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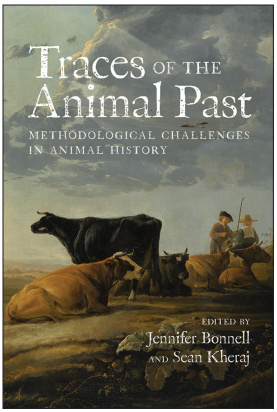

TRACES OF THE ANIMAL PAST: METHODOLOGICAL CHALLENGES IN ANIMAL HISTORY

Edited by Jennifer Bonnell and Sean Kheraj

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Visualizing the Animal City: Digital Experiments in Animal History[1]

Andrew Robichaud

"Where did the cows go?" This was the seemingly trivial question that emerged as I stared at a computer screen that displayed a map our small research team had just created showing the locations of animal industries in nineteenth-century San Francisco. It was a question that unfolded a series of questions, and it was a pivotal moment in a research process that ultimately led to important findings about urban development, politics, and everyday life in nineteenth-century American cities.

To know where something happened is to begin a process of inquiry and exploration that may lead to an understanding of why and how it happened. Over the course of several years, from 2010 to 2015, I began an extended process of inquiry into where animals lived in San Francisco through a series of digital mapping and visualization projects. At times, the project felt like a fool's errand; at other times, mapping and visualization enabled moments of discovery that would not have been possible otherwise. Mapping and visualizing the animal city became an important way that I processed research for a dissertation and book project on urban animal life in nineteenth-century America. The visualizations ultimately led to several research breakthroughs, the publication of three

online pieces, and important findings that would ultimately become part of the book *Animal City: The Domestication of America*.[2] This essay outlines some of the main contours of that research at the Stanford Spatial History Project and suggests how this type of digital and spatial history might be useful to other scholars of animal history, and to historians more broadly—particularly those working in areas where sources are limited or appear to be limited.[3]

The research for the book *Animal City* began with a relatively simple set of questions: What did nineteenth-century cities look like in their human and animal compositions? What can exploration of those changing environments tell us about environmental, urban, political, and social history more broadly? Other historians had blazed a trail in the field of animal history—largely a subfield of environmental history, but also coming from cultural, social, and intellectual history.[4] Some historians had already pointed to the centrality of animals in nineteenth-century cities, which contained a wide range of domesticated, semi-domesticated, and undomesticated species.[5] Charles Dickens described the "gentlemen hogs" he encountered throughout New York City in 1842, and countless other writers and artists depicted nineteenth-century American street scenes with cows, pigs, dogs, and other non-human animals at the centre of urban life.[6] In 2002, Theodore Steinberg summarized and built on some of the early literature of urban animals in a chapter called "Death of the Organic City" in *Down to Earth: Nature's Role in American History*.[7]

The descriptions offered by Steinberg and others—including Dickens—were enough to spark my imagination, but not enough to satisfy my curiosity. The picture of the animal city was incomplete. To say that semi-domesticated hogs, dogs, cattle, cows, and sheep inhabited nineteenth-century cities only gave the broadest outlines of what must have been a vivid (and pungent) reality of how humans and animals lived and interacted in cities. I wanted to spend more time on those city streets—in the alleyways, basements, and urban lots, and in the backyards, stockyards, and slaughterhouses, where animals lived and died. What was the experience of living in these cities? What were the conflicts that played out? What traces of this animal past still remain in our urban landscapes?

Uncovering this urban animal past also led to a clear question of change over time: What happened? What ultimately became of these

animal cities and the many species that were once part of urban life? What happened from the time of Dickens (with his all-too-visible hogs) to the time of Upton Sinclair (with his largely invisible cows, pigs, stockyards, and slaughterhouse workers)? There was evidence of massive urban animal change, but no clear or complete explanation of what happened and why. Soon, it became clear that Americans had engaged in a complex remaking of their urban environments. Transformation of cities came not merely in the *subtraction* or restriction of particular species and animal businesses, but also in the *addition* of a growing set of relationships with animals that included pet ownership, animal entertainment, and zoos.[8] The transformation of the nineteenth-century animal city was, in many ways, about something greater, too: urban residents were at the forefront of new and modern landscapes and combinations of human-animal interactions.[9]

Since the "Animal City" Spatial History Lab project launched in 2010, there has been a wave of animal history scholarship—including several important and fascinating works on animals in nineteenth-century cities, which emphasized the significance of animals in understanding a wide range of urban, social, political, and environmental changes.[10] Additionally, a flurry of several new publications emphasized the importance of nineteenth-century animal protection and humane movements, and the political and cultural dimensions of Humane Societies and Societies for the Prevention of Cruelty to Animals, which actively and forcefully remade human-animal relationships in nineteenth-century cities.[11]

Seeing the Animal City

Historians seeking sources on the animal past face distinctive challenges, the most obvious being that animals leave no first-hand accounts of their experiences. They do not keep diaries or records, or write letters and memoirs that fill archives. This is to say nothing of the opacity of their very experiences living in the world—and our limited capacities as humans to understand those experiences—a topic that we humans will debate endlessly.

Nevertheless, sources on the presence, conditions, and experiences of many animals in nineteenth-century America are pervasive in more traditional sources, though these sources must be read cautiously and critically. There are ample travel accounts that describe urban animal

populations, along with paintings, photographs, and sketches of features of the animal city. There are countless newspaper articles about nuisances and conflicts that arose because of animals in cities. There are court cases, public records of city and state governments, and records of numerous agencies and organizations tasked with policing various aspects of animal life and death in nineteenth-century cities (health departments, city pounds, parks departments, and SPCAs).[12]

But there were also many sources that seemed at first unusable, or of limited utility. What, for example, could be done with the hundreds of entries of animal businesses in San Francisco city directories? As I pored over the long lists of names and addresses in the Crocker-Langley city directories from the late 1800s, I could get a sense of the scale of the horse economy in San Francisco: hundreds of businesses listed under the categories "Horse Shoers," "Horse Clippers," "Bitters," "Stables," "Feed Stores," "Hay and Grain" stores, and more.[13] The directories also contained lists of businesses related to sheep ("Wool Pullers," "Wool Manufacturers," "Wool Graders and Packers," etc.), with other sources suggesting that live animals were likely present at some of the sites. There were milk cows at many of the city's "Milk Dealers" and "Wholesale Dairies," and livestock at many "Wholesale Cattle," "Wholesale Sheep," and "Wholesale Hog" businesses. Ultimately, these sources charted a human-centred commercial economy that was far from comprehensive in accounting for animal life. But the sources nevertheless contained valuable (though imperfect and incomplete) information on where animals lived and died in the city. What more could be done with this dense and flat collection of names and addresses? How could it be brought to life for historical scholarship?

The Stanford Spatial History Project (SHP) was essential in shaping how I came to think about these sources. With an existing interest in historical geography and environmental history, I was already accustomed to thinking spatially. But the intellectual community at the SHP cultivated an environment of collective intellectual exploration. In 2009, I was part of an experimental course called "Spatial History," taught by a team of historians and digital specialists who worked at the SHP.[14] A key part of the course was a collaborative group project that required learning basic skills in ArcGIS and Tableau. Students were supported by several staff members

at the SHP lab space, which included a half dozen computers and appropriate software.

More than anything, spatial history became a way of seeing sources—a lens that I began to use to think about the possibilities of archival sources. Sources just needed a name, a date, and a location to be mappable—and once mapped, previously invisible spatial and temporal patterns might become visible; distances, densities, and networks could potentially be measured and analyzed. There was a sense of experimentation that came from this sort of inquiry—and that sense of experimentation was a stated purpose of SHP projects. An ideal project was not merely an "illustration" or a visualization of something that was already known, but instead should contain some degree of experimentation and some attempt to "see" sources in ways previously impossible. In this sense, a good data visualization could effectively *create* new sources for a historian to analyze, launching a dialogue or an iterative process of inquiry within a larger research project.[15]

City Directories

City directory data contained all three elements of a possible mapping project, along with an experimental quality of not knowing what our maps would ultimately look like. In an initial independent research project (with the help of SHP lab staff), I was able to map city butchers from 1860–1900—leading to a short online article about the transformation of San Francisco's butchering, livestock, and slaughtering landscapes over the course of those decades.[16] Though modest in scale, the project convinced me that if I could map the tens of other animal industries in San Francisco, I might get closer to *seeing* and understanding some of the geographical nuances and trends in urban animal life in nineteenth-century San Francisco. Did animal businesses cluster in certain parts of town? And how did these geographies compare to one another and change over time?

But the city directory data would first need to be entered and refined, and that was no small task. The Animal City project launched with a single undergraduate research assistant (RA) working about five hours per week on data entry (funded through a modest Stanford undergraduate research opportunity fund). The initial tasks for the RA were straightforward: enter the city directory data for each animal business into an excel spreadsheet

that included the business name, the type of business, the year(s) it was active, and the addresses listed. Once we had addresses, the whole set could be processed through a free online geocoder that would create latitude and longitude points that we could then plug into ArcGIS and Tableau. (As Sean Kheraj's essay in this collection suggests, this process has become significantly easier over the past few years.)

But nineteenth-century addresses were not necessarily modern-day addresses. For example, 950 Brannan Street in 1870 might not be 950 Brannan Street in 2012. We had to pay attention to where and when the city made changes to its street numbering systems—information that was printed in the front matter of city directories. Some nineteenth-century addresses needed to be converted into twenty-first-century equivalents, and this took time. Furthermore, some addresses were vague (i.e. "Foot of Scott"), which required further research into topography, historical context, and sometimes an educated estimate to assign a point on a map. Figuring this out took some time, additional research, and data refinement, but ultimately it was a surmountable obstacle. Like any act of historical scholarship, mapping was also an act of interpretation, an attempt at objectivity in the face of sometimes-imperfect information.

But the payoff of mapping soon started to appear, even if finalized visualizations were far in the future. Even as we were refining data, we could already begin to see discernible spatial patterns in the distribution of animal industries that suggested some underlying patterns of urban human and non-human animal life. Butchers clustered near Mission Creek in the 1860s, then abruptly shifted farther south to Islais Creek after 1870, while a growing number of wholesalers began listing downtown "office" addresses. The wool industry clustered south of Market Street, near the wharves and depots where industrial goods changed hands—but also not far from the new slaughterhouse district known as Butchertown. The most spatially expansive features of the urban animal economy were those businesses related to horses, which spread out in a wide network across the developed city. The animal city was coming into sharper focus through mapping—and it was increasingly clear that there was not one animal city, but multiple animal cities.

But like any exercise in abstraction or representation, mapping could also mislead and obscure. For one, animal businesses were only one facet

of urban animal life. They did not account for households that had one or two cows or pigs, or for small-scale or informal businesses not listed in city directories. What about the personal stable of a wealthy San Francisco gentleman? Or the cart mule of an Italian market farmer?[17] Furthermore, through mapping itself, the very uncertainty of our data was revealed. For example, city directories did not contain clear definitions of "Milk Dealers." The maps we made showed "Milk Dealers" occupying a geography that suggested that most did indeed have cows, but we could also safely assume (in the context of other sources) that a "Milk Dealer" in the heart of San Francisco's financial district was an office and did not have a herd of cows on site. The sources we had were primarily describing a human economy, and not necessarily the lives of animals. The maps we made (like any source) had to be critically and carefully read. Once mapped, we had to continue to read the sources against the grain, but they were now in visual form.

But what stood out from the maps we created were the clusters of "Milk Dealers" on the suburban fringe—sites that seemed likely to be actual dairy farms with cows. Even more, these fringe "Milk Dealers" appeared to be migrating over time.

It was the changing geography of these semi-suburban "Milk Dealers" that captured my attention. In particular, I noticed that, beginning in the 1880s, dairies in certain fringe parts of the city began migrating southward and westward—moving out of the neighborhoods in the eastern and northern parts of the city (the Potrero, the Mission, and Cow Hollow), and moving to neighbourhoods farther south (Figure 13.1). "Where were the cows going, and why?" Perhaps something was happening in the 1880s and 1890s to account for these geographic shifts, but what? City Directories tipped me off to the apparent movement, but could not explain why it was happening. More than providing a set of complete answers, mapping raised a new set of questions that I could then take back to other archival sources. In this sense, mapping animal industries was not so much an end in itself, but was instead part of an unfolding research process. It did not replace traditional research, but simply helped highlight certain questions.

Indeed, as I looked more closely at newspapers and laws from the 1880s and 1890s, I began to see stricter rules and enforcement of urban dairy practices. In the 1880s, the city government began cracking down on

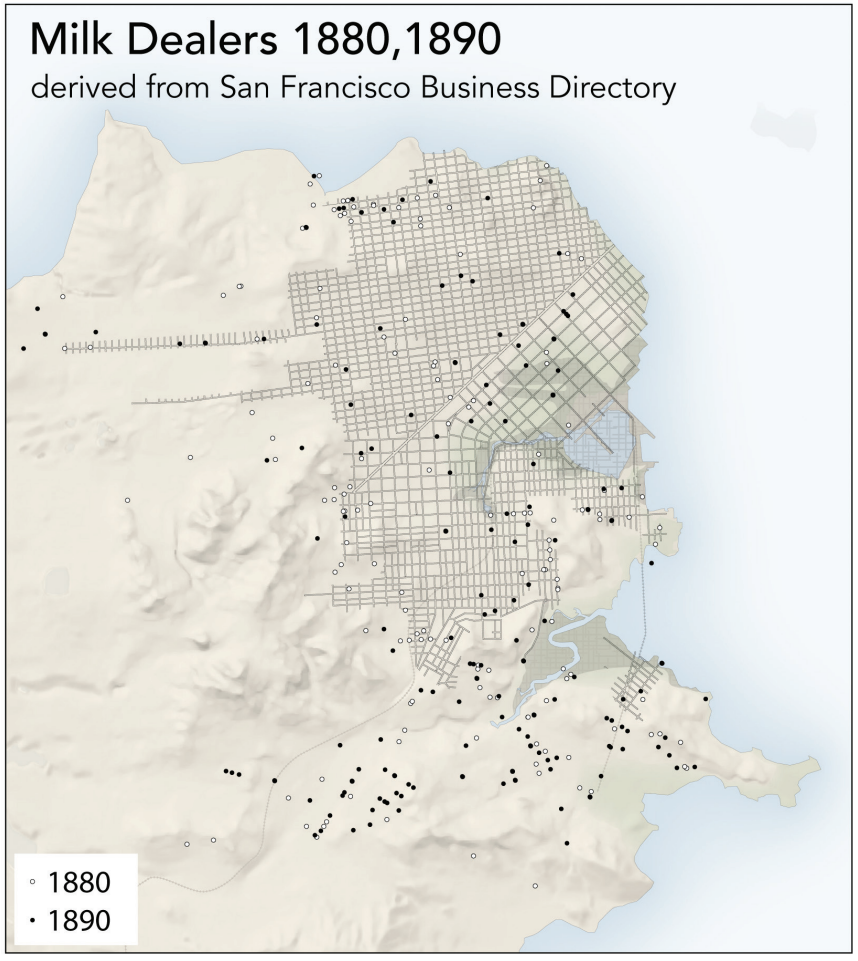


Fig. 13.1 Milk Dealers in San Francisco. Image and cartography by Erik Steiner, with research assistance from Liz Fenje, Stanford Spatial History Project.

small-scale urban dairies—particularly those that used the marshy grasslands of Islais Creek in the southeastern part of the city. Islais Creek was an expansive brackish marsh—one of the few wet, green, and grassy parts of San Francisco. But in the 1880s, San Francisco's city officials became increasingly concerned about the pollution filling the creek and marshes. As

it turned out, the contamination of the creek and the adjoining marshes was part of another set of animal transformation in the city. In the 1870s, the city had ordered the removal of the slaughterhouses, hog ranches, stockyards, and tanneries to the southeastern shores of the city—a part of town that would become known as Butchertown. By the 1880s, the pollution from these animal industries was wreaking havoc on Islais Creek and the expansive marshes.[18]

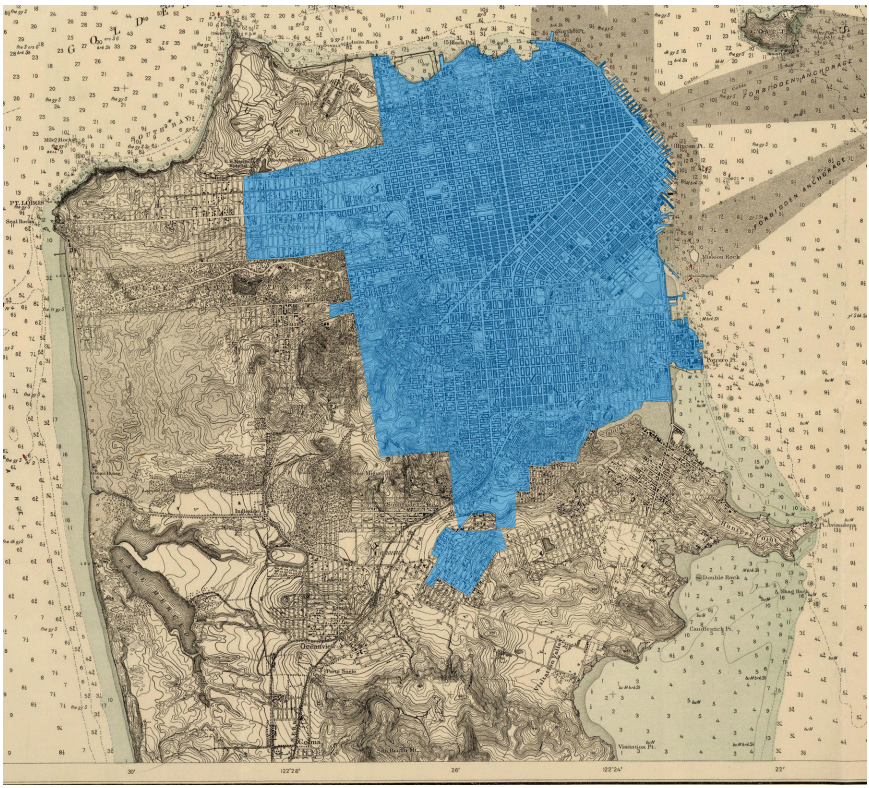
The pollution of the creek had wider social implications. Since at least the 1870s, the grasslands around Islais Creek had been used as cow pastures, particularly for small-scale dairy farmers—most notably Italian immigrants. The pollution of the creek—combined with an apparent aversion to the immigrant farmers themselves—animated city officials to prohibit grazing cows in the marshes. In the 1890s, the city hired a full-time milk inspector, who spent his days on armed patrol, and who focused much of his enforcement on the grasslands around Islais Creek. The city also began a process of widely expanding what was called the "Two-Cow Limit" farther south, to encompass the Islais marshes (see Figures 13.2 and 13.3).[19]

The crisis over the Islais Creek cows revealed an interconnected web of animal life, death, and decay in the city, which came under greater governmental control and scrutiny in the 1890s. Would I have discovered this important phase of regulation had it not been for the mapping? Perhaps. But I might not have looked so closely. Mapping the dairy industry offered me a hint that there were big changes in urban dairy production in the last two decades of the 1800s, and refocused my attention on important periods and places of change. But, ultimately, it was more traditional sources and methods that explained and contextualized that change. In turn, the maps themselves—the changing geography of dairy production—also evinced the force of city policies.

City Ordinances

As the Two-Cow Limit suggests, there were also animals in city ordinances. But, like city directories, the data was flat and seemingly abstruse. Take, for example, the city's spatial restrictions on slaughterhouses. In 1864, a San Francisco ordinance prohibited residents from keeping more than five swine or slaughtering animals within an area delineated as follows:

Fig. 13.2 and 13.3 Visualizations of San Francisco's "Two-Cow Limit" in 1887 (left) and 1905 (right). The Two-Cow limit allowed residents to keep no more than two cows in the area mapped in blue (with some additional restrictions). In 1910, the city extended the "Two-Cow Limit" to encompass the entire city and county of San Francisco. Liz Fenje and Mark Sanchez, Stanford Spatial History Project.



> Beginning at a point at the intersection of the Bay of San Francisco with the west line of Divisadero street; thence south along the west line of said street to its intersection with Ridley street; thence along the south line of Ridley street to Castro street; thence along the westerly line of Castro street to its intersection with the Charter line of 1851 of the City of San Francisco thence easterly along said Charter line to the deep waters of the bay of San Francisco.[20]

The ordinance was a jumble of words with little discernable meaning without visualization.

Like the dairy industry, the geographies of slaughterhouses, hog ranches, and stockyards were shifting, too. This was visible not only in city directories, but also in the growing number of municipal ordinances. Visualizing and mapping these early forms of zoning might offer a better understanding of how city officials were thinking about regulation, urban space, and urban development. To visualize these laws was relatively simple, but was nevertheless revealing of important shifts in how city officials were thinking about urban space, planning, and development. In this case, we had a sense of what mapping the laws would reveal; it was no big surprise what would come out of these visualizations. But the visualizations were a more direct and powerful form of communication—a *visual argument* that could more effectively express a trend than words, sentences, and paragraphs alone.

Tracing the evolution of slaughterhouse space also revealed an important shift in how city officials were thinking about animal nuisances, urban environments, and urban development. This became clear only through mapping. The early ordinances from the 1850s and early 1860s showed what was effectively a "negative space"—slaughterhouses could not exist in certain densely inhabited parts of the city. Over the 1850s and early 1860s, those ordinances continued to expand that negative space outward from the city centre. But in 1866, something shifted. The shape of the slaughterhouse space changed to create a confined and secluded area of dense animal populations and slaughterhouses. In 1870, the city confined the slaughterhouses even further, to a thirty-six-block area on the southeastern coast of the city, which opened up larger tracts of undeveloped land as part of a vision of permanent urban growth.[21]

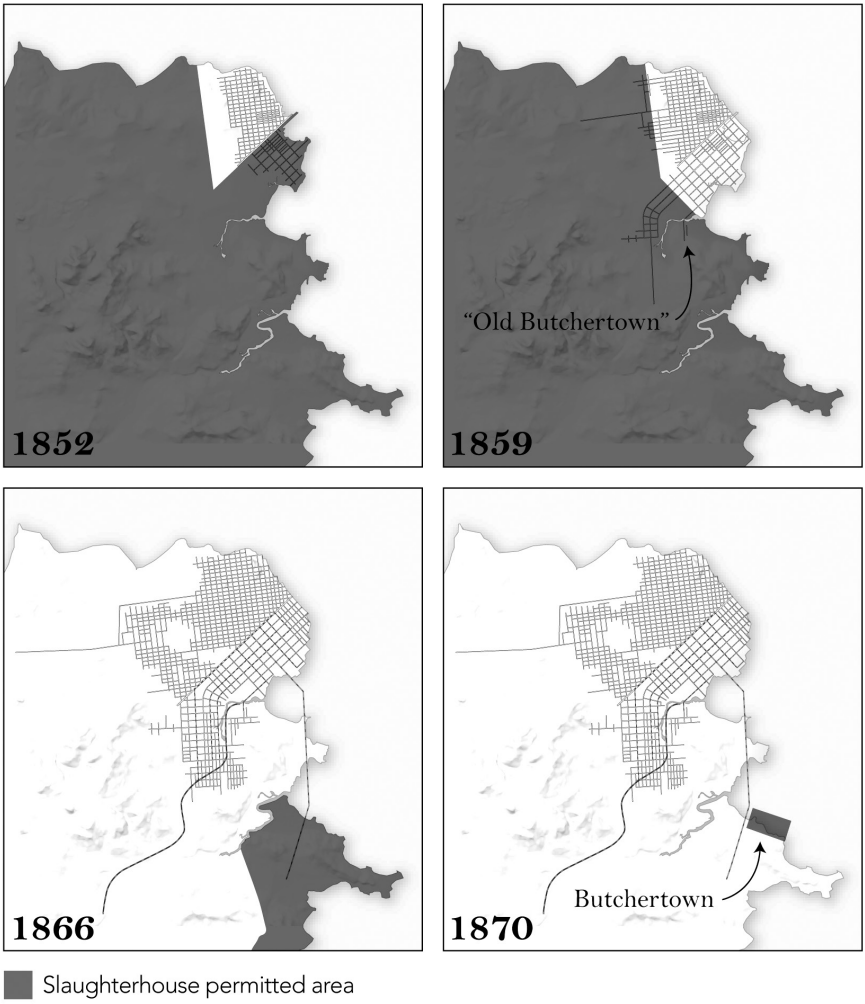


Fig. 13.4 Areas of permissible slaughter, according to San Francisco city laws. Visualizing these laws offered a powerful visual argument about the transformation of slaughterhouse and livestock landscapes in San Francisco. Image and cartography by Erik Steiner, with research assistance from Liz Fenje, Stanford Spatial History Project.

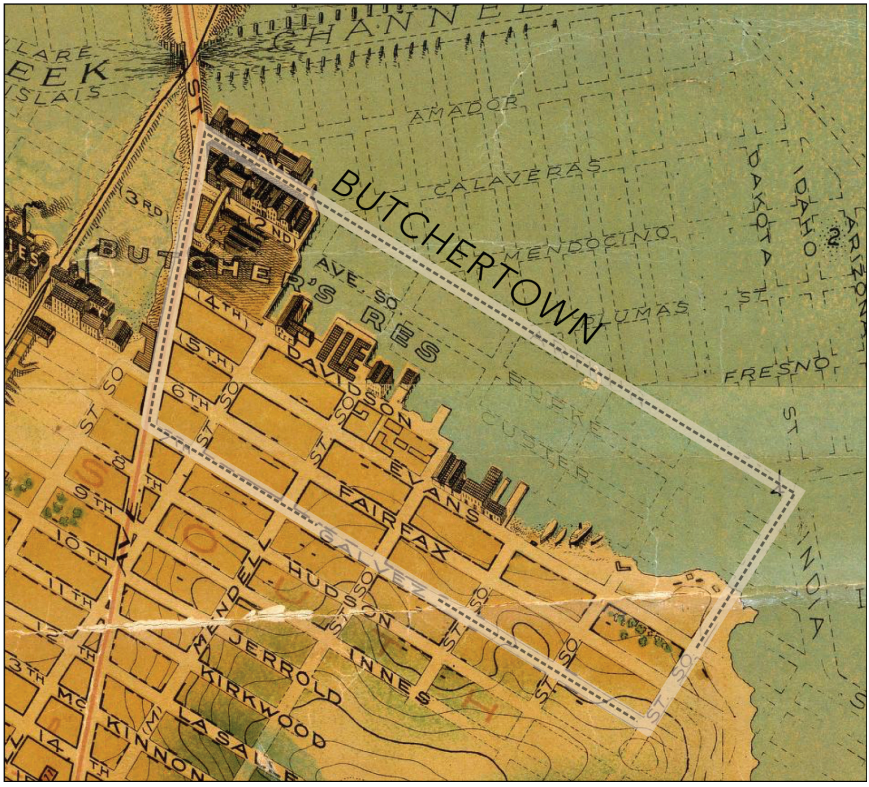


Fig. 13.5 The "Butchers' Reservation" (commonly known as "Butchertown") is shown here overlaid on this 1911 map. Map detail from August Chevalier, "The 'Chevalier' Commercial, Pictorial and Tourist Map of San Francisco From Latest U.S. Gov. and Official Surveys" (1911), courtesy of David Rumsey Map Collection. Cartography by Erik Steiner, Stanford Spatial History Project.

But the new slaughterhouse space was also designed to effect a certain environmental relationship. The 1870 "Butchers' Reservation" (Butchertown) appears in city ordinances as an area confined by a specific set of street names. Visualizing the extent of Butchertown using a map that showed the city's shoreline revealed an important feature of the space: half of Butchertown existed in the shallow waters of the San Francisco Bay. City officials sought to establish a particular form of environmental relationship between the slaughterhouses and the San Francisco Bay

that would create a lasting and permanent solution to the slaughterhouse nuisance. But the waters of the San Francisco Bay could not keep up with the new scale of industrial waste, creating a new pollution problems that lasted into the twentieth century and beyond.

Animal Law Enforcement

Another important development in nineteenth-century urban animal life was the widespread establishment of Societies for the Prevention of Cruelty to Animals (SPCAs)—cultural, political, and legal institutions that first emerged in the United States in major American cities. San Francisco had been among the first SPCAs founded in the United States—established in 1868, only two years after Henry Bergh established the first American Society for the Prevention of Cruelty to Animals in New York City. In San Francisco, I had the good fortune of encountering an unprocessed and previously unused collection of San Francisco SPCA (SFSPCA) archival materials that had recently been gifted to the San Francisco Public Library. Within that collection were the bound diaries of San Francisco SPCA officers. These were law enforcement agents whose primary work was enforcing the expanding set of anti-cruelty laws in San Francisco, beginning in the 1870s. For historians of animals, these collections are valuable sources for understanding urban animal life, along with social relationships that were also being policed.

The officer diaries testified to the powerful police and law enforcement powers of SPCAs in the nineteenth century. Like many SPCAs, the San Francisco SPCA was an active and powerful corporation that acted as law enforcement and, effectively, as an extension of state government.[22] The SFSPCA ultimately employed a full-time officer to police the city, and the SFSPCA was legally entitled to collect whatever fines the court assessed for trial convictions. Those agents kept detailed diaries describing their daily activities and routes through the city—where they had made arrests, issued warnings, or simply observed animal suffering.

The diaries contained a wealth of spatial data embedded in the officers' daily accounts, often pointing to specific places where animals were found abused or suffering. But in certain ways, the diaries were also incomplete: they did not have reliable details about arrests or specific infractions—and they made no mention of prosecutions or legal outcomes. That

information was, however, contained in a separate volume of "Prosecution Records," which was devoid of spatial data. Combined, these sources could be used to create some sense of the geography of law enforcement and arrests, which would offer a fuller picture of how the SFSPCA's power was exerted in real space. Were laws enforced evenly across parts of the city? Were the slaughterhouses and stockyards as policed as the horse stables and downtown streets? Were certain human and animal populations and geographies more or less surveilled and policed?

Tracing out and mapping every route would have been effectively impossible for our small research team at the Spatial History Project—and probably not worth the protracted and tiresome effort. But tracing out a sample of routes was possible—and we could focus on the routes that we knew had the greatest legal impact: those that resulted in prosecutions. A research assistant used the prosecution ledger to locate specific names and dates that could be matched with specific routes in the officer diaries. Using a feature of Google Earth, the research assistant then traced out the agent route as it was described in the diary. Those geocoded routes could then be overlaid on a map to show the routes of nearly two hundred cases that resulted in prosecutions. The map would give us a strong sample of where officers had travelled and exerted police power within the city of San Francisco.

The results from this visualization were somewhat surprising. The routes showed a density of enforcement routes in downtown San Francisco—near city markets where horses transported goods from market farms, and also in residential districts north of Market Street where families lived. There was also concentrated enforcement in some of the more industrial parts of town south of Market Street, and near the rail depots and wharves where horses carried heavy loads and where some livestock were unloaded from boats and trains and driven south to Butchertown. What was more informative, perhaps, was where SFSPCA officers *did not* travel, based on the sample of routes we mapped. In this particular sample, there was no trace of SFSPCA officers setting foot in and around Butchertown—where thousands of animals lived and died in the stockyards, hog ranches, and slaughterhouses. Why? Was the SFSPCA simply not interested in the cattle, pigs, and sheep in and around Butchertown, or in the milk cows and livestock that inhabited the city's suburban areas?

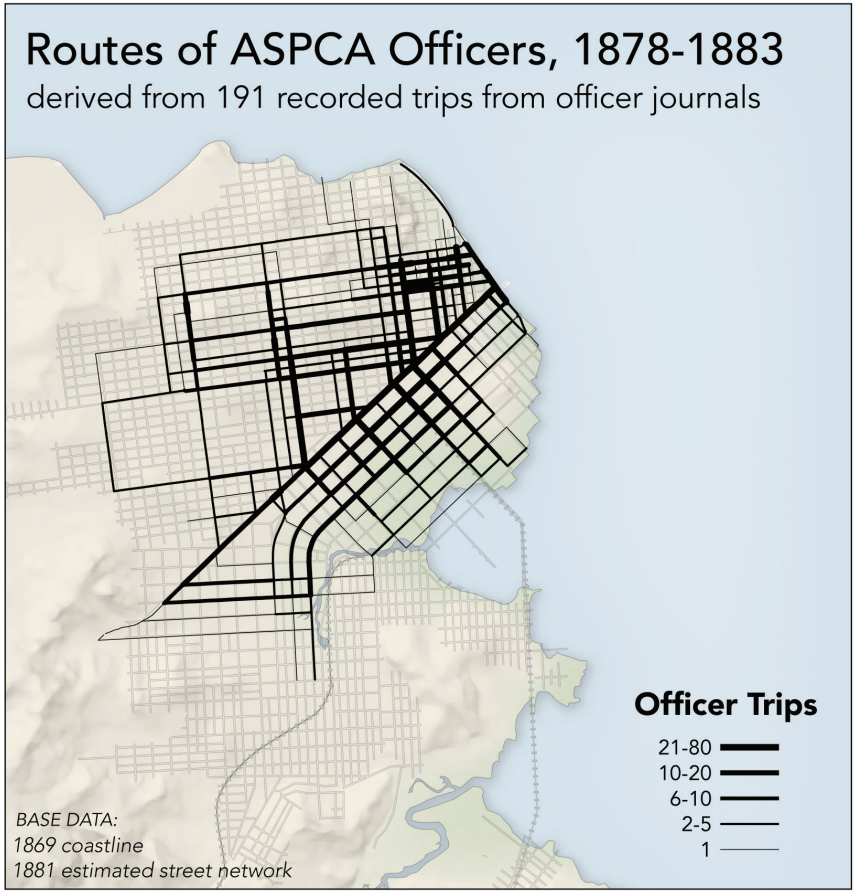


Fig. 13.6 This visualization was created using a sample of routes from cases that led to prosecutions from 1878–1883. This visualization allowed us to see the geographic extent and concentration of animal law enforcement. Research by Mark Sanchez and cartography by Erik Steiner, Stanford Spatial History Project.

This question of why the SFSPCA was so spatially limited ultimately became another research question that mapping posed but did not itself answer. Additional research revealed that there were a few practical limitations to the geography of SFSPCA enforcement. First, as officers made greater numbers of arrests, they were forced to appear as witnesses in court

on most mornings. A trip to Butchertown required at least several hours—and often a full day for travel and observation. A second factor was that because the SFSPCA depended on fines collected from successful prosecutions, they favoured enforcing laws that would lead to this outcome. In short, there was less money to be made in Butchertown, where personal fault for animal suffering was often less easy to discern and prove. There were other reasons for the spatial limitations on SFSPCA power, but the intentional, legally made invisibility and distance of Butchertown was a key limitation when it came to enforcing laws. Increasingly, the geography of animal law enforcement overlapped significantly with human populations and the overlapping geography of horses in the city. Overwhelmingly, SFSPCA arrests related to the suffering of equine residents (and their human owners and observers) in downtown San Francisco.

In considering animal welfare as a means of social control, there was another part of town where I expected to see heavy SFSPCA presence, but where it was visibly absent: Chinatown. Our maps showed agents patrolling around the edges of Chinatown, but rarely within it. Prosecution and enforcement records also showed few Chinese names. The reason for the absence of the SFSPCA's presence in Chinatown is hard to pin down with any certainty. In some ways, the SFSPCA (which was largely—and probably entirely—white) seemed mostly uninterested in reforming Chinese practices when it came to animals. Perhaps reformers saw Chinese San Franciscans as beyond the circle of civilization that partly defined animal welfare movements of the period. Perhaps Chinatown was already under such heavy police surveillance that the SFSPCA did not see it necessary to police there.[23] Perhaps Chinese San Franciscans owned few horses and pets, which were increasingly the focus of SFSPCA officers.

But there is also some evidence to suggest that many SFSPCA members had a prevailing (though certainly condescending and demeaning) sympathy for Chinese immigrants—that many in the organization in fact sought to improve the wider treatment of Chinese San Franciscans, in part by reforming human relationships with animals. This came as many white Americans otherized and dehumanized Chinese immigrants more broadly, often comparing them to animals. Where Chinese San Franciscans do appear in SFSPCA records, they are at times objects of sympathy, not unlike the horses, dogs, and other animals the Society actively policed.

In one case, a San Francisco humane organization celebrated a boy who intervened to stop a child from throwing stones at a Chinese man.[24] This act of mercy stood in contrast to the wider, prevailing anti-Chinese racism and violence across the United States. Ultimately, however, the answer as to why SFSPCA agents did not spend much time in Chinatown remains elusive and perhaps multi-faceted. Nevertheless, mapping agent routes raised the question.

Mapping in these various ways was also useful in thinking about the legacies of nineteenth-century animal spaces. Understanding the geography of nineteenth-century animal landscapes had the potential to explain how certain parts of American cities developed over time, and how these invisible animal landscapes of the past continue to shape the way cities look today. Why was it that the areas devoted to stockyards, slaughterhouses, tanneries, and hog ranches in nineteenth-century San Francisco became an African-American ghetto of the twentieth century? Home Owners' Loan Corporation (HOLC) maps from the 1930s showed that the neighbourhoods in and around Butchertown were redlined—in large part because of their proximity to environmental conditions of concentrated animal life and death. "Occasional winds from the northeast bring obnoxious odors from stockyards and packing plants located in that direction."[25] The same was true of other neighbourhoods adjoining stockyard and slaughterhouse districts in other cities across the country. Nineteenth-century animal industry geographies had lasting effects—evidenced, too, in the property value maps that are now part of online real estate websites, suggesting that this past continues to shape the city and patterns of property values today. Understanding geographies of nineteenth-century animal life also shapes how I walk city streets—something I can now share with students in teaching them how to think about the construction of modern-day urban landscapes.

Conclusions and Questions

Most of the data visualizations from the Animal City project remain unpublished, stowed away in a cloud server. The findings were useful in terms of raising new questions, but the additional labour of refining and publishing them seemed to be daunting and of limited utility. In this sense, digital history might be closer to research that never appears in prose

or in footnotes—or writing that is ultimately cut from a final draft. But there are traces of it everywhere. Digital analysis had an important place in building the foundations of the research that ultimately comprised the book *Animal City*—a book of narrative and analytical history that is not obviously built around digital mapping. Digital work informed a more traditional approach to writing and storytelling—scaffolding that was ultimately removed to reveal a structure more familiar to historians.

And though it is "research," digital work in many ways resembles teaching. Each of these projects had social, collaborative, and pedagogical elements. As a "primary investigator," I worked closely with one undergraduate research assistant at a time. For both of the students who worked on this project, digital work was an entry point into a wider inquiry on the topic. Both students sought to read books and articles on the topic, and asked incisive questions that could, at times, open up the research process further. "Why do you think there was a cluster of stables here?" one might ask. On one occasion, a student ventured into San Francisco and stood on the street corner that he had earlier read was the site of a brutal incident of horse abuse. There was multi-directional instruction at every turn—between the student, me, and the lab staff—where each person engaged the project through different forms of labour, knowledge, and expertise, and with varying perspectives that strengthened the whole of the research project. This sort of collaboration is all too rare in historical scholarship, which is usually a lonely and solitary endeavour. As this sort of digital scholarship becomes more manageable for individuals to do alone (as Sean Kheraj's essay in this collection suggests), what, if anything is lost in erasing the social and collaborative nature of digital history?

For all the energetic collaborative work, there were also unexpected challenges and frustrations. Studying the history of animals can be emotionally and mentally exhausting. I had become accustomed to spending my days reading reports of animals who suffered—horses beaten until their skin was raw or bloodied, or driven until they were hobbled or collapsed on the street. There were accounts of cattle with their "eyes punched out," of turtles strung together on their backs and kept alive in holds of ships to be sold alive in New York markets, and of sheep coming off trains and boats, prodded aggressively but unable to stand. As historians, we understand part of our work as bearing witness. But, at a certain point, I had

forgotten just how bleak and dismal this animal history could be—and that an undergraduate new to the topic might find it overwhelming. A couple of weeks into a summer research job of recording spatial data from the SFSPCA officer diaries, an undergraduate working on the project told me frankly how distressing it all was. The student had just spent two weeks straight of his summer in Palo Alto reading and recording one case of animal suffering and brutality after another. Understandably, it was starting to take a psychological toll. We backed off and did other work for a while. But the conversation revealed to me an important part of both research and teaching that often goes unspoken: that we ought to be mindful of the heavy mental toll of doing research of any kind that requires the historian to take an unflinching look at the brutality and violence of the past. The violent history of human relations with animals makes animal history particularly vulnerable to such challenges.

In the end, mapping and visualizing aspects of the animal city did not contain a discrete set of answers and conclusions. A map can appear tidy and pat, but its construction and underlying data are messy and filled with human decisions and uncertainty at every turn. The conversion of human and animal lives into zeros and ones, and dots on a map, was never a perfect translation. These Animal City mapping projects were as much starting points as ending points. But the process and conversations allowed for an extended meditation on the subject—the sort of long-term, internal processing most historians do—but one that activated visual and spatial thinking, and had social and collaborative components that made it distinct from the verbal, solitary, and intellectual work that dominates so much of traditional historical scholarship. For that reason, the exact payoff of the Animal City project is hard to define in metrics of publications, citations, and footnotes. It was part of a collaborative process of asking and answering questions that ultimately led to more questions and more research. Digital and spatial history never replaced more traditional forms of research or writing, but it did shape that scholarship in ways that were sometimes unexpected. The cows, it turned out, had something to tell when we were willing to pay attention.

NOTES

1 The author would like to thank Sean Kheraj, Jennifer Bonnell, and Catherine McNeur, along with the researchers and staff of the Stanford Spatial History Project—especially Erik Steiner, Jake Coolidge, Mark Sanchez, and Liz Fenje.

2 Andrew A. Robichaud, *Animal City: The Domestication of America* (Cambridge: Harvard, 2019). For the visualizations discussed in this article, please visit: https://web.stanford.edu/group/spatialhistory/cgi-bin/site/project.php?id=1047

3 For spatial history, see Richard White, "What is Spatial History," Stanford Spatial History Project (2010): https://web.stanford.edu/group/spatialhistory/cgi-bin/site/pub.php?id=29. See also Henri Lefebvre, *The Production of Space* (Chicago, Illinois: Blackwell, 1991).

4 For me, some early and influential works in animal history include Harriet Ritvo, *The Animal Estate: The English and Other Creatures In the Victorian Age* (Cambridge, MA: Harvard University Press, 1987), and *The Platypus and the Mermaid and Other Figments of the Classifying Imagination* (Cambridge, MA: Harvard University Press, 1997); Clay McShane and Joel Tarr, *The Horse In the City: Living Machines In the Nineteenth Century* (Baltimore: The Johns Hopkins University Press, 2007); Ann Norton Greene, *Horses At Work: Harnessing Power In Industrial America* (Cambridge, MA: Harvard University Press, 2008); Richard Bulliet, *Hunters, Herders, and Hamburgers: The Past and Future of Human-Animal Relationships* (New York: Columbia University Press, 2005); Jon Coleman, *Vicious: Wolves and Men In America* (New Haven: Yale University Press, 2004); Virginia DeJohn Anderson, *Creatures of Empire: How Domestic Animals Transformed Early America* (New York: Oxford University Press, 2004); Richard White, "Animals and Enterprise," in *The Oxford History of the American West,* ed. Clyde Milner, Carol A. O'Connor, and Martha A. Sandweiss (New York: Oxford University Press, 1994), 237–74. I recognize the importance of the use of "non-human animals" as part of a recognition that humans are, in fact, animals. But for the sake of simplicity, this essay uses the term "animals" in talking about "non-human animals."

5 For example, many urban waste and health histories include elements of animal history. See, for instance, Martin Melosi, *The Sanitary City: Urban Infrastructure in America From Colonial Times to the Present* (Baltimore: Johns Hopkins University Press, 2000); Joel Tarr, *The Search for the Ultimate Sink: Urban Pollution In Historical Perspective* (Akron, OH: University of Akron Press, 1996); and Charles Rosenberg *The Cholera Years: The United States In 1832, 1849, and 1866* (Chicago: University of Chicago Press, 1987).

6 Charles Dickens, *American Notes for General Circulation* (Paris: Baudry's European Library, 1842), 99–102. For visual art, see, for example, Neuville, "Bridewell, and Charity-School, Broadway, NYC 1808; James Kidder, *Boston Common 1829*; Unknown artist, *The Five Points* (painting) (1827), often attributed to George Catlin; Axel Klinckowström, *Broadway and City Hall, New York*, 1820; George Henry Burgess, *A View of San Francisco in 1850* (1878). See also Etienne Derbec and Abraham Nasatir, ed., *A French Journalist in the California Gold Rush: The Letters of Etienne Derbec* (Georgetown, California: The Talisman Press, 1864), 170.

7 Theodore Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002).

8 For pets, see Diane Beers, *For the Prevention of Cruelty* (Athens: Swallow Press Ohio University, 2006); Susan Pearson, *The Rights of the Defenseless: Protecting Animals and Children In Gilded Age America* (Chicago: University of Chicago Press, 2011). For late nineteenth century animal displays and entertainments, see Nigel Rothfels, *Savages and Beasts: The Birth of the Modern Zoo* (Baltimore: Johns Hopkins University Press, 2002); Elizabeth Hanson, *Animal Attractions: Nature on Display in American Zoos* (Princeton, NJ: Princeton University Press, 2002); Susan Nance, *Entertaining Elephants: Animal Agency and the Business of the American Circus* (Baltimore: Johns Hopkins University Press, 2013; Etienne Benson, "The Urbanization of the Eastern Gray Squirrel in the United States," *Journal of American History* 100, no. 3 (December 2013).

9 See John Berger, "Why Look at Animals?," in *About Looking* (New York: Vintage, 1980): 3–28; and Bulliet, *Hunters, Herders, and Hamburgers*.

10 See, in particular, Catherine McNeur, *Taming Manhattan: Environmental Battles in the Antebellum City* (Cambridge, MA: Harvard University Press, 2014), and "The Swinish Multitude," *Journal of Urban History* 37, no. 5 (2011): 639–60; Michael Rawson, *Eden on the Charles: The Making of Boston* (Cambridge, MA: Harvard University Press, 2010); Catherine Brinkley and Domenic Vitiello, "From Farm to Nuisance: Animal Agriculture and the Rise of Planning Regulation," *Journal of Planning History* 13, no. 2 (2014): 113–35; Frederick Brown, *The City is More than Human: An Animal History of Seattle* (Washington: 2016); Jessica Wang, "Dogs and the Making of the American State: Voluntary Association, State Power, and the Politics of Animal Control in New York City, 1850–1920," *Journal of American History* 98 (2012): 998–1024; and Etienne Benson, "Urbanization of the Eastern Gray Squirrel." See also Sean Kheraj, "The Great Epizootic of 1872–73: Networks of Animal Disease in North American Urban Environments," Environmental *History* 23, no. 3 (July 2018): 495–521; and "Urban Environments and the Animal Nuisance: Domestic Livestock Regulation in Nineteenth-Century Canadian Cities," *Urban History Review/Revue d'histoire urbaine* 44, no. 1–2 (Fall/Spring 2015/2016): 37–55; P. J. Atkins, ed., *Animal Cities: Beastly Urban Histories* (New York: Routledge, 2016).

11 Susan Pearson, *The Rights of the Defenseless: Protecting Animals and Children In Gilded Age America* (Chicago: University of Chicago Press, 2011); Janet Davis, *The Gospel of Kindness: Animal Welfare and the Making of Modern America* (New York: Oxford University Press, 2016); Jessica Wang, "Dogs and the Making of the American State: Voluntary Association, State Power, and the Politics of Animal Control in New York City, 1850–1920," *Journal of American History* 98 (2012): 998–1024;

12 San Francisco Municipal Reports, for example, contained annual reports from many of these departments, along with statistics on animals impounded, arrests made, etc. Animal lives are scattered throughout these reports, but not centralized in any one department.

13 For the centrality of the horse in nineteenth-century cities, see Clay McShane and Joel Tarr, *The Horse in the City: Living Machines in the Nineteenth Century* (Baltimore: Johns Hopkins, 2007); Clay McShane, "Gelded Age Boston," *The New England Quarterly* 74, no. 2 (2001): 274–302; and Ann Norton Greene, *Horses at Work: Harnessing Power in Industrial America* (Cambridge, MA: Harvard University Press, 2008).

14 The course was designed and taught by Richard White, Zephyr Frank, and Erik Steiner, with additional training and assistance from Whitney Berry, Mithu Datta, and Kathy Harris.

15 For other digital mapping projects that shaped my thinking of the possibilities of this work, see Brian Donahue, *The Great Meadow: Farmers and the Land in Colonial Concord* (New Haven: Yale University Press, 2004), along with his and other essays in *Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship*, ed. Anne Kelly Knowles (New York: ESRI, 2008).

16 Andrew Robichaud and Erik Steiner, "Trail of Blood: The Movement of San Francisco's Butchertown and the Spatial Transformation of Meat Production, 1849–1901," Stanford Spatial History website: https://web.stanford.edu/group/spatialhistory/cgi-bin/site/pub.php?id=31.

17 Some of this smaller-scale data was, I was told, kept by the San Francisco water department, which recorded the number of animals in each household. But their archives were largely inaccessible and would have required an exceedingly tedious process of searching and requesting individual property records. Water departments in other cities may have more accessible records and might be of interest to animal historians. Sanborn maps also contain valuable data on stables and other built features of the animal city.

18 Robichaud, *Animal City,* chapter 3.

19 Robichaud, chapter 3.

20 "Official—Order No. 566," *Daily Alta California*, January 23, 1864, 6.

21 See Robichaud, *Animal City,* chapters 2 and 3. See also: Ted Steinberg, *Gotham Unbound: The Ecological History of Greater New York* (New York: Simon & Schuster, 2014).

22 Here my findings echo and build on the work of Jessica Wang, "Dogs and the Making of the American State."

23 Nayan Shah, *Contagious Divides: Epidemics and Race in San Francisco's Chinatown* (Berkeley: University of California Press, 2001).

24 "Does It Pay?" 1897 pamphlet, San Francisco SPCA, San Francisco Bands of Mercy, San Francisco Charities, Pamphlets, vol. 2, no. 7., The Bancroft Library, University of California, Berkeley. See also Robichaud, *Animal City*, chapter four.

25 Description from area "D16," Mapping Inequality Project: https://dsl.richmond.edu/panorama/redlining/#loc=5/39.1/-94.58