Madison’s Urban Fire Regime

Geography 565 Colloquium

Michael Schmelter
Jonathan Cain*

Abstract:

This research looks at documented major fire incidents from 1855-present day, Madison, Wisconsin. It draws mostly upon primary sources including fire marshall reports, newspaper articles, and interviews from first hand witnesses/firefighters. As a result of our research we have compiled a listing of major fire events in Madison, Wisconsin; classified by building classification type, geographic location, and time period. Our research also shows that Madison’s fire regime is driven heavily by people and specific to particular points in space and time.
Literature Review

Introduction

Fire plays a critical role in the development of human society. And the role fire fills in any human society depends on many critical factors. Since evidence for human fire use predates the appearance of large human settlements our project divides human fire use into three time periods. The first period covers the origins of fire use as a human tool up to the the mid-nineteenth century. The next period begins where the first ends and continues on to the end of World War II. The last period is considered the “modern” time, which begins after World War II up to present day. These time periods emphasize the rate of change in anthropogenic fire use being dependent on human population and culture. And the changes in population and culture occur over decades and centuries (Guyette, Muzika, & Dey, 2002, p. 472). Another factor to consider is that human population began accelerating around the time many societies began industrialization. Naturally, the transitions between these time periods represents a fuzzy buffer time that may be different due to differences in the geographic distribution of resources, land, and the density of human population inhabitants.

First, a clear and concise meaning for “urban” in the context of urban fire regimes is necessary. The United Nations demographic yearbook for 2011 highlights how the variability of national definitions for the concept of “urban” impairs the ease of comparing urban and rural distributions (United Nations, 2013, p. 5). Since our case study focus is Madison, Wisconsin in the United States we are using the definition employed by the United States. According to the United Nations Demographic Report 2011, the United States defines agglomerations of 2,500 or more inhabitants that contain population densities of 1000 persons per square mile or more (United Nations, 2013, p. 101). Also there two types of urban areas, one with 50,000 or more inhabitants and so-called urban clusters composed of 2,500 to 50,000
inhabitants (United Nations, 2013, p.101). One potential issue with our urban definition is how it is tabulated (United Nations, 2013, p. 9). In this project, we assume urban populations to be tabulated by place of residence and not occurrence.

Next, a common theme appears in the literature discussion about human land use and fire use. Some (Guyetta, et al.) define the anthropogenic fire regimes as patterns of wildland fire shaped by the dynamic interactions of vegetation and human populations (2002, p. 473). Since little is known about the changes in human population and culture and how those changes alter the anthropogenic use of fire and the dynamic effects those changes on ecosystems, that definition suits their use (Guyette, Muzika, & Dey, 2002, p. 472). For our purposes, the natural environment is any environment not experiencing direct, or immediate, significant human modifications; in addition, the region must have a population density below 1000 persons per square mile.

So areas with a population density exceeding 1000 people per square mile mark the environment for an urban fire regime. Urban fire regimes follow a system of rules and the fires that occur are nearly always anthropogenic, but those are the only major similarities between urban and natural regimes. Kull (2004, p. 47) explains that fire is a complex process, with diverse causes, purposes, and effects. Of course, some of these effects are predictable, some effects are intentional, and generally the focus in urban fire regimes is prevention and surpression (Kull, 2004, p47-48). Therefore, our focus within the urban fire regime is concerned with social, political, and economic causes for anthropogenic fire these change over time and population density (Kull, 2004, p.68-69; Lipsett, Waller, Shusterman, Thollaug, & Brunner, 1994, p. 434, 437; Kerr, 2012, p. 349).

Besides the natural and urban fire regimes there is one more complication. That is the buffer between the two regimes best described as a buffer. There are low density communities in these areas
and a significant lack of understanding about wildland fuel treatment for preventing fire along the wild-urban interface (WUI) (Mell, Manzello, Maranghides, Butry, & Rehm, 2010, p. 248). However, Cohen (2001) accurately points out that wildland fire will always occur in forests and rangelands, and this has an impact on people, property and resources too (Cohen, 2001, paragraph 4). Cohen recommends a sound method for reducing fire risk in the WUI and argues that the best means for protection is reducing vulnerability not fire suppression (Cohen, 2001, paragraph 5). An example of negative feedback from fire suppression is its effect on the savanna ecosystems in southern Wisconsin. This suppression led to a decline in its oak-hickory forests and experienced a rise in less fire resistant forest canopy with unknown implications for future fire safety in any of the fire regimes discussed (Rhemtulla, Mladenoff, & Clayton, 2009, p. 1074-1075).

Finally, the literature review exposes several trends, and the effects of these trends on the environment. This review is concerned with the human perspective of fire and the associated feedbacks of fire use in the natural environment, the urban environment, and the buffer connecting the two. Early fire use contributes to resource production that meets various survival needs such as changing natural ecosystems and reshaping, or redeveloping urban environments. A general trend not readily apparent, or that is taken for granted, in the literature is addressing human social-cultural constructions about urban fire regimes. A crucial outcome from understanding a given city’s urban fire regime is how it provides a means to better understand the costs, benefits, and side effects associated with urban fire (Murray, 2013, p. 1). Modeling, prediction, and informed urban policy all benefit from understanding urban fire regimes and this only supports the protection of people, property, and the environment. Thus, urban fire regimes develop within a complex emergent process that affects human land use and understanding how urban fire regimes change as well as alter land use offers a unique and
complex challenge as urban population density continues to increase.

**Origins of Fire and the Origins of Settlements**

Humanity depends on fire. This dependence is an inseparable part of the species for the emergence of simple stone tools, standing upright, and the use of fire all coincidentally occurred with the emergence of the species (Diamond, 2009, loc. 576-578; Pyne, n.d., p. 131). Stephen Pyne identifies how anthropogenic fire use and human migration caused changes in vegetation to such a degree that anthropogenic fire is responsible for maintaining various grassland ecosystems (Pyne, n.d., p. 131-132). Besides North American human societies, aboriginal Australians societies managed the landscape with fire in order to optimize the growth of edible plants (Diamond, 2009, loc. 1717).

Many early nomadic societies principle use of fire involved widespread alteration of the natural fire regime. Rather than occasional lightning strikes in the summer months causing fire, anthropogenic fires tended to cluster in the spring and fall (Pyne, n.d., p. 132). Native Americans used fire to create and sustain habitats that depend on fire as well as for hunting game (Pyne, n.d., p. 132-133). This activity impressed colonists of North America because roughly twice a year—the Fall and Spring—fire cleared all the overgrowth on the forest floor, and this eased passage and hunting for the natives (Cronon, 2003, p. 49).

Prior to urban settlements anthropogenic fire regimes existed in the natural environment. The lack of a permanent settlement and low population density made sense to the cultures in those times and places. Also, the lack of urban areas can be understood by considering how a given society lived with the land. When uncontrolled fires threatened gatherings of people the nomads could simply move which allowed for more use of fire and the control wasn't of the fire, but in people moving (Pyne, n.d., p. 133).
However, this mobility and extensive fire use does come with a cost and the evidence is apparent in the North American and Australian extinction record.

During the past 40,000 years a series of megafaunal extinctions occurred across the North America and Australia. While there isn’t much literature that directly links these extinction in North America with anthropogenic fire use, Diamond (2009) does link the Australian megafaunal extinctions in every habitat without exception to anthropogenic fire and the resulting habitat modification (Diamond, loc. 685-688). The result of these modifications have been both good in bad. In Madagascar the anthropogenic use of fire for good and evil demonstrates the global nature of anthropogenic fire use and its perceptions (Kull, 2004, p.57-58). Such drastic outcome creates a setting for people to begin considering managing fire use with better predictions and planning to protect human settlement (Avitabile et al., 2013, p. 82). Thus, as fire creates abundance fire also destroys, and this necessity for making better decisions based on improved understanding of fire regimes (Cronon, 2003, p. 50-51; Kull, 2004, p. 71-75; Mell, Manzello, Maranghides, Butry, & Rehm, 2010, p. 238).

**Early Settlement – Pre Industrial/Industrial**

**Natural Fire Regime Meets Human Intervention**

Fire regime within the natural/rural interface during the 19th century and early 20th century was ruled mainly by practices of public wildland officials. Based upon a lack of manpower and resources it was extremely difficult to control or suppress every rural/wildland fire so by default a hands off approach to this kind of fire was practiced (Van Wagtendonk, 2007). As seen in the newly established National Parks, officials needed to pick and choose their firefighting battles.

“The commanding officer [Army, Yellowstone National Park] decided that
human-caused fires along roads posed the biggest threat and that the Army would concentrate its suppression efforts on the control of those fires. There were not enough soldiers to fight all of the fires in the park so thus arose the first conscious decision by a manager of federal land to allow some fires to burn while others were controlled. This policy of fire suppression was also applied in Sequoia, General Grant, and Yosemite national parks when they were established in 1890” (Van Wagendonk, 2007, 3).

This ideology remained (for the most part) in effect for much of the 19th century, however, an increase in catastrophic death and property loss due to fires around the turn of the century would change the national opinion on how fires should be managed.

Without forethought (or past experience) on the effects that total fire suppression may have on future fire regimes, the U.S. entered a new fire control era based on complete control over all fires. Until the middle of the next century, a majority of forest managers and wild fire crew managers believed that fires should be suppressed at all times (Natural Resources Defense Council, 2003). By 1935, the U.S. Forest Service ordained a fire management policy stating that, “All wildfires [were] to be suppressed by 10 A.M. the morning after they were first spotted” (National Park Service, U.S. Forest Service, 2001, 1). This “10 A.M.” policy was built around the ecological theory that fire exclusion promotes ecological stability. Additionally it was believed that fire exclusion would reduce human commodity damages and economic losses (National Park Service, U.S. Forest Service, 2001). This sentiment was echoed in a 1923 “Fire and Accident Prevention Day” pamphlet organized by the Industrial Commission of Wisconsin. In this pamphlet, then governor of Wisconsin, John J. Blaine, gave the following proclamation:

“Fire respects neither man, thing or place; it is an enemy which never sleeps; it destroys
the resources of field and forest, the products of human labor, the palace and cottage, the shop and factory; it robs labor of employment, it lays waste cities and country… it always wastes and never creates, save smoke and ashes. It is meet and proper that we give at least one day of sober, concentrated thought to this problem of waste, and its economic results” (Industrial Commission of Wisconsin, 1923, 2).

This ideology is fairly typical of the time period. Possibly a reaction to recent catastrophic fires such as the Peshtigo/Chicago fires of 1871 (Fire and Accident Prevention Day was originally started to commemorate the Great Chicago Fire (Industrial Commission of Wisconsin, 1923).) this fire management practice completely ignores the ecological benefits of fire that become more apparent following World War II.

**Urban Fire Regime**

![Image of Madison Fire Company No. 2](image1.png)

**Wisconsin Historical Society 1872**

The image depicted above is a lithograph of Madison Fire Company No. 2 with the second state capitol building and the original State Street engine house to the right. This company was comprised completely of volunteers (M.F.D. History Book Committee, 1992). Early stages of the
urban fire regime were decorated with the new excitments of recently established fire companies and brigades (Lewis, 2002). Among those fascinated and moved by this spectacle were the children of the early to mid-1800’s. From this early era of urban fire control/management we are able to see the origins of ‘fireman prestige’ as well as the social construction of a fire as an event/spectacle. In the lower left hand corner of the image there are two young boys visible; these boys were known as ‘torch boys’ who would carry torches through the city streets leading the way to fire scenes. The position of ‘torch boy’ is not unique to Madison however it is unique to this time period and to the urban fire regime. Torch boys or ‘runners’ could be found in nearly any city that had a moderately established fire fighting force (Lewis, 2002). Volunteer and municipal fire companies were becoming increasingly common throughout the early to mid-1800’s. The calamity and excitement of a fire crew racing to a fire scene sparked the intrigue of city children all across the United States and what David Andrew Lewis describes as “a powerful spell to young hearts and minds” (2002, 56), took control of children driving them to the streets whenever they’d hear sirens. As put by an 1881 article from The Fireman’s Journal, “There is a fascination in running to fires. Hardly a man or boy or woman or child lives who has not at some time been moved to enthusiasm by the sound of an alarm or by the prospect of standing within easy reach of a burning building. In going to a fire the chance attendants do not contemplate helping the persons whose house or goods may be in danger of combustion, they want to see spectacle…” (1881, n.p.).

**Early Madison Major Urban Fire Case Studies**

**Campbell, Hogg & Welch, 1855**

The first major urban Madison fire was October 28, 1855. This fire originated at the Campbell, Hogg & Welch planning mill/factory. It expanded into a nearby residential neighborhood destroying one
This event will be critical in our research because it represents the first fire in a newly established urban fire regime. More analysis of the Sanborn Fire Insurance maps of this area will provide substantial insight into the effects of industry and city planning on the role of human provoked land use change on the occurrence of fire. This fire was also significant because it exposed the dire need for an organized fire service. During his inaugural address, Madison’s first mayor, J.C. Fairchild announced, “No city has been so providentially exempt from fire in the past as Madison. During the last winter, two fires occurred [Campbell, Hogg, and Welch and Webster Street]. A recent fire in the business section of the city illustrates two facts: a want of necessary apparatus and a surprising knowledge and tact on the part of your citizens in subduing fire… This want of apparatus must be supplied, and connected with public cisterns” ((M.F.D. History Book Committee 1992, 7).

**Webster Street, 1856**

The following year on March 2\textsuperscript{nd} the second highly destructive Madison fire occurred on Webster Street which was the central business district of the city at the time. Interestingly enough much of the credit for suppressing and eventually extinguishing this fire is given to local residents (aside from volunteer firemen). They were able to contain the fire within three buildings and in effect saved their main business district. This case study is inherently interesting because of the civil effort of citizens in controlling the fire (M.F.D. History Book Committee 1992). Comparing this event to modern major fires shows a deep disparity in fire control practices over the past 150 years. We will use this case study to analyze both the changes in fire control practices as well as society’s reaction to fire. Would a group of common citizens take the initiative to join together in aiding firemen to control a fire? Does the distinction between ‘volunteer’ and ‘professional’ have an effect on the public’s assessment on the
quality of the firemen? Would citizens have the opportunity to take such actions today? What social implications does this suggest about both society’s emotional response to fire and the government’s role in fire suppression?

**Washington Ave, 1857**

In 1857 Washington Avenue was completely destroyed by fire from Webster Street to Bruen’s block. The fire department worked diligently at suppressing this fire however they were met with the insurmountable obstacle of fighting the blaze with an extremely limited water source. Because water was inaccessible the entire block ended up being destroyed. An article in the Wisconsin State Journal reported on this event that, “The firemen were on the ground, and worked as only firemen work, but in consequence of the lack of water, their exertions were in great manner wasted. However, but for them, the best portion of the city would assuredly have been burned up… The fire has shown the utter absurdity of our common council in the preparation against fire… The reservoir on Webster Street isn’t worth a penny for any practical purpose, being so leaky that it won’t hold water” (M.F.D. History Book Committee 1992, 8). Should the completely new concept of urban fire control be blamed for the Webster Street debacle? Maybe. Cases similar to this were happening quite frequently in newly established urban fire regimes all across the United States. Another example are the turn of the Century Oahu fires in which there were no readily accessible water sources. According to Hawaii’s Board of Water Supply, “The problem was that the system had grown too much, too fast and too haphazardly. There was a complete lack of long-range planning. Because of the absence of a united reliable water system, fire protection was minimal and the threat of disease in the water was constant” (2004, n.p.). This lack of long term planning can be seen within many fire related topics throughout the 19th century. Buildings, water sources, street design; none were originally planned while the full extent of an urban fire
regime was comprehensible.

**Pre Industrial/Industrial - Modern Day**

**Modern Natural Fire Regimes and Fire Exclusion:**

Despite the growing recognition of natural fire regimes as an important aspect of forest ecology by researchers in the 20th century, the majority of land management practices in the U.S. continue to support a policy of fire exclusion. The continuation of fire suppression policy has significantly altered historical natural fire regimes to this day. Due to a continued policy of fire suppression, “the annual acreage consumed by wildfires in the lower 48 states dropped from 40 - 50 million acres (16 to 20 million hectares) a year in the early 1930s to about 5 million acres (2 million hectares) in the 1970s” (Cohen 2008, pg 21). As a result of continued fire suppression policy in most of the U.S., the amount of live and dead vegetation as a source of fuel for fires increased. Although fire suppression has in fact resulted in less fires, the size and intensity of fires has increased due to the buildup of fuel sources.

In the late 1960’s and early 1970’s policy makers began to recognize the historical and ecological importance of wildland fires. Current policy reflects this change in belief however there is a lapse between our policy and our practice. According to Jack Cohen in his article, *The Wildland Urban Interface Fire Problem: A Consequence of the Fire Exclusion Paradigm*, our current policies recognize the fact that wildland fire is a keystone ecological process and allows for planned burning (prescribed fire) and designating unplanned fires as desirable (fire use) (2008). Cohen continues to say that even though our policy is sound, “…in practice the nationwide total number of wildland fires suppressed as wildfires overwhelmingly dominates the fire occurrence statistics. For example, the ten-year (1998-2007) average number of total wildland fires per year designated for suppression is
approximately 80,000 occurrences, compared with 327 designated as desirable” (Cohen, 2008, 21). This disparity in policy and practice suggest that our past practices of “fire exclusion” are very much so still in effect today. Cohen calls this the “fire exclusion paradigm” because of our inherited culture and practice of preventing and suppressing almost all wildfires despite our policy stating otherwise (Cohen 2008, 21).

The altering of natural fire regimes has had a significant effect on the composition of species dependent on fire as part of their life cycle such as the ponderosa pine in the western United States. It is now evident that “Anthropogenic changes to fire regimes affect biodiversity and inappropriate fire regimes have been identified as a threatening process for some species in fire-affected systems” (Avitable et al 2013, 81).

**Natural/Urban Interface Fire Regime**

There is a great level of uncertainty when it comes to decision making by natural resource managers regarding fire. The lack of information in terms of historical fire regimes and the effects of current fire management practices on the landscape has the potential of leading to unintended consequences. According to Avitable et al, “Although land managers may lack detailed information, they are required to make decisions about issues such as fire suppression and prescribed burning. The resulting fire management strategies have the potential to alter fire regimes in ways that advantage, or disadvantage, the biota” (Avitable et al. 2013, 82).

Although prescribed burns are used as a tool to manage existing grasslands and oak savannah ecosystems, the majority of the areas historically associated with these types of landscapes are managed for fire exclusion. This is because a large portion of the grassland and oak savannah
ecosystems found in Southwest Wisconsin at the time of European colonization were converted for agricultural purposes over the past 150 years (Zouhar et al 2008, 113). However, one of the problems associated with current fire management practices is that some of the grassland and savannah ecosystems that were originally altered for agricultural use have been abandoned and permitted to naturally succeed without the introduction of fire regimes to control the invasions of nonnative species. In other cases, the introduction of prescribed fire regimes to manage landscapes dominated by invasives are negatively impacting biotic communities due to lack of research regarding the effect of fire regimes on specific nonnative plants (Zouhar et al 2008, 115).

**Modern Urban Fire Regimes**

A valuable source for examining the effects of urban fire regime in the modern era is the paper titled, “Who Burned Cleveland, Ohio? The Forgotten Fires of the 1970s”, by Daniel Kerr. This paper exposes political and economic motivations that rely on fire to promote destruction and change in urban communities. African American neighborhoods in Cleveland, Ohio suffered from major unemployment following an economic recession in 1958. In the 1960s, Cleveland mayor Locher used fire as cost-effective part of the city urban renewal program (Kerr, 2012). The program Locher implemented burned abandoned homes with a goal to reduce population density in the region. Fire prevention was not the goal of this. Locher burned homes to restore profitability to the city's real estate market (Kerr, 2012).

From 1965, fire played a prominent role in restructuring residential landscapes in Cleveland and other urban areas across the United States. Private arsonists working in concert with city demolition crews destroyed over 24,000 housing units and created hundreds of acres of vacant lots that
developers used in the 1980s. Public memories of these fires fixates on first set of fires set by rioters, but the vacant lots and fire-scarred landscapes that mark most inner cities across the United States in the 1980s were not for the most part caused by these riots (Kerr, 2012).

In Cleveland in the 1970s, arson was a part of everyday life, but the majority of fires were a means for landlords to squeeze capital out of their real estate holdings. In 1973, the Ohio FAIR Plan Underwriting Association reported 80% of the money it paid out in fire-loss involved arson or "suspicious circumstances" Historian Stephen Pyne quoted as arguing that, "the urban built landscape is as much a fire environment as forests and fields" (Kerr, 2012, 334). In the 80s, fire-resistant single-family mansions were part of the Renaissance Village development in Hough neighborhood of Cleveland. The riots spectacular riots were over exaggerated and this served the interests of property owners over those of the unemployed and working class. The city worked to aid the property owners by cutting back fire prevention services, subsidies that decreased the vigilance of insurance companies, and a permissive attitude adopted by the city and federal government all facilitated the proliferation of fires (Kerr, 2012).

**Research Question/Thesis:** How has Madison’s fire regime changed over time and space and what factors were the most influential in causing these changes?

**Methodologies**

**Overview:**

Our data gathering process was the driving force behind our entire Urban Fire Regime/Geography project. In order to properly analyze the changes in the urban fire regime of Madison, Wisconsin the first step was to gain as much knowledge as possible from historically noteworthy, and perhaps more interestingly not as well documented, Madison fires. The fire history of
Madison is rich with unique and diverse fire events all documented in what seem to be equally as unique and diverse sources. Over time, the agencies responsible for recording data on the city’s fire history changed drastically, in turn drastically altering the way in which the data was presented within the documentation. Aside from the difficulties of data continuity, we were successful in creating several datasets outlining the notable (and not so notable) fires throughout Madison’s history which ultimately allowed us to analyze the spatial, temporal, and economic relationships held between the fires and their fuel sources for a majority of the 20th century. Within the proceeding methodologies section we will discuss our data acquisition process, problems that arose during this process, how we determined an appropriate classification system to use on our acquired data, and how we determined the method with which we would use to visually display our data.

**Data Acquisition:**

Our data acquisition process was entirely archival in nature. We used newspapers (The Wisconsin State Journal), Annual Reports of the Chief of the Fire Department (various dates 1901-1976), and Madison Fire Department archival materials (various dates 1855-1991) in order to create a list of what our criteria deems a “noteworthy fire event”. The type of information about each fire event varied greatly across the board from the minimalistic 1950’s Annual Report of the Chief of the Fire Departments binary classification of “Fires Discovered vs. Total Alarms” to the complete and exhaustive description of every fire in the city for each given year from the Annual Reports of the Chief of the Fire Department 1901-1908. The one piece of literature that was able to bring some cohesiveness to these varying documentation types was Madison Fire Department History Book Committee’s, *Capital City Courage: a History of the Madison Fire Department*. It outlined a select
number of fires in a reasonable amount of data for almost the entirety of the 20th century. With this book we were able to cross check major fires listed from other sources and gain more information on fires that were simply recorded as a number and not classified in any way whatsoever. Although this documentation was extremely useful in our research it posed some problems while attempting to create and defend our criteria for what we deemed to be a “noteworthy fire event”.

*Capital City Courage: a History of the Madison Fire Department* proved to be our most useful tool in determining what we would deem a “noteworthy fire”. One critique of fire severity classification systems, as posed by Pamela G. Sikkink, in her work entitled *Comparing eight fire severity classifications: what can be done with a muddled process?*, is that the nature of fire and its causation have so many variables that a single classification system attempting to determine the “severity” of a fire is a ridiculous notion in and among itself (Sikkink, 2013, 2).

Sikkink describes the process as follows:

“If ever the statement “fitting a square peg in a round hole” was appropriate, it would be in applying current fire or burn severity classifications to the range of fire effects observed on a burn site by a field person. Matching fire-effect data to severity classes that were created for classifications with specific purposes or goals in mind is always unpredictable; but, in the case of the fire severity classes, it really becomes muddled if the class determined by one method disagrees with the class determined by another. Making this hugger-mugger process even more confusing is picking an appropriate method to use for classification of the burned area from the variety of classifications that now exist for describing fire severity, especially if the effects cover many spatial scales” (2013, 3-4).
This passage from Sikkink’s study hits the nail on the head. Every issue which we’ve encountered during data acquisition and classification has stemmed from the central issue that fire is itself inherently unique within its own position in time and space. The deep connection shared with a fire and its geography (be it physical, human, temporal, or economic) makes classifying a fire as “noteworthy” nearly impossible yet extremely revealing of our own personal values. Because we are not fire geography experts we relied heavily on the classification systems used by others in the field. By combining multiple classification systems with our own limited knowledge of the Madison fire regime we are able to better communicate our ideas through common language (class types) thus taking a complicated multifaceted phenomenon and boiling it down to a few key, easy to understand labels. The classification system we used for the “major fires” spreadsheet (which provided the data for our maps) is broken down into building use type, location (latitude, longitude), and time. We chose to classify the recorded fire events in this manner because it directly correlates to our research question/thesis.

Building Use Type

Our classification for buildings based upon their use is based loosely off of the Tennessee Board for Licensing Contractors: Contractor Classification Outline and the Michigan State Tax Commission’s, Property Classification and other similar governmental licensing agency classification systems. It is important to note that our classification system is not meant to follow along any agency specific guidelines or classification, yielding the state agency issuing the classification irrelevant. We are simply using their input as a way of understanding how buildings are classified to aid in the creation of a classification system most relevant and useful to our project’s needs and not necessarily to the state of Wisconsin, the City of Madison, or the building classification methods they may already have in place.
This being said, the classification system which we have established is a reasonable reflection of the basic ideas held within Madison’s zoning code, https://www.cityofmadison.com/dpced/ (last accessed 4 December 2013). This classification system breaks down building types into commercial, residential, industrial, government, university, and ‘other’ categories.

1. **A commercial** building, as outlined by the Michigan State Tax Commission’s, *Property Classification* is defined as: “Platted or unplatted parcels used for commercial purposes, whether wholesale, retail, or service, with or without buildings” (2013, 9). We remained true to this classification barring the statement that says with or without buildings; for our purposes the land must have a building or a building being constructed in order to fall under a classification other than ‘Other’. Aside from this we made neither additions or reductions to the type of buildings which would fall under the original classification.

2. **A residential** building, classified by the Michigan State Tax Commission’s, *Property Classification* is: “Platted or unplatted parcels, with or without buildings, and condominium apartments located within or outside a village or city, which are used for or probably will be used for residential purposes are properly classified residential. Parcels that are used for, or probably will be used for, recreational purposes, such as lake lots and hunting lands, located in an area used predominantly for recreational purposes are properly classified residential” (2013, 3). We did not run into any accounts of undeveloped recreational lands however we did encounter the issue of unfinished apartment complexes that had succumbed to arson. Because the intent of this property was to be used for residential purposes we (in continuation of the pre-stated
definition) labeled them as residential properties.

3. An **industrial** building, classified by the Michigan State Tax Commission’s *Property Classification* is: “Platted or unplatted parcels used for manufacturing and processing purposes, with or without buildings Parcels used for utilities sites, for generating plants, pumping stations, switches, substations, compressing stations, warehouses, rights-of-way, flowage land, and storage areas Parcels used for removal or processing of gravel, stone or mineral ores, whether valued by the local assessor or by the state geologist” (2013, 3). Our only diversions from this definition occur when warehouses, manufacturing sites or other building types typically classified as ‘industrial’ are owned/operated by local, state, or federal government agencies.

4. Our classification of a **government** building is any building that is funded in part or whole by public tax dollars and developed and maintained by the like thereof aside from University buildings/facilities. These buildings do not necessarily need to be used directly for functional governing processes (ie. Hospitals, Libraries, etc.)

5. We felt that the University of Wisconsin-Madison has had such a profound and unique effect on the development of the city both physically and socially that it warrants its own building classification altogether. There are certain layout design features that are necessary for the daily operations of a university that are not found elsewhere in the city. It is because of these kinds of alterations to what would otherwise be a very different urban environment that we discriminated between **University** and Non-University buildings. In the areas of future research section we will discuss the possible further delimitation of the ‘University Building’ classification into University Housing,
Educational Spaces, various Laboratory types, Utilities, and public spaces.

6. Finally the classification of ‘Other’ was given to any undeveloped space that encountered a fire event. This includes fires stemming from “rubbish in the road” and the extremely common “marsh fire”.

Location

Within the documentation we were able to determine the approximate address (and in most cases the exact address) of each fire event. With the address of the incident known we were then able to extract the decimal degree latitude and longitude location of the fire via an online app accessed through: http://itouchmap.com/latlong.html. This app allows you to enter the address of a location and it will in turn supply you with the latitude and longitude of the entered location. The importance of obtaining the latitude and longitude of the fire events will become evident in the section outlining our geovisualization methodologies.

Time

Part of our research question deals with analyzing the temporal shift in the characteristics of Madison’s urban fire regime over time. In general analysis of our gathered data we were able to look at the time period through a relatively fine scope and notice small variations in building classification type fires as well as the location of these fires; however, when representing this data visually, such a fine resolution hindered the ability to see global patterns over space. We dealt with this geographic problematic (power raised from abstraction at the price of uncertainty (Roth, 24 October 2013)) by coarsening our time classification. Instead of classifying each fire by its specific year we broke the entire
study’s time span into three classes based on similarities between the fires within each class. Our first class was 1855-1939, the second 1940-1968, and the third from 1969-1991.

‘Noteworthy Fires’

Now that we have defined our classification systems for each of the main tenets of our research (building type, location, time) it is time to tackle defining what we consider to be a ‘noteworthy fire’. This classification is as complex and flawed as the urban fire regime we are attempting to explain. Because of the patchwork nature of the data available we have used almost every fire event containing the required amount of data needed in our project. If we were to define a noteworthy fire as being damaging to the extent of a certain dollar amount this would undermine those who do not have money to begin with. Does a rich individual feel worse about the burning of his/her home than a poor individual? Would any individual feel more pain from the destruction of a multi-million dollar food storage warehouse than a middle class family would upon the destruction of their own personal, modestly priced home? We do not believe it is our place to make these judgments within the confines of an urban fire geography research paper. Being that fire is infinitely multifaceted and thusly infinitely diverse we concede to define a noteworthy fire, for the purpose of this paper, as one that is documented completely (to our own specifications) and with an above average amount of description within our given literature sources. Albeit limited, this classification allows us to simultaneously use the classification systems of each of our data source’s editors as well as assure us that only usable data will be classified and integrated into our CSV file. We also find this classification method to be of the most ethical at our choosing given our limited knowledge of the science behind fire classification system engineering.
Visual Representation Methods

To visually represent our data we decided to use a small multiple type map set representing major fires divided by land class over our three defined time periods as well as a final map showing the total distribution of all ‘major fires’ over time. The small multiples allow for a synergistic accumulation of data classification systems in order to create a product whose usefulness surpasses that of the original data sources and classification systems combined. These systems are limited in their ability to represent data because they are single faceted (space or time/single space in time). With a small multiple style geovisualization we are able to play on the strengths of all of the data sources in order to produce a revelation within the map user upon viewing the culmination of all sources combined over both space and time (Roth, 2013, 10). Through the small multiple maps many patterns, both spatial and temporal, become visible which we will be discuss in greater detail within the results section of this paper.

In order to use latitude/longitude data on our small multiples we needed to construct a CSV document of all the data we had acquired about our selected noteworthy fires. Necessary elements included the decimal degree latitude and longitude coordinates of each fire event location, the reclassified ‘time period’ of each fire (1855-1939, 1940-1968, or 1969-1991) and the building use type related to each of the fires. The remainder of the data shown on the map not already mentioned was acquired from OpenStreetMap which is a highly credited source of freely volunteered, crowd sourced, geographic information.
Findings & Conclusions

Temporal Distribution Findings

According to our findings 11.24 percent of all fires between 1901 and 1908 were directly related to some kind of electrical device or electrical error (Annual Report of the Chief of The Fire Department, 1901-1908, n.p.). The only class of fire that was more common was the chimney fire which accounted for 27.57 percent of all fires within the same time period. This statistic is significant seeing as though in 1900 only 3 percent of U.S. buildings had access to electricity and in 1908 that number had only grown to 15 percent while the vast majority of buildings had chimneys http://americandigest.org/mtarchives/american_studies/americain_1900.php (last accessed 8 December 2013). Although specific statistics on commercial business electricity access were not available, it is noted that businesses during this time period were more likely to have and use electrical equipment than residential households (Callon, 1998, 4).

By graphing the trend of building class fire distribution over time (Figures 1) we can see that throughout time the large disparity between residential and commercial fires evens out. This trend is most likely accredited to the rise in Madison’s population over time (figure 3) as well as the development of electricity as commonplace within commercial industry. As the population rose the land area of Madison increased at a higher rate and the population density subsequently dropped (figure 2). The large drop in population density between 1940 and 1960 can be accredited to the high level of annexation activity characteristic of many post-WWII urban centers in the United States (Rast, 2007, 55-56). The increase in population resulted in a rise in residential housing demands. More residential
housing led to a higher statistical probability of fires in residentially classed buildings.

Post 1969 (Late Period) arson was responsible for 29% of what we have classified as ‘Major Fire Events’. Prior to 1970, zero arson fires had been responsible for a ‘Major Fire Event’. It should be noted that this may be a result of discrepancies in the reporting/identifying of arson fires. As stated in the methodologies section, the agencies responsible for recording data on the city’s fire history changed drastically, in turn drastically altering the way in which the data was presented within the documentation. Before 1970 suspected arsons were labeled as ‘Fires Found’ (Annual Report of the Fire Chief, 1950’s) and not as adamantly investigated as arsons of today. The first of the major arson fires were related to the university and student protests. The first major arson attack was the use of a fire bomb to set fire to the “Old Red Gym” at 716 Langdon St. on January 3rd, 1970. The blaze lasted for 16 hours and required the assistance of 72 firefighters to extinguish. This trend of students using fire in protest continued with the $250,000 Kroger Store protest fire in May of 1970 and the $2,000,000 fire-bombing of the Math Research Building in August of the same year (Madison Fire Department History Book Committee, 1992, 37). Throughout the remainder of the late period our data shows a shift away from student protest driven arsons to arsons of residential buildings for unknown reasons. Although a joint Fire/Police Fire/Arson Investigation Team was established in 1976 (Madison Fire Department History Book Committee, 1992, 38) the motivation behind many of the ‘Major Fire Event’ arsons is either unknown or undisclosed. In the mid 1980’s there were three cases of apartment complexes under construction being intentionally set on fire. Soon after this outbreak the joint Fire/Police Fire/Arson Investigation Team was granted additional funding and gained its second full time investigator (Madison Fire Department History Book Committee, 1992, 47). Today, Fire/Arson investigation is a complicated endeavor that requires a coordinated effort between the Madison Fire
Department and the Madison Police Department with four full time arson investigators on staff.

Initially, upon starting our research, we expected to find a direct correlation between population density and number of fires. As seen in figure 3 this is not the case. Our data shows an inverse relationship between population density and number of fire calls between 1900 and 2010. We are not suggesting that there is a correlation between the increase in fire calls and the decrease in population density, however; we are suggesting a correlation between raw population growth and an increase in fire calls. As we will discuss in the spatial distribution findings subsection, the areas with the highest amount of fires are the areas with the highest number of people. As the city expands and sprawls out past the confines of the isthmus the fires follow and expand Madison’s urban fire regime.

**Spatial Distribution Findings**

Spatially, the changing range of fires within the city of Madison correlates directly with the expansion of the city both in population (figure 3) and geographically (Maps). In the ‘Late’ period we see many fires on the far eastern and western extents of the city whereas in the ‘Early’ period the fires are restricted to the capitol square and isthmus areas of current day Madison. For much of the ‘Early’ period, the north-central region of the isthmus was Madison’s central business district and the city’s boundaries did not extend out far past the isthmus (Madison Fire Department History Book Committee, 1992, 6-7). The high number of businesses located downtown in hand with the higher rate of fire incidence within commercial buildings during this time period explains the high geographic concentration of fires on the isthmus during the ‘Early’ Period. This relationship may seem elementary, however is interesting because it shows that fire follows people and sheds light onto the fact that an urban fire regime is determined as much, if not more so, by the human geography of a place rather than its physical
Conclusions

Electricity is in one way or another associated with every commercial building today in Madison. Electricity users and distributors have had over 130 years since Thomas Edison’s 1882 Pearl Street Station distribution system (Brown, Sedano, 2004, 2) to improve the quality of electrical infrastructure and our understanding of its intricacies. By analyzing our data we see that the proportion of fires caused in part by electrical devices decreased dramatically between the ‘Early’ and ‘Late’ periods possibly because of an increased understanding of proper electricity use and distribution. Although technological aptitude has lowered the number of electrical fires the total number of fires has increased steadily along with the population and size of the city (as lowered the number of electrical fires the total number of fires has increased steadily along with the population and size of the city (figures 2 and 3). This observation will be a driving force for our final arguments involving the complex relationship between fire, humans, and an urban fire regime.

Another spatial trend seen within our maps is the diffusion of both commercial and residential fires outward from the central isthmus area over time. This expansion of urban fire regime is representative of the overall expansion of city boundaries, its residents, and its various building class types. In the early period, Madison’s central business district was located along Webster St. and other centrally located streets (Madison Fire Department History Book Committee, 1992, 7). Today Madison’s boundaries and building classes are much more dispersed and so are the fires that follow them.

Although it has been said, and is probably true, that attempting to define a fire classification
system or “Urban Fire Regime” is nearly impossible because of its complexities, one common thread we have found throughout all of our data is that the Urban Fire Regime of Madison, WI directly follows the people who live there and the buildings they build: there is no Urban Fire Regime without people. We offer then that perhaps it is human beings and society in general that are responsible for creating the idea of an Urban Fire Regime. Perhaps the urbaness of an area is not as much to blame for its altered fire regime as the people who label it as such are. Maybe the complexity of classifying fire severity and classification types described by Sikkink and Cote are a direct result of a flawed notion that humans and fire are separate entities existing in separate regimes that only connect during classified fire events. To define an Urban Fire Regime would require a comprehensive analysis of every urban population, their specific cultural/societal practices, the development of the urban layout of the city over time, the role that fire has played during the development of the urban population, the psychological workings of citizens who choose to commit arson, the physical geography of the land on which the city is located along with a potentially infinite list of other factors that we do not yet realize have an effect on Urban Fire Regimes. The factors are so great and so dynamic that in the end the sum of all the intricacies would surely be greater than any definition or classification we could derive. In short, the Urban Fire Regime of Madison, Wisconsin is complex and driven by humans. Where the people go, fire is soon to follow.
FIGURE 1

Major Fire Land Class Analysis by Percentage

- Commercial
- Residential
- Industrial
- UF
- Government
- Other

% Total of Major Fires for Time Period

Early (1855-1939)
- Commercial: 52%
- Residential: 41.9%
- Industrial: 16.1%
- UF: 11.6%
- Government: 9.7%
- Other: 4.3%

Middle (1940-1968)
- Commercial: 34.7%
- Residential: 22.6%
- Industrial: 16.1%
- UF: 10.1%
- Government: 6.1%
- Other: 3.2%

Late (1969-Present)
- Commercial: 16.32%
- Residential: 4.4%
- Industrial: 4.4%
- UF: 6.1%
- Government: 2.3%
- Other: 4.3%
FIGURE 2

Fire Statistic Trends By Decade Year

Period of high post-WWII annexation activity by the City of Madison
FIGURE 3

Dane County Population Growth

Population

Year

1840  1880  1920  1960  2000

0  150,000  300,000  450,000  600,000

POP
MADISON, WI
‘MAJOR FIRE EVENTS’
1855-1939

Early Fires Map
MADISON, WI
‘MAJOR FIRE EVENTS’
1940-1968

Middle Fires Map
MADISON, WI
‘MAJOR FIRE EVENTS’
1969-PRESENT

Late Fires Map
Madison, WI ‘Major Fire Events’
1855-Present

All Time Fires Map
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