Does Urban Sprawl Spread Like Manure?

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Manure is spread evenly over agricultural lands to benefit the production of crops, resources, and food to the surrounding inhabitants. Does the spread of urban development benefit the neighboring agricultural lands in the same manner as manure? Unlike genetically engineered seeds and fertilizer that behave predictably and consistently, urban sprawl is not as predictable, nor as consistent. Variables at the local level determine where new development will occur and even when that development occurs. We demonstrate the effects of urban sprawl in terms of the number of urban inhabitants, agricultural production, and the change in political boundaries from 1840 to present time.

The census data of Dane County illustrates urbanization through a comparison of urban and rural data, such as changes in agricultural production, acres of farmland lost to urbanization, and rural versus urban population data. Through our Case Study Farm, located in Verona, Wisconsin, five miles southwest of the City of Madison, we demonstrate the qualitative effects of urban development through the past eight decades. An interview with the owners of the farm, an analysis of their family history and photos, coupled with historical census data of Dane County provides a greater depiction of agricultural changes due to urbanization of Madison.

Previous research conducted on the subject of urban development and its effects on the natural landscape were beneficial to the exploration of our research. Jerry Paulson focuses on the rezoning laws taking place in Wisconsin and their roles in the Wisconsin's Farmland Preservation Program in his paper, *Dane County, Wisconsin: Plats Versus Plows.* Exclusive agriculture zoning prohibits any building of non-farm residences without rezoning the land (Paulson 2003: 2-3). In Dane County, thirty out of the thirty-four towns have exclusive agriculture zoning. The main purposes of these zones, specifically in Dane County, are to,

> "Preserve productive agricultural land for food and fiber production; preserve productive farms by preventing land use conflicts between incompatible uses and controlling public service costs; maintain a viable agricultural base to support agricultural processing and service industries; reduce costs for providing services to scattered non-farm uses; pace and shape urban growth; implement the provisions of the county agricultural plan; and comply with the provisions of the Farmland Preservation Law to permit eligible landowners to receive state tax credits" (Paulson 2003: 3).

Tax credit is given to farmers who keep exclusive agriculture zones. However, in some cases, as in the four towns of Dane county (Paulson 2003: 3) that do not practice exclusive agriculture zoning, tax credit alone is not enough incentive for family farmers. A few farmers can gain greater financial benefits by selling their property at a high price for development. Taken from the 1992 Bureau of Agriculture Census data, since 1990, 13,658 acres of land in the exclusive agriculture zones have been rezoned for other purposes, mostly to create lots for rural residences (Paulson 2003: 3). A review of the laws and various regulations applied to farmland gave us a better understanding as to how our case study farm is effected by changes through the years and what changes they might have had no control over.

Sprawl is a relatively new pattern of human settlement. During the early twentieth century people concentrated within cities, but during the 1960s this pattern began to change. In Robinson, L., Newell, and Marzluff's *Twenty-five years of sprawl in the Seattle region: growth management responses and implications for conservation* people moved to suburbs, which were areas of low density and were initially a few kilometers away from cities in a leap-frog pattern. More people now live and work in suburbs than in cities. "During the 1970s and 1980s 95 percent of U.S. population growth took place in suburban areas outside cities" (Robinson et al 2005; 51). We now have low-density sprawl that occupies a much larger portion of land than high-density living, common in urban centers. This is evident in Madison, yet, today there are plans for a number of new high-density housing units in downtown concentrating around the university. Robinson et al's

article states that the area covered by sprawl increases faster than population growth. Sprawl is converting agricultural land into developed environments at a hazardous rate and causing native plant species to be replaced by invasive species. These new species lead to a higher use of pesticides and herbicides for the farmer.

Our research focuses on urban sprawl after 1860 in Dane County, illustrating the affects sprawl has had on our case study farm, located near Verona, Wisconsin, since 1933. Robinson et al decided to study King County, Washington, home to Seattle, as a study area. According to Robinson et al, King County's population has increased by 44 percent from 1.2 million to 1.7 million between 1970 and 2000 while the number of households increased by 72 percent.

The effects of sprawl have urged policy makers to create regulations and incentives to reduce them. Robinson et al examine an important aspect of development: "smart growth" programs and the creation of urban growth barriers (hereinafter "UGBs"). UGBs establish greenbelts and restrict the number of new residential permits issued in hopes of shaping development and keeping the degrading effects of sprawl to a minimum. These programs are not intended to prohibit growth outside urban areas, but to direct most new growth to the areas inside the UGBs. We utilize this information by examining the zoning issues revolving around this development. We briefly spoke to our Case Study Husband about the existence of zoning and he affirmed that they were in effect around the farm. (Case Study Husband, Telephone Interview, 14 December 2009).

David Goldfield's article, *Urban History*, explains the different stages in urban history that transformed the city into a sub-urban area. There are five different stages that lead to the rise and fall of the American city (Goldstein 1990: 26). Although his descriptions for the different stages can be vague, he suggests that not every city has gone through all the same steps at the same time;

rather they each evolve at their own rate. An examination of the various stages in urbanization enabled us to better understand the trends for the growth of Dane County.

A significant portion of these studies relied primarily on quantitative data, however, we combined our data with qualitative interviews to further illustrate the changes in urbanization. As the quantitative data we gathered are important, the book, *Questioning Geography*, explains why first hand interactions with your research subject can give you a better understanding of the subject. The book states, "But how can he, as a Western outsider, come to understand how some Africans interpret landscapes? Meyer's explains how he increasingly relies upon research [interviews] as a menu of addressing these important questions" (Castree 2005: 229).

Our research on the effects of urban sprawl over agricultural lands throughout Dane County garnered several relevant conclusions. We first define 'sprawl' as a process of excessive development stemming from a city center (Hayden 2004:11-14). In our analysis of Dane County's historical urban development, sprawl is identified in terms of the rural land, or non-urban agricultural area, that is consumed by the intruding urban development. The first conclusion determined that urban area spread throughout the decades**.** This is represented by the flashmap still pictures dating from 1900, 1950, and 2000 (Figs. 5.1-5.3) which illustrate the expansion of urban growth throughout the 20th century.

The interview with our Case Study Farm Owners depicts Madison growth through the visible development of housing just north of their property. 'Where there used to be just 5 houses on the hill (in their backyard) 19 years ago, there are now entire neighborhoods' (Case Study Husband, Personal Interview, 15 November, 2009; Fig. 4.2). This increasing development is a threat to their and neighboring agricultural lands.

A second conclusion gathered from our research is the startling shift in population growth from rural to urban between 1920 and 1930 (Fig. 1.9). The census population data concludes that the population divide in 1920 totaled 45,953 inhabitants for rural areas and 43,479 inhabitants for urban areas. Before this time rural population of Dane County was consistently greater than urban population; however, in 1930, the urban population reached 72,587, while the rural population decreased to 40,150 (Fig. 1.9). The year 1930 marks the beginning of a rapid increase of urban population, and a much slower increase in rural inhabitants. From 1930 to the present, urban population has grown more rapidly than rural population.

Our third conclusion reveals the influence of technology on urban expansion and the efficiency of agricultural production. As collected from our interview with the Case Study Farm Owners, the onset of mass car production brought about changes in the distance from the city center that people could live. Commuting to work or school no longer impeded upon people's decision to live in the city. It was now feasible to live in a suburb and commute to work. 'A meter indicating the amount of cars traveling across the main road in front of our Case Study Owners' home indicated about 3,000 cars pass by the main county road daily' (Case Study Husband and Wife, Personal Interview, 15 November, 2009). Our Case Study Owners experienced the negative effects of these automobiles through the increased traffic noise and congestion.

Innovations in farm equipment and seed allowed for greater production in less time. In 1933, our Case Study Farm owned '120 acres, 6 cows, and no tractors; presently, they own 600 cows, 4,000 acres, and 10 trucks' (Case Study Husband, Personal Interview, 15 November, 2009). The difference in production capacity is seen through the Case Study Farm photos (Figs. 4.7-4.9). These photos depict a 24-row planter and a modern-day thresher, both with GPS capabilities (in comparison to the 2-row corn planter they owned in the early 1940s).

The fourth conclusion uncovers trends in the rate of agricultural production between 1840 and 2008. The production of tobacco, oats, and corn highlight the overall trends in production, with the decades 1920-1930 and 1940-1950 showing highest increases in production (Figs. 1.2, 1.3, 1.5). Recorded production of the years in between these key decades report declines in production levels.

Our final conclusion states that with the spread of urban development from Madison, less rural land became available for farmers. With the increasing urban population, (as per our discussion in conclusion 2) more farmland transformed into urban development. This corresponds to farmland data from the period. In 1930 the average acres per farm began to increase from 121.2 acres to 180.0 in 2000 (Fig. 1.8). Meanwhile, total acres of farmland in Dane County began to decrease from 710,214 in 1930 to 563,000 in 2000 (Fig. 1.7). The total number of farms repeated the downward trend. From 1920 to 2000 the recorded number of farms decreased from 6,217 to 3,120 (Fig. 1.6).

We arrived at our five conclusions concerning urban sprawl in Dane County, Wisconsin through a number of different methods. Throughout the semester we collected population, farmland and agricultural census data, observed and compared old photographs of downtown Madison obtained from the Wisconsin State Historical Society Visual Archives, and studied Dane County plat maps from 1900 onward. Our group also conducted an informal interview with the two owners of a farm located in Verona, Wisconsin (to whom we will refer to as our Case Study Farm Owners/Husband/Wife), and produced a photographic reproduction of our Case Study Farm for comparison purposes.

Our collected population census data for Dane County included total county population, urban population, rural population, and the population of Madison for the years 1840 to 2000. To

obtain population and agricultural production data we searched through numerous internet engines including; the National Agricultural Statistics Service, the U.S. Census Bureau, and the Historical Census Browser, U.S. Department of Agriculture, and the Wisconsin Crop Reporting Service. The agricultural census data for Dane County included total production of wheat, corn, oats, potatoes, tobacco, and soybeans for the years 1840 to 2008. We collected all of this information in the unit of bushels except for tobacco, which we obtained in the unit of pounds. Included within the agricultural census data, we searched for information concerning farmland itself in Dane County. In this subgroup we acquired the total number of farms, total acres of farmland, and average acres per farm from 1840 to 2000. The sources we used to collect this data include the Census of Agriculture, the Historical Census Browser, and the Wisconsin Crop Reporting Service.

We obtained four different historical photographs from the Wisconsin State Historical Society Visual Archives, via the Internet, ranging from 1860 to 1927 to compare and depict the growth of Madison throughout the decades. The first photograph is from 1860 and is an image of State Street looking toward the State Capitol building. We compared this image to another photograph of the same view from 1905 to visually analyze the urban infrastructure and development. We followed the same process with two photographs of East Washington Avenue from 1885 and 1927.

Plat Maps from each decade, beginning in 1904 through 2005 provided the digital overlays on our flashmap to visualize the rate and extent of Madison's urban sprawl. On 15 November 2009, our group conducted an informal interview with our Case Study Farmers at their home in Verona, Wisconsin. This interview gave our project a qualitative representation of the effects of urban growth on surrounding rural areas. Prior to the interview, we hand delivered our Case Study Farm Owners the questions that we would ask them upon our visit. The majority of our interview

took place in their kitchen, where the atmosphere was extremely relaxed, and the farm owners answered all of our questions with great detail. We followed up the initial questions, which pertained to the overall changes in farming, with more specific, detailed questions (Fig. 3.1). The last few questions we asked focused on the sprawl that has already taken place and will most likely take place in the future (Fig. 3.1).

We conducted our interview so that each one of us asked one or two general questions, while maintaining eye contact with the interviewee. The other three group members took notes: one person focused on the responses of the Case Study Husband, another paid attention to the responses of Case Study Wife, and the other focused on the responses of both.

Our photograph reproduction supplements the interview by providing a visual analysis of the effects of technology and transportation on the farm throughout the decades. To create our photograph reproduction, our Case Study Farm Owners allowed us to take photographs of images they had of their farm from decades past. While on our guided tour of the farm, we were able to capture a modern day reproduction of a historical photo taken in 1904.

Limitations existed on the part of our research, primarily concerning the census data and Plat Maps collection. The census information for Dane County was difficult to collect for every decade between 1840 and 2009. This created some holes in our results section (Figs. 1.1-1.9), with at least one decade of information missing in each category. We evaded these concerns by focusing our conclusions in the data that was clear and present in our graphs, and excluding discussion over the years where we found no data.

With regard to the Plat Maps used for the production of our flashmap, our group had originally intended to use USGS maps for the analysis, however, we ran into a roadblock with availability of years. By implementing Plat Maps for analysis, as urban sprawl progressed, we had

to piece together as many as seven townships in order to represent one year's sprawl. In 1904 this was not a problem seeing as the urban area concentrated in the isthmus.

The scale of the final flash production is definitely a limitation as well. By concentrating on the entire county it does not allow for minute developments to be represented. Accuracy was also limited due to the scale variation from decade to decade. Digitizing and alignment of the Plat Maps with the PDF base map was another issue. Time was the major limitation when dealing with outlining the Plat Map urban area. Extra effort could have been given to outline every geographic feature, however, this level of accuracy was unnecessary when illustrating general urban trends. The same rationalization was used when deciding what to include on the Dane County PDF image (the background for the Flash production). Roads, streams and topography were deleted along with bike paths and annotations due to the fact that they were erroneous to our presentation.

Limitations for the Flash map consisted of projector scale, census data availability for bar graphs, space available for graph representation within the flash production, and amount of time necessary to represent the vast amount of information that was collected. Time constraints and feasibility of completing the map on time kept us from including all census data gathered for agricultural production. When representing bar graphs another issue was the scale of production. Instead of being able to place wheat, corn, and tobacco on one graph with production totals as the y-axis, they were instead represented as percentages of themselves with no production being zero percent and the highest production being one hundred percent. A further reason for this decision is the fact that tobacco production is recorded as pounds while wheat and corn is recorded as bushels, thus creating inconsistencies with the y-axis.

Urban Photo Description

The urban photo montage depicting the development of the City of Madison illustrates the changes in infrastructure and population that occurred within the 19th and early 20th century. The first photograph we analyzed is an image of State Street looking toward the state capitol building in 1860 (Fig. 2.1.). In this photograph, State Street appears to be a gravel road with no automobiles. On both sides of the street there are open, green spaces with trees dominating the area. There is a noticeable developed central business district that has a low, homogeneous skyline and the visibility in the photograph is clear. We compared this image to another photograph of State Street looking toward the state capitol in 1905 (Fig. 2.2).

In the photograph from 1905 (Fig. 2.2), the open, green spaces dominated by trees observed in the 1860 photograph are replaced by buildings. There is nothing but infrastructure on both sides of the street. Although the rural population of Dane County still outnumbered the urban population in 1905, the population of Madison was on a steady incline. The increased development to maintain a growth in urban inhabitants is seen in this photograph (Fig. 2.2). By 1905, almost all of the area surrounding the capitol building was developed and only a few trees remained. The street is now smooth and nicely paved and there are trolleys scattered with horse drawn carriages along the road. The skyline in this photograph is no longer homogeneous. There are smoke stacks towering over the rest of the buildings emitting a haze of smoke and that interferes with the clarity of the photograph.

The third photograph is an image of East Washington Avenue in 1885 (Fig. 2.3). In this photograph there are buildings lining the shore of Lake Monona with clusters of structures within the isthmus. Again, the skyline of these buildings is low and fairly equal. The rest of the photograph is pure open land with no buildings, and the few trees that do appear are in the

foreground of the photo. We compared this image to another photograph of East Washington Avenue taken in 1927 (Fig. 2.4).

Between 1885 and 1927, the density of buildings on East Washington Avenue skyrocketed. In the photograph from 1927, the open land observed in 1885 is no longer present. There are a number of cars parked and driving on the smooth, more developed streets, and again, the low, homogeneous skyline is gone due to the towering smoke stacks. Due to the greater amount of development and the emissions from the coal powered smoke stacks, the visibility in this photograph is not clear.

The changes we observed in these photographs are directly related to the changes that occurred in farming. The earlier photographs, with less development and more open land, green space, and underdeveloped roads exemplify a large, persisting rural population within Dane County. They represent a large population of people living in the country relying on farming and agriculture for their livelihood. The later photographs illustrate people migrating to the city during the roaring twenties and the expansion of urban life. They show later stages of a city becoming more and more densely populated. These photographs demonstrate and support our conclusions. Urban area is spreading due to increasing urban population from the rural to urban migration of the 1920s. This migration meant that urban population now surpassed rural population. Furthermore, technology is evident in the expansion, and no doubt added to the rate at which expansion occurred.

Interview Analysis

To better understand the effects of urban sprawl and bring a qualitative aspect to this project, our group decided to interview the owners of a farm located just outside the boundaries of

Verona, Wisconsin (Fig. 4.13). The interview took place on 15 November 2009 at the farm owners' residence and was made possible through a group member's personal connection with a grandchild of the owners.

A week before the actual interview we provided the owners with the questions we planned to ask them. We understood this would prevent any spontaneity in responses, however, since we intended to inquire about events that occurred seventy years prior, we felt some reflection may be necessary for full recollection. All four group members contributed to the construction of our questionnaire (Fig. 3.1). There were five questions in total and each group member asked 1 to 2 questions, maintaining eye contact with the farm owners, while the remaining three members took notes (Fig. 3.1). This created an overlap in our notes; however, it lessened gaps in the collected data seeing as no recording devices were used.

On 15 November 2009, the day of the interview, all four group members met with the farm owners at their farmhouse in Verona, WI. After the interview, which lasted for approximately one hour, the husband (Case Study Husband) took us on a guided tour of the farm and allowed us to take pictures of the farm, as well as historic photos hanging on the walls of his personal and work office. This interview provided real-life support for our hypotheses that made by comparing census data (Figs. 1.1-1.9) with historical urban photos (Figs. 2.1-2.4) and Plat Maps (Figs. 5.1-5.3). One conclusion gleaned from our interview analysis is that urban sprawl in Dane County encroached upon farmland and threatened the persistence of farms throughout the 20th century. Our Case Study participants, who requested to remain anonymous, were extremely generous in both their information and hospitality.

The owners of our Case Study Farm are an older married couple that has lived in Verona since 1933. The husband, who was born in 1930, is a short, stocky man with a kind face and a

mellow disposition. Subdued but friendly, he was always willing to provide information. Born about three miles from his current residence, our Case Study Husband recalled farming his entire life. He was a member of the Dane County Zoning committee, the Dane County Planning Committee, and was the school treasurer on the Verona School Board. His wife (Case Study Wife), who also grew up on a nearby farm, is a welcoming woman with a warm smile and a love for storytelling. You can see by the countless tales they tell and the numerous pictures throughout the house that they really love their family.

In 1933 Case Study Husband's family purchased 120 acres of land in Verona, Wisconsin. When they moved into their current house nineteen years ago, they could see five houses on the horizon when looking north toward Madison. Today, the same view shows countless homes (Fig. 4.2). Urban sprawl is visibly approaching their current property. Case Study Husband estimates that 'within the next twenty to forty years the city will reach their property, forcing the farming community further into the country. According to Case Study Husband, since 1933, their farm has been pushed approximately fourteen miles further from their original location due to expanding urban development' (Case Study Husband, Personal Interview, 15 November, 2009; Figs. 5.1-5.3).

Along with being forced further and further away from the impending city, farms, such as our Case Study, are having difficulties building necessary infrastructure because of zoning laws. Bureaucrats not in tune with the rural inhabitants needs hinder rural farms' progression. An example of this is the sixteen months it took for a state engineer to approve a Dane County water plan that was affecting the Case Study farm. When asked why the engineer took so long, the husband's response was, "because he could" (Case Study Husband, Personal Interview, 15 November 2009). For this reason, our Case Study Farm Owners built their new equipment shop/office according to code that allows it to be used as a repair shop when the city eventually

overtakes their land. The ironic part of zoning is that it is less difficult for the city to sprawl; however,

> "(Now that) people moved to the country to escape Madison it is more difficult for the farm to develop because the suburbs complain about things such as the smell of manure. Plus the farm can't expand because the roads are so important. Three thousand cars and tons of cyclists ride past the house everyday" (Case Study Husband, Personal Interview, 15 November 2009).

On the other hand, there is neighboring Fitchburg, Wisconsin which actually restricts farmers from converting their land into urban development. This causes financial strains on farmers that no longer have the capital to survive in a business where corporations make it difficult for small operations to survive.

The Case Study Farm began in 1933 with '120 acres of land, six cows, six pigs, and two hundred chickens' (Case Study Husband, Personal Interview, 15 November, 2009. Case Study Wife informed us that "we were all poor but we were all alright" (Personal Interview, Case Study Wife, 15 November 2009). To survive the hard times they would exchange eggs for groceries, receive help from surrounding farms during harvest, and visit relatives in Madison who often had more provisions. Case Study Husband recalls his earlier years when they would work the fields with a two-row plow pulled by horses, a stark contrast to the twenty four-row-planter owned today (Fig. 4.1). Even with the lack of technology and wealth, the Case Study Farm was one of few local farms to have electricity, running water, and an indoor toilet.

Today things are very much different. The Case Study Farm now covers over four thousand acres! Two hundred forty acres are owned, while the remainder is rented. 'They house and milk six hundred cows (Fig. 4.4), and use ten semi-trucks for distributing what is produced on the farm' (Case Study Husband, Personal Interview, 15 November 2009). This accumulation is

worth $1.7 million and has afforded them a 2,500 square foot single-story ranch-style home valued at $273,000 (Dane County Interactive Map, 2009), comforts of modernity, and frequent world travels.

This wealth was realized because of hard work, no doubt; however the advent of technology allowed farming to become more cost/time efficient. In the early 1940s, horse-drawn plows were progressively replaced by engine-driven tractors (Fig. 4.7). When Case Study Husband was 16 he remembers “getting a fancier tractor with hydraulics” (Case Study Husband, Personal Interview, 15 November 2009). In 1953, at age 20, Case Study Husband remembers when they began using a combine, which is a single piece of machinery that performed the duty of three machines: reaping, binding, and threshing. Today the Case Study Farm spends over half a million dollars on top-of-the-line GPS-guided equipment (Figs. 4.8, 4.9) that is replaced every six years. This equipment allowed two weeks and multiple workers (Fig. 4.16) worth of threshing, to be completed in one day by a single worker.

Technological innovation was unnecessary unless there was a need for increased crop production. Dane County's increasing population (Fig. 1.9) created that need, while seed genetics, synthetic fertilizers, tractors, and mechanized milking have provided a solution. Ideally the entire farm would use manure supplied by the cows, however, manure provides for only 600-800 acres, the rest is dependent on fertilizers. According to Case Study Husband, 'if not for inputs, America would be dependent on other nations for food' (Case Study Husband, Personal Interview, 15 November 2009). Fertilizers and genetic seeds allow the Case Study Farm to harvest 200 bushels per acre compared to non-genetic seeds and manure which produce 65 bushels per acre.

This boom in production is very apparent when looking over our census data. If you compare the statistics from Figures 1.1-1.9 it is evident that technology allowed farming to

produce more, with less farmers on more acres per farm. In 1920 rural population comprised 51% of Dane County's total population, by 1930 this shifted to 36% (Fig. 1.9), the economic boom of the roaring twenties attracted people toward the city and away from the country. By 2000 rural population would be at 15% (Fig. 1.9).

Mass production of the 1920s brought affordable technology, such as automobiles, radio, and telephone service to the masses. Along with automobiles came the development of government-funded roads and highways. When comparing the numerous automobiles and paved roads of 1927 (Fig. 2.4) to the horse drawn carriage of 1905 (Fig. 2.2), both the increase in automobiles and the construction of roads is obvious. Even though urban population surpassed rural population during the twenties (Fig. 1.9), the combination of roads, automobiles, electricity, telephone, plumbing, sewer systems, and radio gave cities the tools to start sprawling. People no longer had to live in close proximity to their place of work, they could live on the rural/urban fringe and commute to work. Figures 5.2 and 5.3 illustrate this concept with Madison's political boundary spreading away from the isthmus.

During the depression people moved to the cities and gave up on farming. This meant that more farmland had to be harvested by fewer farmers. Between 1920 and 1930 the number of farms in Dane County decreased from 6,217 to 5,859 (Fig. 1.6) while the total average number of acres per farm increased from 116 to 121.2 (Fig. 1.8). By 2000 the number of farms declined to 3,120 (Fig. 1.6) while acreage had increased to 180 acres per farm (Fig. 1.6). The Case Study Farm supports this data, for it grew from 120 acres in 1933 to 4000 acres today. Without technology this trend would have been devastating to not just for Dane County but the greater American public as well.

Even though rural population percentage and total farm acreage declined from 1920 onward, crop production and acres per farm still increased (Figs. 1.1-1.5, 1.8). Due to technology and innovation, corn production nearly doubled between 1930 and 1940 (Fig. 1.2), from 1.9 million bushels to 3.3 million bushels, and nearly tripled between 1970 and 1980 (Fig. 1.2), from 11.9 million bushels to 29.3 million bushels. This advancement is seen on the Case Study Farm. Bushels per acre of corn increased from 80 bushels per acre in 1950 to 200 bushels per acre presently, while total acreage increased from 40 acres to 2,400 acres over the same period. 'This increase was made possible through genetically modified seed that is resistant to pesticides. 'Instead of spraying only the weed by hand, farmers now sprayed entire crops by machine' (Case Study Husband, Telephone Interview, 14 December 2009).

Technology aided in the increased production of soybeans as well. Soybeans did not become popular for American farmers until the 1930s, even then they were primarily used as livestock feed or winter poultry rations. However, as Manchurian soybean exporting routes closed due to Japanese invasion, Europe turned to America to supply their need. This need, along with growing domestic uses, prompted American farmers to adapt combines for harvesting the bean. This concept can be seen with a 91,000% increase of Dane County's soybean production from 38,600 bushels in 1940 to a max of 3,523,300 bushels in 2000 (Fig. 1.4). The Case Study Farm mimics this trend as no soybeans were found on the farm until 1960. Even then there were only 5 acres producing 20 bushels per acre. Once again, as species were genetically modified to resist pesticides, greater gains were made. Today the case study farm cultivates 800 acres and is able to produce yields of 40-55 bushels an acre (Case Study Husband, Telephone Interview, 14 December 2009).

The production of wheat in Dane County fluctuated over the decades. The greatest year was 1860 when 3,005,000 bushels were harvested (Fig. 1.1). This was primarily due to the rise in wheat prices from May 1854 to May 1855 and the little capital required to grow wheat (Hibbard, 1902: 123-129). Since then production has been in waves, increasing between 1910 and 1940, decreasing between 1940 and 1970, and increasing again until 2008. Wheat production is heavily dependent on the international market, and with rising production from China and India, since the 1960s, returns on wheat have decreased. With limited return there is little motivation to harvest. This lack of motivation is manifest by the Case Study Farm not cultivating wheat until the 1990s. Even today, the 170 acres that is dedicated to wheat comprises only 4.25% of the farm's total production. When compared to corn which makes up 60% of production, or the 20% and 10% that soybeans and alfalfa respectively contribute, one begins to see how insignificant wheat production is in Dane County.

Interestingly tobacco production increased up until the 1920s, then began to steadily decline through the years of technological innovation that increased production of corn, wheat, oats, and soybean. This makes perfect sense as tobacco harvest has always relied on intensive manual labor. It also gives insight to national health trends; smoking was not viewed as hazardous to one's health until 1930. Thereafter more action was taken to deter people from smoking.

Urban sprawl is not the only factor threatening the existence of farms. The lack of interest in farming amongst the youth is a major problem for the future. The owners of the Case Study Farm have ten grandchildren, of the ten, only one works on the farm today (Case Study Wife, Personal Interview, 15 November 2009). The other grandchildren have gone to college or technical schools and now earn a living within some type of city boundary. This is an example of the loss of interest in farming as a profession. Due to loss of interest amongst the younger family

members, our Case Study Farm hired outside workers who pull 12-hour shifts. In addition to the difficulties of farming in general is the extreme cost of the agricultural business. A tractor that could be purchased in 1948 for $1,600 has been replaced by a combine that now costs $290,000. Natural seed that cost $12 a bushel has been replaced with genetically modified seed that today costs $250- $280 a bushel. Wooden barns were replaced with metal structures, and milking, which was once done by hand, is now completely automated (Figs. 4.5, 4.6).

To illustrate the effects that changes in technology, rural to urban population shift, and a need for higher production from less farmland have had on the Case Study Farm, we have numerous photos (Figs. 4.10-4.15) taken at different periods throughout the farm's history that are to be discussed. From the earliest photo of the Case Study farmhouse (Fig. 4.15), taken in 1904, one can see the subtle differences in construction and landscape of the barnyard when compared with a photo taken during the interview (Fig. 4.14). In Figure 4.15 a red wooden barn and windmill can be seen next to the owner's farmhouse. By Figure 4.10 the windmill is gone; however, the barn remains until Figure 4.13 where it has been replaced by a white modern steel milk house that takes up the right hand mid-ground in Figure 4.14.

The two trees situated between the house and barn in Figure 4.15 were felled to make way for the garage and gravel road access to the improved barn. A new tree stands (Fig. 4.14) in almost the exact location as the original two (Fig. 4.15). The old fence posts seen in the right-hand foreground of Figure 4.15 represents the use of the old wooden barn for possible hay storage and animal penning. These fence posts are not present in Figure 4.14, illustrating the change in purpose from a multi-use barn to a modern and more efficient, single-task milk house.

Growth of the farm is depicted by the presence of six large silos in the right-hand background of Figure 4.14 that were not present in Figure 4.15. The construction of the silos and

milk house (Fig. 4.14), and the deletion of the red barn and fence posts (Fig. 4.15) show a change in the level and purpose of production on the farm between 1933 and 2009. As stated above, the original farm consisted of 'one hundred and twenty acres, six cows, six pigs, and 200 chickens' (Case Study Husband, Personal Interview, 15 November 2009). Farming was performed by family members and trade was conducted locally. Growing population from the 1920s onward (Fig. 1.9) created a need for higher production (Figs. 1.1-1.5) while technology (Figs. 4.6-4.9) provided the means to fulfill this need. The new silos (Fig. 4.3) can store 240,000 bushels of grain. This grain is shipped to Evansville, Wisconsin located twenty three miles to the southeast of Verona, showing how transportation and infrastructure has increased the distance of business.

In the foreground of Figure 4.14 there is a sunken garage attached to the farmhouse on what used to be flat, barren ground in Figure 4.15. Figure 4.15 also depicts two horse and buggies, while the recent photo (Fig. 4.14) has a gravel road leading to the garage with several automobiles parked in the middle ground. These observations combined with the construction of silos and the milk house help explain how technology has made it possible for Dane County to have greater production (Figs. 1.1-1.5) with less farms (Fig. 1.6) and less overall farmland (Fig. 1.7) resulting from the growth of Madison (Figs. 5.1-5.3).

Urban sprawl does not spread like manure. This conclusion is evident in the way in which urban sprawl effects not only the inhabitants of the city but the livelihoods of surrounding rural folk. When living in a capitalistic society these results are inevitable. Within the political boundary of the City of Madison you see that development is not uniform, certain areas of the city are affluent, there are homeless people living in other areas, different neighborhoods have a mix of middle class people that work a wide range of jobs, students concentrate in other areas of the city

for affordable housing, and in the suburbs you have many professionals that commute. Not only are the people affected by politics and the market, but the extent and rate at which a city grows is also affected. Due to the roaring twenties which brought economic success along with affordable conveniences such as automobiles, people moved to the cities. This exodus caused extreme urban growth and allowed people to live on the urban/rural fringe. Height restrictions that did not (and still do not) allow buildings to be taller than Madison's capital building propelled outward growth as well.

As mentioned earlier, not only does urban not spread like manure on the city, urban does not spread like manure over the countryside as well. As Madison grows inconsistently it means that countryside near the sprawl is subject to the rate and extent of the urban growth. Our interview informed us that certain towns have different zoning ordinances which greatly affect a person's livelihood. Infrastructure, such as the grid work of roads and encroaching suburbs, limits the growth of the farm, causing farmers to search further from urban areas for land that can be cultivated. As Madison sprawls, urban dwellers live closer to farms (Fig. 4.1) and are on the receiving end of the farmers practices. In turn, the public applies pressure on farmers to alter their operations so things such as fertilizer from field runoff does not make its way into Lake Mendota and cause regular cases of hazardous blue-green algae. These pressures and possible state regulations end up placing farmers on the receiving end of effects due to urban sprawl. Those that happen to live further from Madison are somewhat better off, although they 'suffered more during the depression' (Case Study Husband, Personal Interview, 15 November 2009). They also have less annoyance today from suburb populations than the farmers whom benefited from living closer to Madison during the years.

The growing urban population places the unfair burden, on the rural minority of the county's population, of a needed increase in food production on shrinking farmland. This is all in the hope that innovation will provide a way. If farmers can weather the storm, expand operations and rise to the challenge of the industry, then they stand to make a good life for themselves, much like Our Case Study Farm. On the other hand, if farmers 'do not have the cash flow or the manpower they will be working into retirement just to break even' (Case Study Husband, Personal Interview, 15 November 2009). Much of this has to do with hard work, much of this has to do with good fortune of living in an area where zoning will allow you to do with the land as you see fit, a further example of how urban sprawl does not spread evenly like manure.

A question we would like to ask then is, what does this mean for the future? Currently, the population of Madison is on the rise, and according to the Dane County Human Services, the projected total population of Dane County will reach 480,600 by the year 2010 (Gleason, 2009:1). With this increasing population, if rural land continues to decrease, will cities incorporate farming into the urban setting by way of green belts; or, will agriculturalists be limited by what they are allowed to do with purchased land through zoning or outright laws. Will technology and innovation continue to provide a solution for the burgeoning population? Yet, if that population is kept from spreading outward, the city could resort to smart growth upward. This would require consideration and tolerance on the part of the urban population in order to make any sort of difference for the rural population. Overall, what is the problem: increasing population, decreasing farmland, or a combination of the two?

In the coming years agriculturalists surrounding the City of Madison will inevitably be impacted in some way by future urban sprawl. Whether or not zoning is implemented will be a significant factor of the positive or negative effects encountered by farmers. Either way, no matter

what happens in the future, as stated by our Case Study Wife, “everyone will all be alright.” (Case Study Wife, Personal Interview, 15 November 2009).

Figures 1.1-1.9: Census Data: Agriculture, Population, Farmland

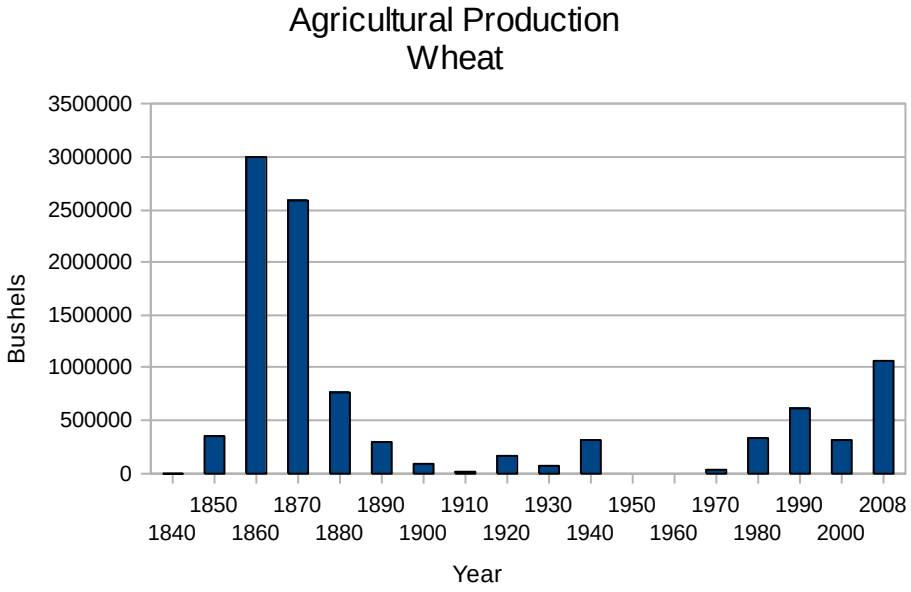

Figure 1.1. Agricultural Production census Data. Sources: NASS (2009); U.S. Dept. of Agricultre (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

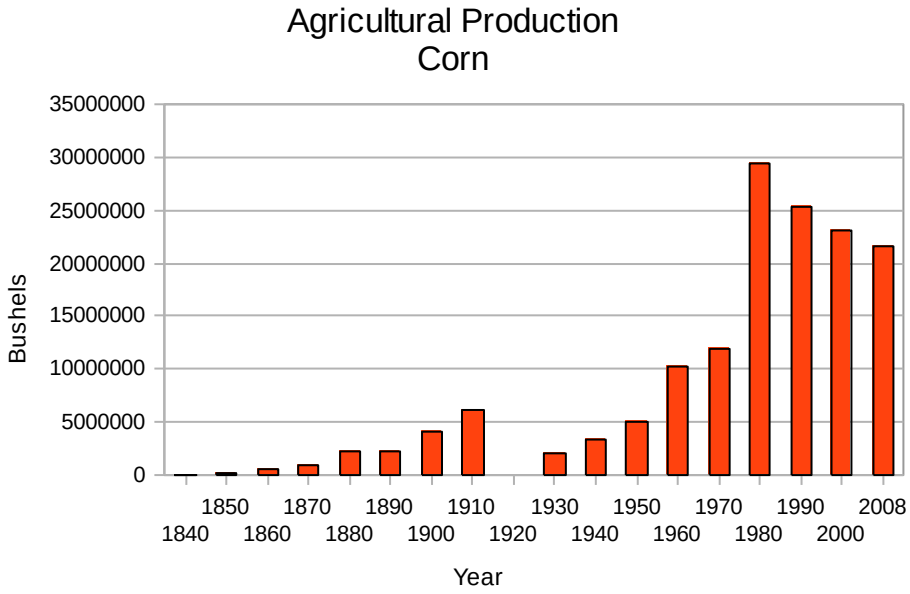

Figure 1.2. Agricultural Production census Data. Sources: NASS (2009); U.S. Dept. of Agriculture. (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

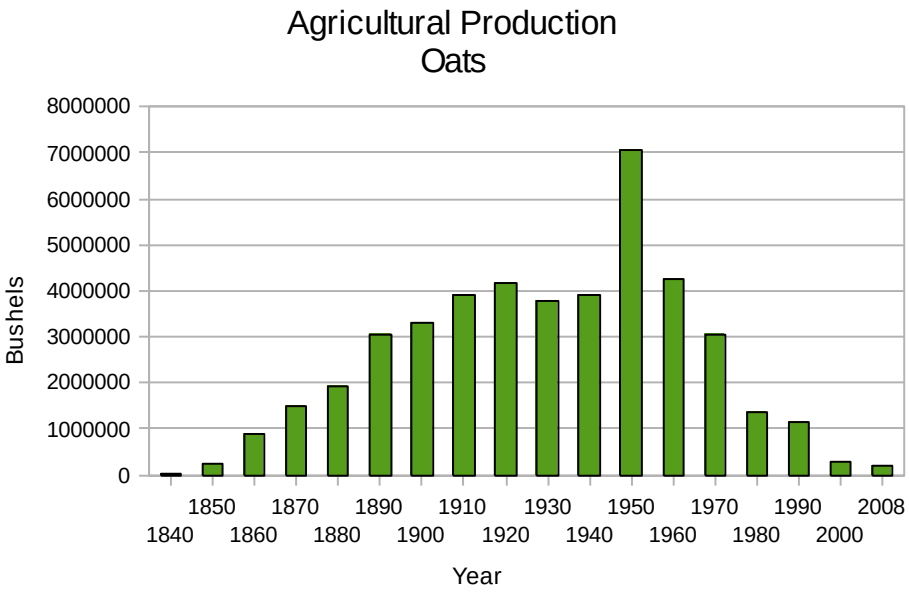

Figure 1.3. Agricultural Production census Data. Sources: NASS (2009); U.S. Dept. of Agriculture. (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

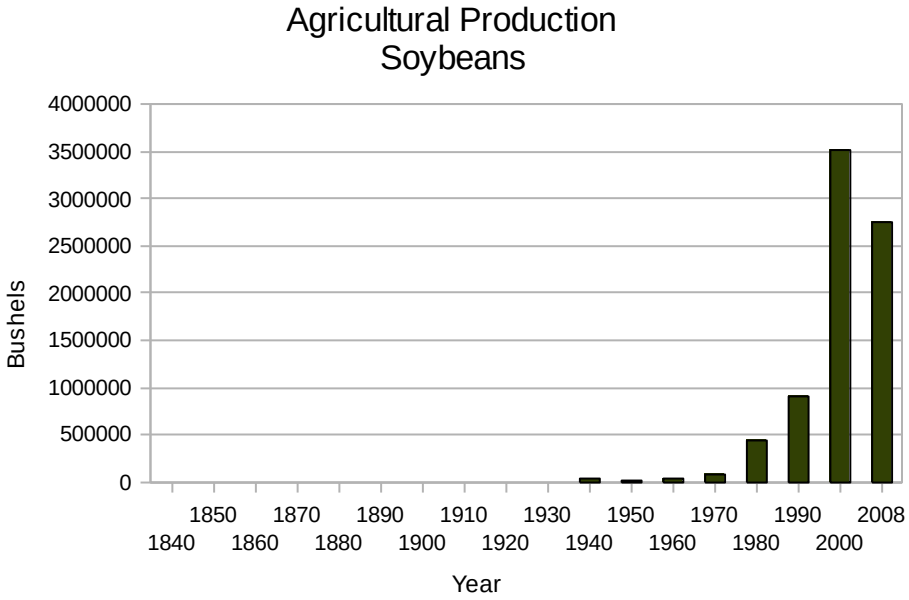

Figure 1.4. Agricultural Production census Data. Sources: NASS (2009); U.S. Dept. of Agriculture. (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

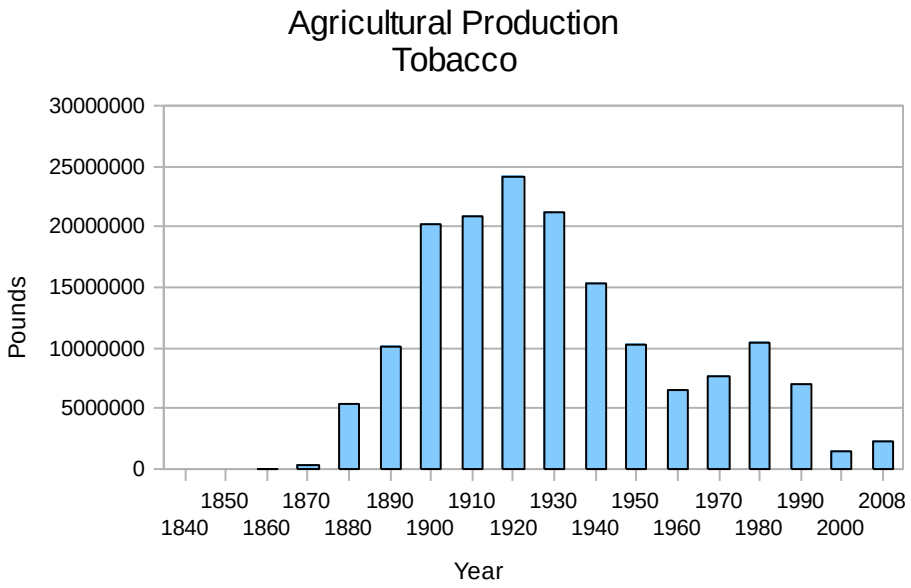

Figure 1.5. Agricultural Production census Data. Sources: NASS (2009); U.S. Dept. of Agriculture. (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

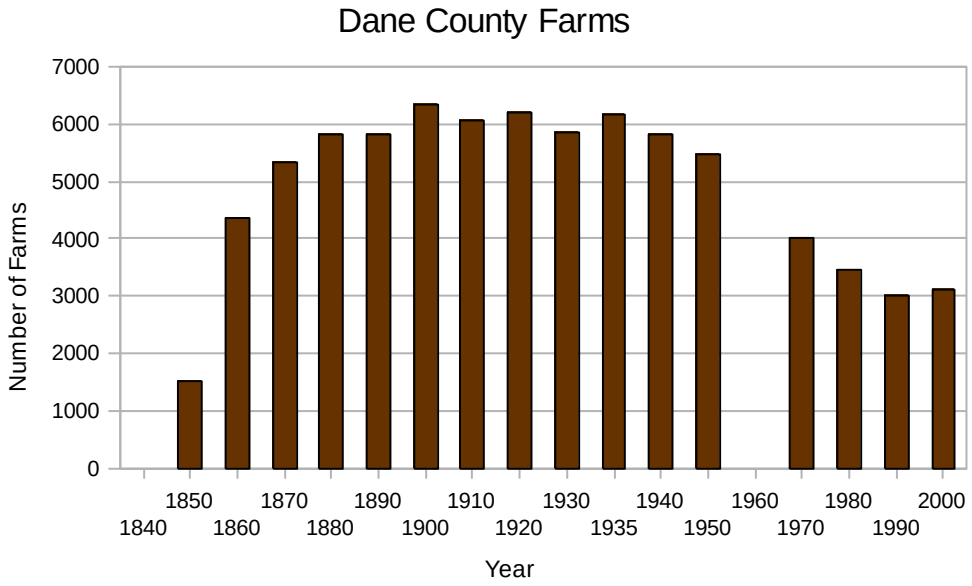

Figure 1.6. Farmland Census Data. Sources: Census of Agriculture (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

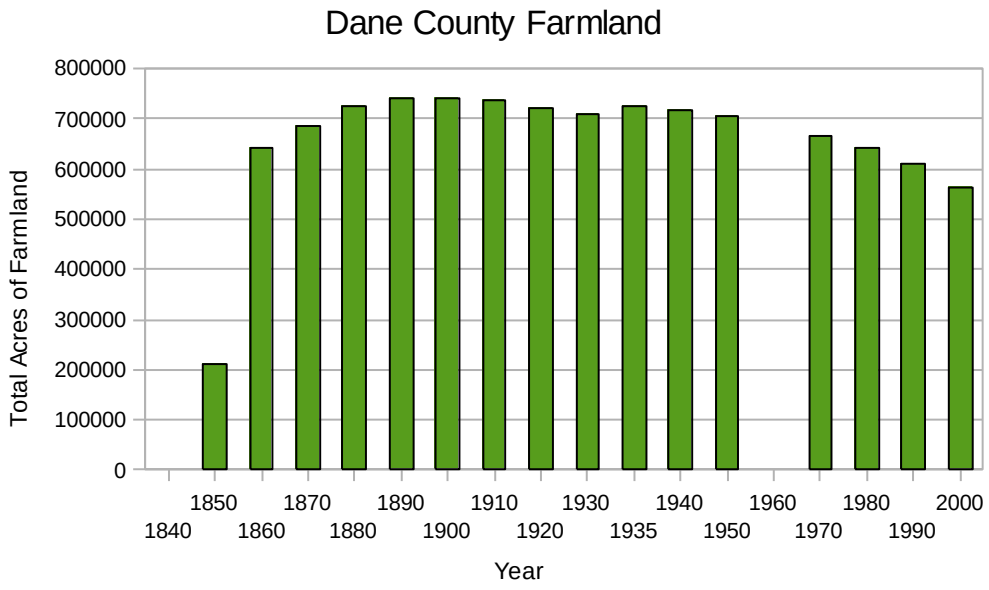

Figure 1.7. Farmland Census Data. Sources: Census of Agriculture (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

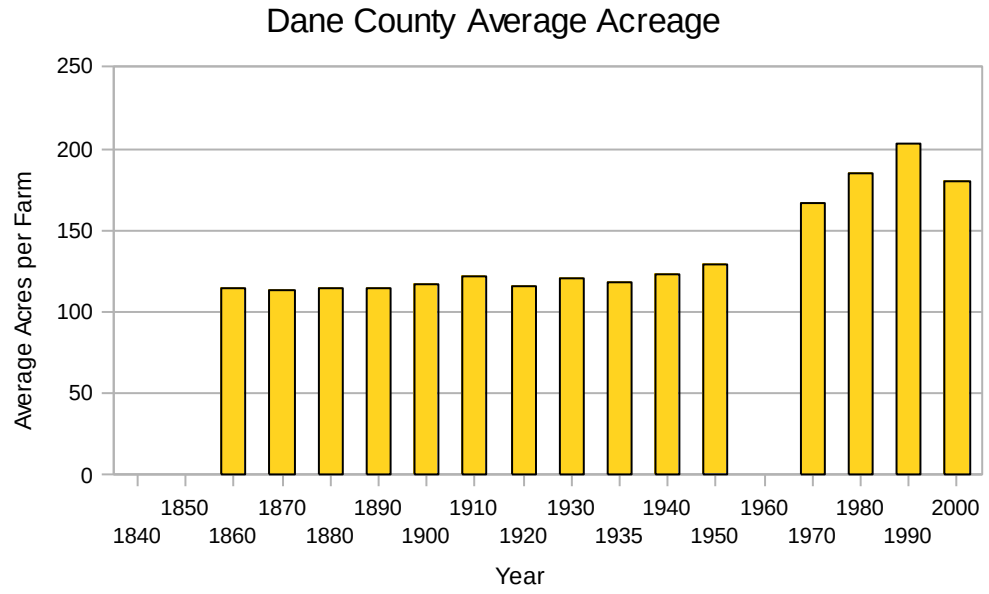

Figure 1.8. Farmland Census Data. Sources: Census of Agriculture (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

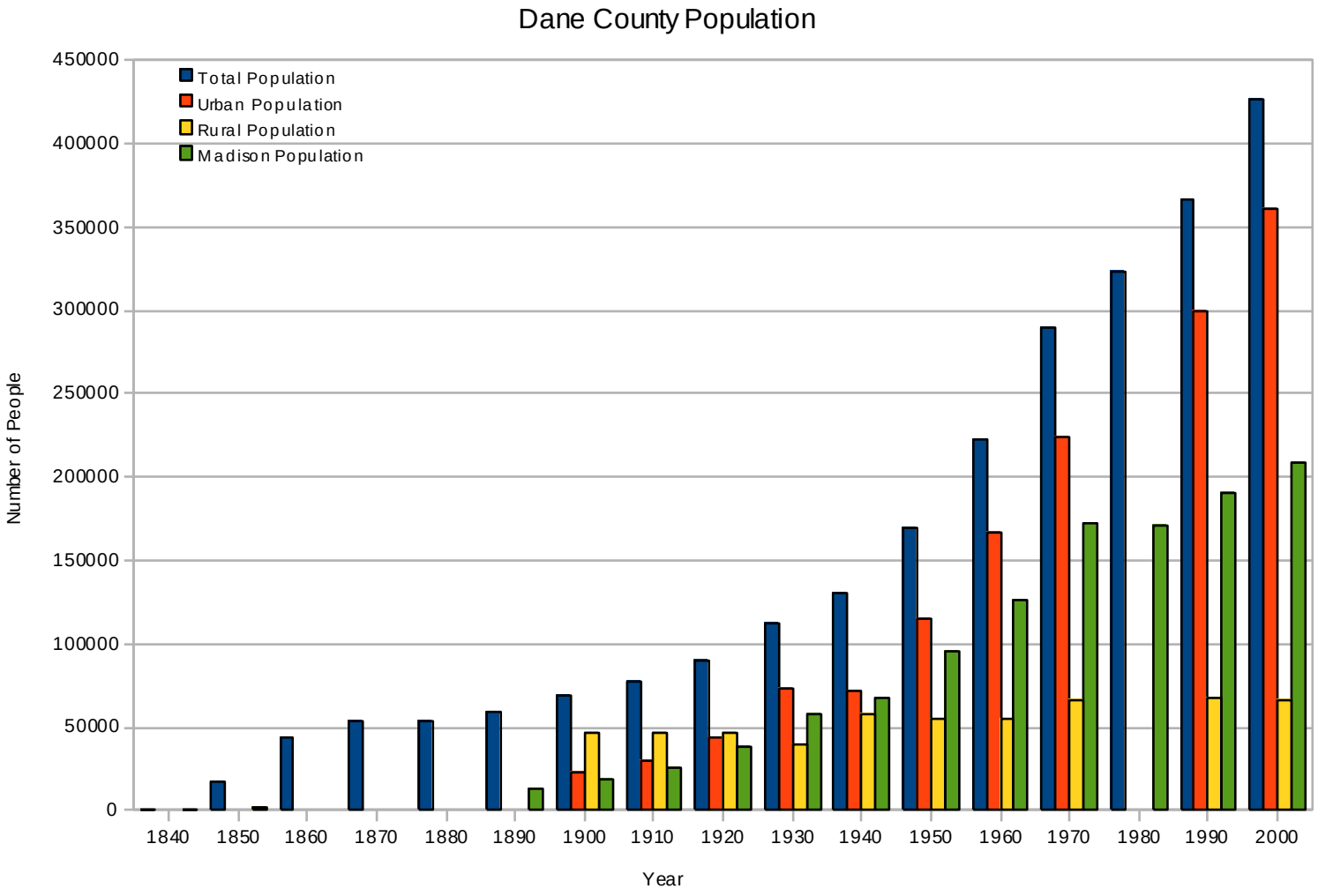

Figure 1.9. Farmland Census Data. Sources: Census of Agriculture (2009); Univ. of Virginia (2009); WI Crop reporting Service (1940).

Figures 2.1-2.4: Urban Photo Montage

Figure 2.1. State Street, 1860, WI State Historical Society: Division of Archives (WHi-27109), (2009).

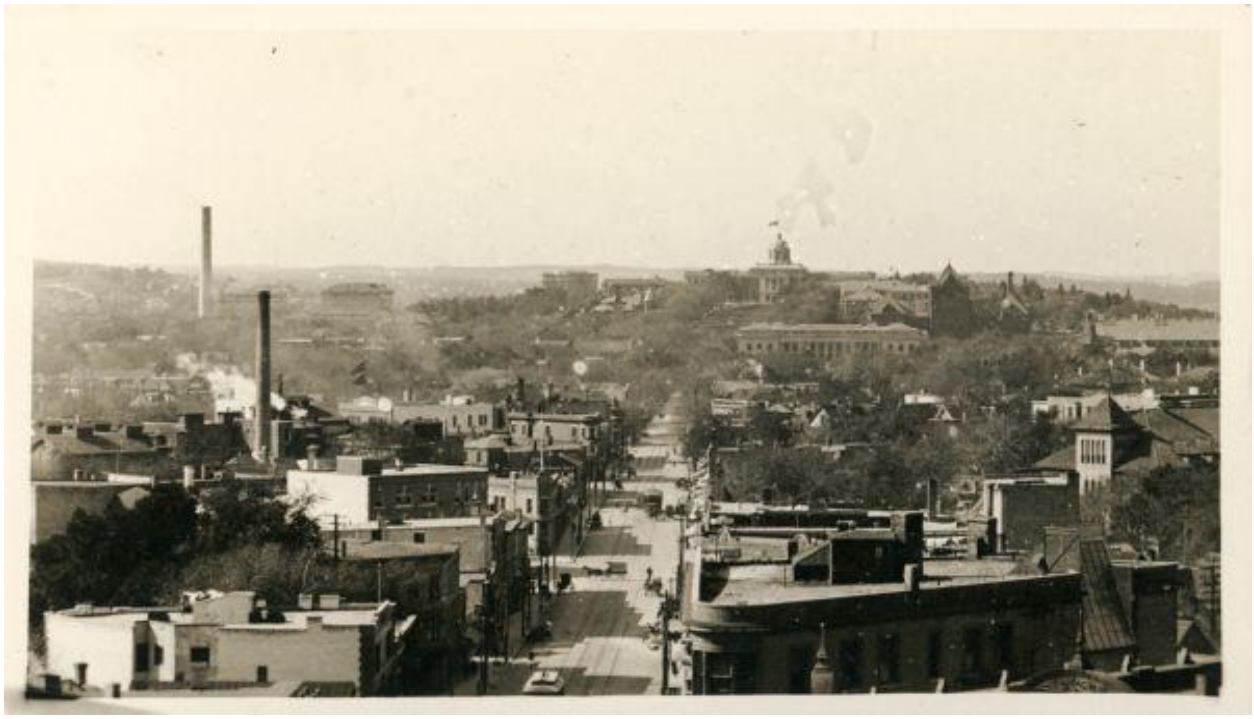

Figure 2.2. State Street, 1905, WI State Historical Society: Division of Archives (WHi-51667), (2009).

Figure 2.3. East Washington Avenue, 1885, WI State Historical Society: Division of Archives (WHi-9825), (2009).

Figure 2.4. East Washington Avenue, 1927, WI State Historical Society: Division of Archives (WHi-51932), (2009).

Figure 3.1: Interview Questionairre

1.) How has the (your) farm changed over the years?

2.) How has farming changed over the years (1930)?

3.) How has family life on the farm changed over the years?

4.) How has the growth of Verona, Fitchburg, and Madison affected you?

5.) How will the growth of Verona, Fitchburg and Madison affect the future of farming in the area? What does the growth of Verona, Fitchburg, and Madison mean for the future of farming in the area?

Figures 5.1-5.3: Flashmap Stills, 1900, 1950, 2000

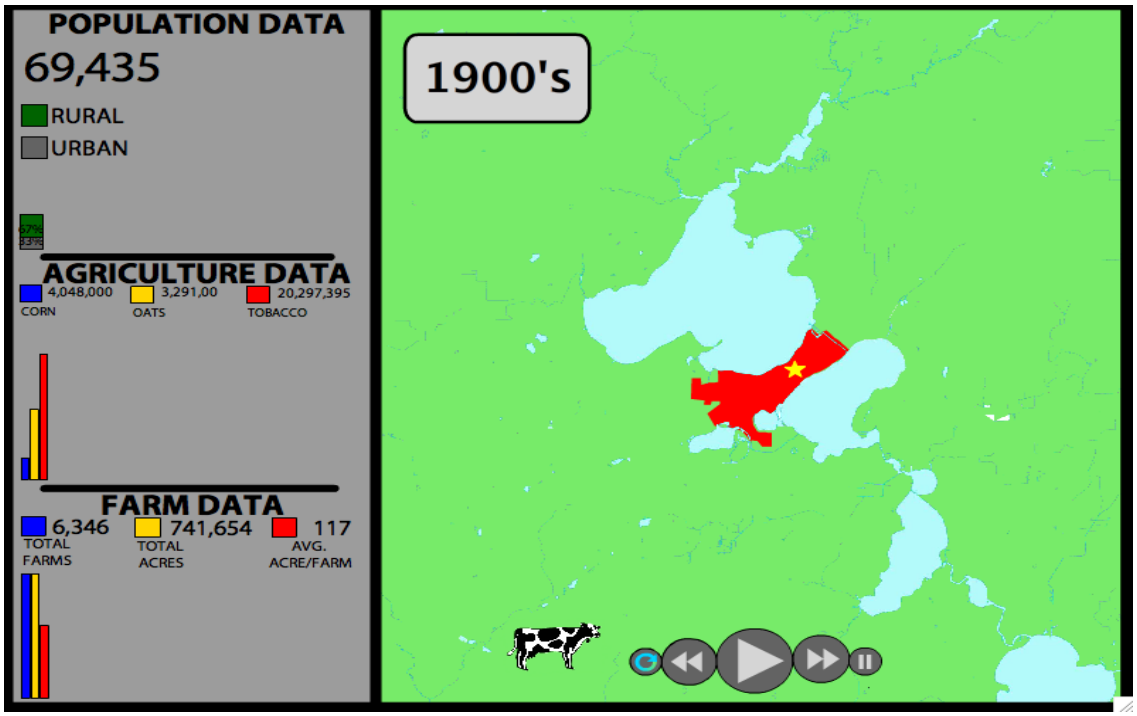

Figure 5.1. Flashmap Still, 1900. Source: Original flashmap (2009).

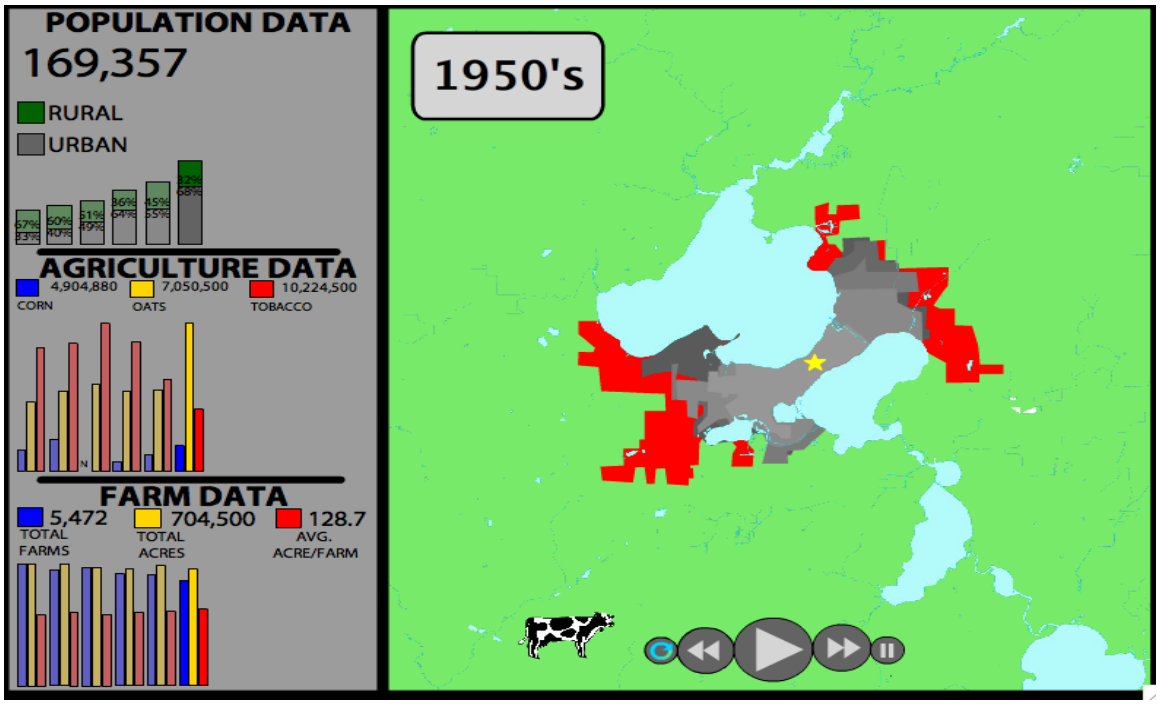

Figure 5.2. Flashmap Still, 1950. Source: Original flashmap (2009).

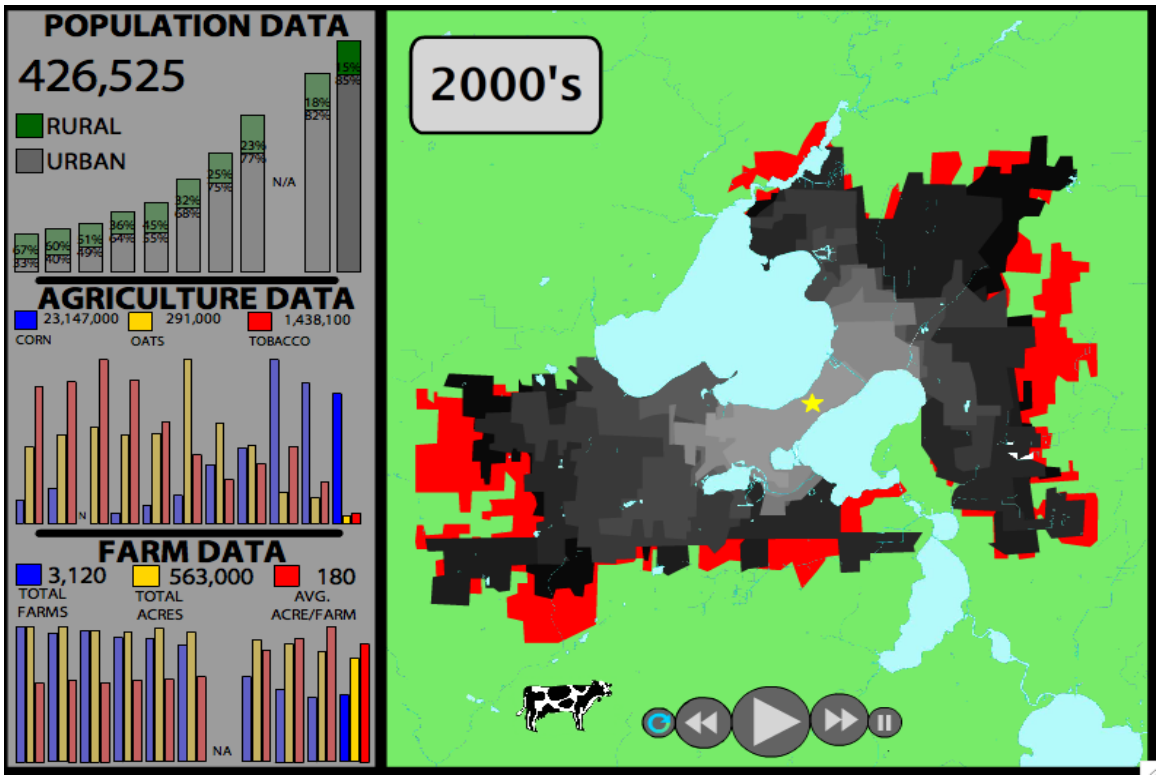

Figure 5.3. Flashmap Still, 2000. Source: Original flashmap (2009).

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Figures 1.1-1.5.) National Agricultural Statistics Service (NASS).*Data and Statistics: Quick Stats*. United States Department of Agriculture. (Last accessed 25 November 2009). URL: http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/.

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Figures 1.6- 1.8.) National Agricultural Statistics Service (NASS). *Data and Statistics: Quick Stats*. United States Department of Agriculture. (Last accessed 25 November 2009) URL: http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/

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Figure 1.9.) The Census of Agriculture. *Historical Census Publications (1840-1950)*. United States Department of Agriculture. (Last accessed 20 November 2009). URL: http://www.agcensus.usda.gov/Publications/Historical_Publications/index.asp#twelfth.

University of Virginia Library. *Historical Census Browser*. (Last accessed 29 November 2009). URL: http://fisher.lib.virginia.edu/collections/stats/histcensus/

Wisconsin Crop Reporting Service.1940. *WI County Agricultural Statistics: Bulletin 202 South District*. WI Department of Agriculture, Madison, WI: State Capitol.

Figure 2.1.) Wisconsin State Historical Society. *Wisconsin Historical Images: State Street Looking Toward Wisconsin State Capito, 1860*. WI State Historical Society Image Archives, (WHi-27109). (Last accessed 29 November 2009). URL: http://www.wisconsinhistory.org/whi/fullRecord.

Figure 2.2.) Wisconsin State Historical Society. *Wisconsin Historical Images: State Street Looking West, 1905*. WI State Historical Society Image Archives, (WHi-51667). URL: http://www.wisconsinhistory.org/whi/fullRecord.

Figure 2.3.) Wisconsin State Historical Society. *Wisconsin Historical Images: View Over East Washington Avenue, 1885*. WI State Historical Society Image Archives, (WHi-9825). URL: http://www.wisconsinhistory.org/whi/fullRecord.

Figure 2.4.) Wisconsin State Historical Society. *Wisconsin Historical Images: East Washington Avenue From the Wisconsin State Capitol 1927,*. WI State Historical Society Image Archives, (WHi-51932). URL: http://www.wisconsinhistory.org/whi/fullRecord.

Figure 3.1.) Case Study Husband/Wife. *Personal Interview Questionnaire*. Verona, WI 15 November 2009.

Figure 4.1.) Case Study Farm. *Urban Infringement.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.2.) Case Study Farm. *Urban Sprawl.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.3.) Case Study Farm. *Silos*. Verona, WI. Photograph taken 15 November 2009.

Figure 4.4.) Case Study Farm. *Cattle Barn.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.5.) Case Study Farm. *Mechanized Milking.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.6.) Case Study Farm. *Mechanized Milking.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.7.) Case Study Farm. *Early Model Tractor.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.8.) Case Study Farm. *Claas Jaguar Harvester.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.9.) Case Study Farm. *Combine*. Verona, WI. Photograph taken 15 November 2009.

Figure 4.10.) Case Study Farm. *Case Study Farm Aerial Photo.* Verona, WI. Photograph taken 15 November 2009.

Figure 4.11.) Case Study Farm. *Case Study Farm Aerial Photo.* Verona, WI. Photograph taken 15 November 2009.

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Original Flashmap Code:

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//button commands

stop()
playButton.addEventListener(MouseEvent.CLICK, onPlayClick);
function onPlayClick(e:MouseEvent){

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        mad1910.play();
        mad1920.play();
        mad1930.play();
        mad1940.play();
        mad1950.play();
        mad1960.play();
        mad1970.play();
        mad1980.play();
```

```
		mad1990.play();
		mad2000.play();
		popGraph.play();
		clock.play();
		agGraph.play();
		farmGraph.play();
		farmNumbers.play();
		agNumbers.play();
		popNumbers.play();

}

rewButton.addEventListener(MouseEvent.CLICK, onRewClick);
function onRewClick(e:MouseEvent) {

		mad1900.gotoAndStop (mad1900.currentFrame-15);
		mad1910.gotoAndStop (mad1910.currentFrame-15);
		mad1920.gotoAndStop (mad1920.currentFrame-15);
		mad1930.gotoAndStop (mad1930.currentFrame-15);
		mad1940.gotoAndStop (mad1940.currentFrame-15);
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		mad1960.gotoAndStop (mad1960.currentFrame-15);
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		mad1980.gotoAndStop (mad1980.currentFrame-15);
		mad1990.gotoAndStop (mad1990.currentFrame-15);
		mad2000.gotoAndStop (mad2000.currentFrame-15);
		clock.gotoAndStop (clock.currentFrame-15);
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		agGraph.gotoAndStop (agGraph.currentFrame-15);
		farmGraph.gotoAndStop (farmGraph.currentFrame-15);
		farmNumbers.gotoAndStop (farmNumbers.currentFrame-15);
		popNumbers.gotoAndStop (popNumbers.currentFrame-15);
		agNumbers.gotoAndStop (agNumbers.currentFrame-15);
}

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		mad1980.gotoAndStop (mad1980.currentFrame+15);
		mad1990.gotoAndStop (mad1990.currentFrame+15);
		mad2000.gotoAndStop (mad2000.currentFrame+15);
		clock.gotoAndStop (clock.currentFrame+15);
		popGraph.gotoAndStop (popGraph.currentFrame+15)
		agGraph.gotoAndStop (agGraph.currentFrame+15);
		farmGraph.gotoAndStop (farmGraph.currentFrame+15);
		farmNumbers.gotoAndStop (farmNumbers.currentFrame+15);
		agNumbers.gotoAndStop (agNumbers.currentFrame+15);
		popNumbers.gotoAndStop (popNumbers.currentFrame+15);
```

```
}

pauseButton.addEventListener(MouseEvent.CLICK, onPauseClick);
function onPauseClick(e:MouseEvent) {

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	mad1920.stop();
	mad1930.stop();
	mad1940.stop();
	mad1950.stop();
	mad1960.stop();
	mad1970.stop();
	mad1980.stop();
	mad1990.stop();
	mad2000.stop();
	clock.stop();
	popGraph.stop();
	agGraph.stop();
	farmGraph.stop();
	farmNumbers.stop();
	agNumbers.stop();
	popNumbers.stop();
}

resetButton.addEventListener(MouseEvent.CLICK, onResetClick);
function onResetClick(e:MouseEvent) {

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	 mad1920.gotoAndStop (1)
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	 farmGraph.gotoAndStop (1)
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}
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