus gradually increased. However, food safety problems have emerged in an endless stream in China.

Right after the Olympics, in September 2008, the melamine milk formula incident caused outrage among consumers and fraught parents and led to an international outcry about the standards of food safety in China (BBC, 2010)._Five hundred times the maximum allowed level of melamine – a toxic chemical used to make plastics and fertilizers – was detected in the products of 22 Chinese dairy companies, one out of every five suppliers in China. The use of melamine can add higher protein but can also cause kidney stones and kidney failure. Six babies died and 300,000 were ill. It was the darkest time in Chinese food history to date. The pictures show that in one of the Carrefour stores in China, most dairy products were removed from shelves after the melamine incident in 2008 (see figure 1). Many Chinese families have not bought domestic dairy for a long time; the trust has gone.

In order to restore mainland Chinese consumers’ confidence in its domestic dairy products, small, local dairy businesses revived and new businesses have emerged as the times required, supported by national and local government programs. The ranch Jiuniu that was involved in this project is one of these dairy businesses. Initially, when it was established in 2009, it only served consumers’ needs within a district due to quality and

hygiene concerns; however, the company has developed more than 50 direct-sale stores located in communities with a high flow of consumers during the past years. Over the years, Jiuniu has been appointed as the focus of key agricultural projects in Shanxi Province and has received government funding and loans as a result, but its development has also been considerably restricted by the conservative local government. I have heard stories, complaints, secrets from my parents, my uncle and aunt, suggesting that the dairy business has always had a complex relationship with the local government. Unfortunately, much of this is too sensitive to include here, but it is certainly worth paying attention to government interventions while looking at the dairy industry in China.

Chapter 4: Government Intervention

“I have a dream ... to provide every Chinese, especially children half kilo of milk every day” (President Wen Jiabao, n.d.)

Revitalizing the dairy industry became the most urgent need for the Chinese government and people, with children and teenagers as the major targeted milk consumers. In order to support the milk program, the majority of elementary schools in China responded to national School Milk Programs which took place in 2000. School children have to drink milk as part of the school diet in their elementary school years. Most of the post-90s children have memories of having a bag of warmed-up milk and a small pastry for breakfast. From 2000 to 2015, China’s School Milk Program has covered 31 provinces, with more than 60,000 schools, supplying over 15.17 million servings per day across the country, which has benefitted over 22 million students (xinhuanet, 2017).

While this was an innovation in China, looking at Western and Western-influenced countries, school milk programs have a long history (USDA, 2019):

Federal assistance in providing milk for school children in the U.S. has been in operation since June 4, 1940, when a federally subsidized program was begun in Chicago.

In 1947, Japan, approximately 3 million children began receiving powdered non-

fat milk donated from America in their school lunch.

In 1950, a typical school lunch served for Japanese elementary school-aged children included a bread roll made using wheat flour from America, potato stew, croquette, sliced cabbage, and milk.

In 1958, fresh cow's milk gradually replaced powdered milk over the next several years.

It is all about catching up. In China, 90% of elementary and middle school students are still not covered by the school milk program. Milk has become a strategic tool to catch up where China has been left behind in past 60 years, compared to the US and Japan.

For a long time, Chinese have been drinking milk out of patriotism. A Beijing-based filmmaker, Jian Yi, now 43, clearly remembers he first saw milk in an advert on TV in the 1990s. The ad said explicitly that drinking milk would save the nation. It would make China stronger and able to survive competition from other nations. The most frequent hearsay about milk I heard in my childhood was that Japanese grow taller than Chinese because they drink milk every day. At the time, every Chinese person knew the slogan produced by the Japanese government, "A CUP OF MILK CAN MAKE A NATION STRONGER". I was too young to understand how a cup of milk

could make a nation stronger and never questioned whether this was the political strategy produced by the Chinese government or Japanese government to promote people drinking milk. At the age of seven, I didn't understand all these connotations, but knew I had to drink milk for a reason. Obviously, this program worked better among adults, making them believe in drinking milk as an effective action to surpass the Japanese. Why Japan and the Japanese in particular? China and Japan have complicated relations, mainly due to Japan invading and committing war crimes in China between 1894 and 1945. About 300,000 innocent people were inhumanely killed in the Nanjing Massacre. When Japan invaded China, they asked Chinese people to call them the “Great Japanese Empire” and the “Great Japanese Imperial Army” to show its mighty power. However, a very strong hatred for the invader made the Chinese call Japan “Small Japan”, and some people still do so nowadays. The brutal aggression against China left an indelibly painful memory for Chinese people, and surpassing “Small Japan” became a strong motivation for Chinese people to drink milk.

From traditional farming to modern agriculture, to an era that emphasizes the concept of organics, it has taken more than a century for Chinese to have milk in their daily diet. Milk is no longer a luxury but an affordable product for most Chinese, which emblemizes the tremendous progress of the Chinese dairy industry. From big national consolidated brands to small local businesses, it signifies an open market of Chinese husbandry, but more importantly, a strong demand among Chinese people to pursue better quality, fresh milk. The history of material scarcity, scandals in milk quality and

government propaganda have all reinforced the status of fresh milk and its symbolization of nutrition, health and social class. Most Chinese still believe the slogan of ‘a bottle of milk a day makes a stronger Chinese’ (每天一瓶奶，强壮中国人). The only reason that alfalfa matters so much is because of the huge demands of the Chinese dairy market. Therefore, this project encourages its audience to think of the alfalfa trade beyond commercial buying or selling, and to reflect further on what can be brought to both its destination and origins beyond the products themselves.

Chapter 5: Flowing Boundaries

Flowing Boundaries will be a photo collection of 58 images presented in diptychs or triptychs to tell the story of two production sites: Imperial Valley, California and Taiyuan, China. Through the narrative, viewers are able to speculate regarding the fluid boundaries between the US and China that are formed by water and milk; to think about the utilization of resources with or without national boundaries; and to relate their individual consumption of resources (water, labor, energy) to the environment of global trade.

In terms of locations, the reason I decided to focus on only Imperial Valley and Taiyuan instead of documenting all the places that are involved in the alfalfa trade is mainly because: 1) Imperial and Taiyuan are two terminals in this trade chain that represent alfalfa production and alfalfa consumption as well as milk production and consumption; 2) therefore, transportation between two countries (such as loading at Long Beach Port and container shipments on the sea) is not the focal point of this project; 3) high security bringing technical difficulties. I briefly pretended to be an intern with an Australian agricultural trade company in order to get into one of the terminals at Long Beach Port with a manager who works for an Italian shipping line. The manager contacted the marine terminal company, which operates several terminals at Long Beach, saying we were interested in exports. The security level at the terminal was nothing lower than an airport, with a passport needing to be checked before we could go in. Our information was registered while we waited for officers to show us

around. There was a patrol car following us all the time while we were driving inside the terminal. I was not allowed to bring any cameras and professional equipment except my phone camera.

Presence of Water

The biggest criticism in this trade is about water. It may sound bewildering when it becomes apparent that local residents are suffering from water shortages while gallons of water are invisibly flowing to the other side of the world. This is not just about alfalfa, though. Everything we use, wear, buy, sell and eat takes water to make. According to A.Y. Hoekstra, virtual water is “the water ‘embodied’ in a product, not in real sense, but in virtual sense. It refers to the water consumed in the production of any agricultural or industrial product” (2003: 13). Virtual water flows are a common global phenomenon. Beyond alfalfa, in a world that is highly globalized, the virtual water trade is seen as a two-dimensional, even multi-dimensional, flowing process. There is no single country on earth that only exports or imports virtual water. Even so, and although this body of work is named *Flowing Boundaries*, it has never been the aim for this project to emphasize water issues.

Beyond the concerns of “real water”, there are also services and other resources which can be seen as “virtual water” and which are embedded in this trade. Martin Seelig (2001) once stated in his book, what we see today on the water, on the roads, and in the air are the actual movements of commodities. Indeed, they have been largely

ignored, as water consumption is always the key to the debate. “*Water*” in this project does not simply refer to H₂O as a fluid to irrigate fields, but is also a representation of various hidden production inputs such as land, energy, labor, capital and more that are ignored in the alfalfa trade process. These have become underlined in this photo series. In a similar example, the term “virtual immigrants” (Lund, 2014) is used to describe the unseen labor force involved in the trade, referring to people who do not need to change geographical location, but the products they make are imported by other states and countries. That is to say, their labor is “fluid” and “immigrated” from their origins in the same way as water, without having their physical presence there. According to Seelig, infrastructure such as warehouses, shipping containers, roads, railroads, ports, and airplanes is also important to smooth the process of distribution of products .

Therefore, while we examine this exportation and importation, it is important to look, not just at water, but also at other production inputs. In this work, ‘real water’ has appeared three times throughout the series: in the All-American Canal which lies on the border between Mexicali (US) and Calixico (Mexico); in an image where a Mexican irrigation worker is standing next to his farm’s canal in Imperial Valley; and in a water sink that has been filled with water when a worker flushes the ground before milking. Although these images show the presence of real water, more than that, they represent other issues such as labor and power dynamics that are embedded within them.

Narrative

Images are organized in diptychs or triptychs to connect stories of Imperial Valley and Taiyuan, except for two single landscape photographs. In *Flowing Boundaries*, it will be the presentation of photographs without any caption or description, so that viewing the images is purely looking at the images themselves with no interference. This is progress I have made from previous work. Because of the ethnographic approach, my earlier work relied heavily on descriptions, while this time I would like to exhibit its picturesque qualities within commodity movement. It is going to be a pictorial account for the audience to interpret their own version of the stories.

In a retrospective show curated by MOMA to celebrate Walker Evans' *American Photographs*, images were arranged in clusters, some with four lined up horizontally; some placed high and low... (Figure 2). As introduced by curator Sarah Hermanson Meister and staff, the pictures provide neither a coherent narrative nor a singular meaning, but rather, create connections through the repetition and interplay of pictorial structures and subject matter such as American cultural artifacts: the architecture of main streets, factory towns, rural churches, and wooden houses (MOMA, 2013). In *Flowing Boundaries*, land, buildings, trucks, people from both places are the constant theme as they are virtual resources that participate in the alfalfa trade. For instance, laborers are included in the series, including drivers, factory workers, irrigators, farmers, alfalfa packers, a farm owner and his grandson, local residents and cows. They are all summarized as 'labor', though each of them speaks for a different part of the narrative.

Another repetitive theme to notice is the rectangular shape that continuously comes into sight from the beginning to end. This shape symbolizes loading trucks, shipment containers at the port, containers stacks in factories, milk bags, gift boxes and more. One diptych work depicts two trucks with fully loaded alfalfa in panorama shot, while the photo next to it is a close-up shot of sliced bread. The shapes of alfalfa bales are similar to loaves of bread, while the two represent production and consumption respectively. *Flowing Boundaries* also includes portraits of several natural landscapes that are occupied and/or abandoned by humans in Imperial Valley. Although a single image may not contain a special meaning, all strongly suggest the ownership, the economics and the social value associated with landscape when they are read with another part of the diptych and wider narratives. With regard to photo order, sets of diptychs one next to the other may not constitute a coherent narrative; however, they form strong interactions with each other through the structure of images and the repetition of the theme. The whole body of work provides a space for viewers to construct their own landscapes and storylines.

Chapter 6: 52 Milk Stores

'52 Milk Stores' will be a photo collection of 52 storefronts owned by Jiuniu, a local dairy provider in Taiyuan, China, along with the insertion of photographs of landscapes and people from nearby communities to reflect on their economic status and lifestyle. Jiuniu now has 52 direct-sale stores selling fresh dairy products and baked goods within varied communities across the city of Taiyuan. Almost 90% of the stores are located in local communities with a high flow of population. A very few of them are close to government offices and residences. None of them are located within the high-end communities that are relatively newly constructed. Therefore, most photos are delivering a conservative and backward look, which is the normal life of the city. The gesture of presenting 52 stores together is important, as no individual store is able to tell a big picture. Only in collective form will the work exhibit the massive scale of the dairy consumption scene in China. It is also meaningful to show the city of Taiyuan instead of showing giant cities in China that are doing well economically, because the growing demand for fresh milk exists in every part of China. From its establishment in 2009, when the government started to promote local dairy businesses after the melamine formula scandal, Jiuniu in Taiyuan is the epitome of dairy consumption in Chinese cities.

Typology

The format of documenting storefronts has a similar approach to typology photography such as Bernd and Hilla Becher's renowned water tower series, with an

aesthetically consistency: “grids of black-and-white photographs of variant examples of a single type of industrial structure”, as explained by MOMA. I was inspired by how those photographs are a set form of themselves to make a statement. Although major structures are apparently the center in typologies works, surrounding environments are also carefully observed by photographers. For instance, in the Bechers’ work (Figure 3), the photos are is homogeneous, yet different details are revealed in each by looking at the very bottom. The neighboring environments vary from natural to industrial, to urban or suburban. These diverse locations strongly suggest how industrial sites deeply and extensively affect landscapes and people’s lives in 20th Century Germany. Moreover, at each site, the Bechers also created overall landscape views of the entire plant, which set the structures in their context and showed how they related to each other (Figure 4). In a show curated by MOMA, the two formats of the Bechers’ works were presented together, as described by Peter Galassi, Chief Curator of Photography of MOMA, “... they lie at the polar extremes of photographic description, each underscores the creative potential of the other. The typologies emulate the clarity of an engineer’s drawing, while the landscapes evoke the experience of a particular place.” I intentionally chose to include the ‘borderline’ environment in the storefront photos, such as residential buildings, offices on top of the stores (mostly by showing windows) and other kinds of businesses that are next to Jiuniu. Just as water tower typologies show the surrounding environment, in my work, it is more than the milk stores themselves, as street views, high ways, residential buildings and people are incorporated into the series as well.

Visual Ethnography

In her book *Portraiture and Photography in Africa*, Elisabeth L. Cameron wrote that, in her field photographs, her goal was to capture a “truth” or a moment or event frozen in time (2013, p142). My work has a similar approach to Cameron and other ethnographers who are interested in visual culture. The Center for Land Use Interpretation is a non-profit research and education organization with the aim of examining the physical landscape and its human occupation. The Center maintains a Land Use Database, which is a collection of visual materials including a photographic archive and screen shots from Google Earth of what they have termed “exemplary” sites in the US. Most of these database images were not taken by professionals with high-end equipment, as the quality and aesthetics are less important than their cultural and social meanings. As the whole purpose of this project is to document what has happened to land, database photos are less likely be manipulated, taking an outsider role to show the relationships between the physical landscape and its human occupation in an objective position. In my thesis work, although ‘Flowing Boundaries’ and ‘52 Milk Stores’ have very different approaches, what they share is my perspective as a photographer, always stepping back to photograph for the sake of rational documentation.

I spent some time observing most of the communities where milk stores are located. Once, on my visit to Xuefujie Store, located on one of the main streets in Taiyuan with well-equipped schools nearby, somehow the map directed me to a small

lane. When I walked into it, I encountered a local community that looked exactly like Taiyuan 20 years ago, just like the area where my grandparents used to live when I was around six years old. I could not believe there was still a place like that after the big demolition movement in Taiyuan. After I walked out from the area in another direction, I saw the store was next to the entrance of the community, and in front of me was a very wide road with high-rise buildings, so that scenes I had seen inside the community contrasted with the bustling ‘outside’, seemingly like two separate worlds. The people who lived in this community were all retired workers from the railway construction group, and most of them had migrated from North-East China due to transferring work. Inside the community, there were tofu shops, barbeque restaurants and so on, also owned by North Easterners (I recognized them by their accent). Although it was a very large-scale community with a thriving population, they were not target consumers for Jiuniu. Revealing the overall environment and ‘offcuts’ (referring to non-essential but detailed information) is designed to present what the city looks like and who the consumers are, and therefore, to relate to the dairy consumption scene in China.

During my visit, many areas of Taiyuan were under construction, and this may be reflected in the photos. In them, transformation and stagnancy are intertwined. For instance, I visited a store that was going to close soon due to a year-long construction of the city’s first subway line, which covered its area. The inconvenient transportation has led to many small businesses shutting down during this time. One of the photographs is of an old lady who lives in the nearby community, and who has to pass

the construction site every day for groceries. The long green leek inclined in her grocery bag contrasts with the yellow machine at her back.

Curation and Composition

However, unlike traditional typologies, this series of work does not strictly follow the “pattern”, for instance, the arrangement in grids and the unified composition (Figure 5). In terms of curation, most typology photo works are presented in grids, while the photographs in *52 Milk Stores* are arranged in clusters based on geographical locations. Mapping out photographs should give the audience a sense of the location and clustering effects of this business. Taiyuan consists of six districts, and stores are spread all over the city. Thinking of the blank webpage as a map of Taiyuan, the 52 stores are mapped out based on their locations and distances. Lines in different colors are used to represent districts, with stores that are connected by lines of the same color located in the same district. However, distances between stores are not calculated and mapped precisely, due to ratio and shape differences between the webpage canvas and the map of Taiyuan. In addition, if each store image is adjusted to be smaller in order to match the ratio, then the visual experience will be affected.

Considering the composition, the images of 52 storefronts are not all the same, as they were not taken from the same distance and angle, and do not have the same edit. For some stores, cars are parked in front of them every day and night; some stores are constructed on the ground, some are on stairs; some stores are located on a narrow

sidewalk, next to a busy road; some stores have different designs as Jiuniu is still in the progress of branding; some stores may share the same color signs as neighboring businesses because the City Amenities Committee requires them to do so. In light of this, compositions in *52 Milk Stores* are adjusted based on various situations. Besides this, I did not avoid people, and cars appeared in the scene because the original purpose was to understand the situation of Jiuniu in Taiyuan city without embellishing any of the elements. The process incorporated the methodology of doing ethnography field research, where being at the place and meeting people is seen as being at least as significant as taking good photographs. The thesis paper is thus not purely an artist statement, but also a long ‘research report’ that can be converted into a photo essay book in future.

Use of Text

On the website of The Center for Land Use Interpretation, a variety of places are categorized by more than a hundred key words (illustration 1) such as instability, heaven and hell, off color or more straightforwardly, gate, bridge, or gift shop. The list of terms is not just for convenience, but also provides abundant possibilities in relation to land use in the United States. Walter Benjamin (1931) points out the need for photographic images to be related to text in order to have authenticity. *52 Milk Stores* turned out to be a combination of field photographs (including titles and descriptions in both English and Chinese *pinyin*) written field notes, personal reflections, and fact checks (the majority of audience are not locals from Taiyuan) in order to complete its

full meaning.

Through exploring a local dairy business in China, the project would like to demonstrate the impacts that an unimpressive trade commodity, like alfalfa, could bring to the region and people living there. This encourages viewers to think about how alfalfa, as a resource from the US, can be used and transformed at the consumption end – the dairy market in China and its consumers. Meanwhile, they are encouraged to think of water and alfalfa beyond its material form, as resources are transferrable during the trade process and their values are hard to measure in numbers. The most significant point about this transnational alfalfa business is not how much water it consumes and how farmers benefit from it; instead, it is about how resources can be transformed and utilized in a different way.

Appendix

List of Figures



Figure1: Dairies were out of stock at Carrefour in China during Melamine Formula incident, took by Flickr user Marc van der Chijs

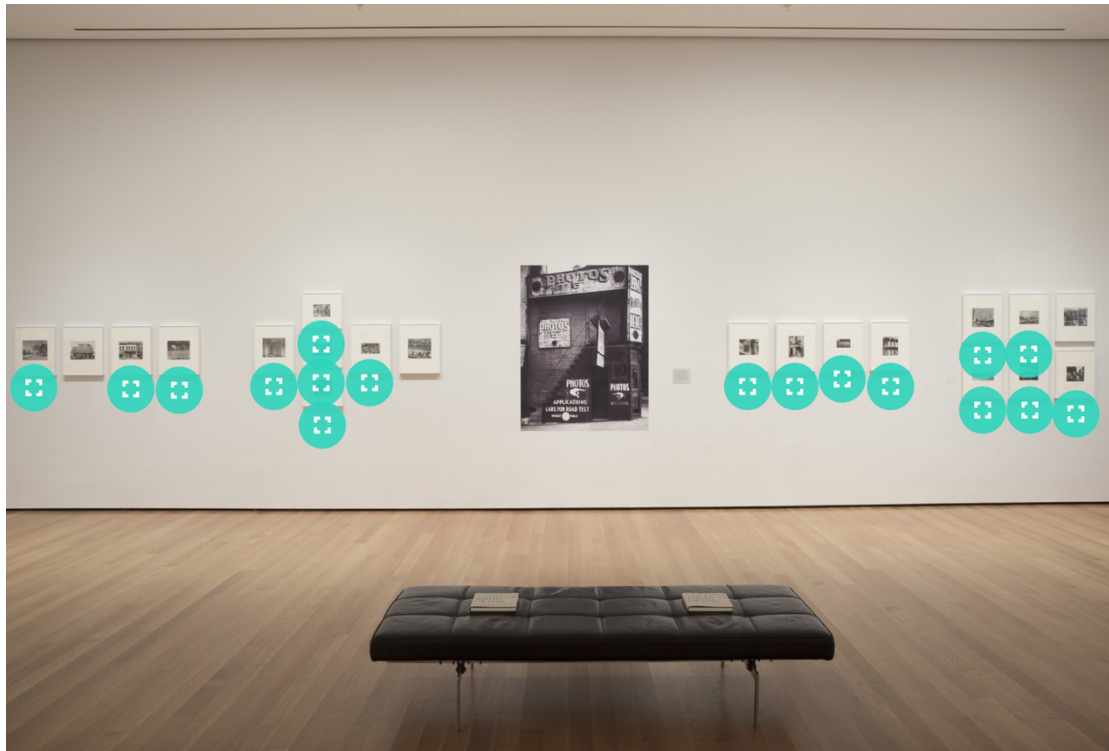


Figure 2: Installation view of Walker Evans' American Photographs at MOMA (2003). Reference from MOMA.



Figure 3: in the Bechers' work, the photos are homogeneous, yet different details are revealed in each by looking at the very bottom. Water Towers 1972–2009 © Estate of Bernd Becher & Hilla Becher. Reference from Tate.org



Figure 4: At each site, the Bechers created overall landscape views of the entire plant, which set the structures in their context and showed how they related to each other. Reference to MOMA



Figure 5: Installation view of the Bechers' works at MOMA. Reference to MOMA

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The image shows a dark-themed website interface for the Morgan Cowles Archive. At the top, there are navigation links: "CLUI HOME", "COWLES ARCHIVE HOME", and "ABOUT THE COWLES ARCHIVE". Below this, the main heading reads "MORGAN COWLES ARCHIVE" with the subtitle "MANAGING THE IMAGE RESOURCES OF THE CENTER FOR LAND USE INTERPRETATION". The central part of the page features a grid of 40 key words, arranged in four columns and ten rows. These words are used to categorize various places.

| | | | |
|----------------|------------------|--------------------|-------------------|
| ACCESS | EROAD | OUT OF BUSINESS | SILOS AND TANKS |
| ANIMAL KINGDOM | FAST FOOD | OUTER SPACE | SLUMPING |
| ARCH-ITECTURE | FAUX-CADES | OUTSIZED | STARS AND STRIPES |
| ARROWS | FENCES | OVERLOOK | STOP AND GO |
| BEACHED | FLOOD | PARKING | SURFACING |
| BENCHMARK | FOOD AND LODGING | PHOTO OP | SURVEILLANCE |
| BLANK PLAQUES | FOOTPATHS | PICNICKING | TEEPEES |
| BOAT RAMPS | GATES | PIPE | TELEPHONY |
| BOOTHES | GIFT SHOP | PITS AND PILES | THE END |
| BRIDGES | GLOBES | PLAY | TOURISM |
| BUNKERS | GOING POSTAL | POINTS OF INTEREST | TOWERS |
| CASTLES | HAVE A SEAT | PORTALS | TRACES |
| CLASSICAL | HEAVEN AND HELL | PYRAMIDS | TRAFFIC CONES |
| COMING SOON | HISTORICAL | QUESTIONS | TRAILS |
| DAMS | HOME | RE-SIGNED | TREES |
| DANGER | HYDRANTS | RE-TIRED | TRESPASSING |

Illustration 1: On the website of The Center for Land Use Interpretation, a variety of places are categorized by more than a hundred key words (illustration 2) such as instability, heaven and hell, off color or more straightforwardly, gate, bridge, or gift shop.

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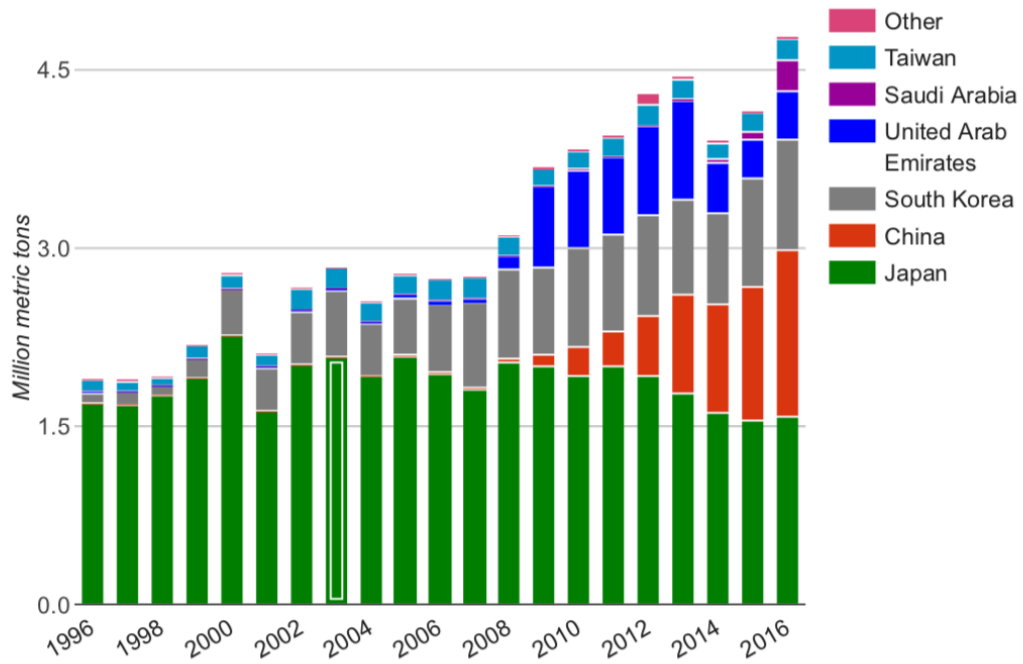


Chart 1: This chart shows the increasing amounts of hay exported from U.S. western ports. Chart made by Robert Hopwood, The Desert Sun. Source: U.S. Commerce Dept. data compiled by Bill Mathews, Dan Sumner and Dan Putnam, University of California, Davis

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