Catastrophic Wildfire in California’s Wildland Urban-Interface: A Tahoe Fire and Fuels Team Case Study.

by

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MPP Essay

submitted to

Oregon State University

in partial fulfillment of the requirements for the degree of Master of Public Policy

Presented April 1, 2020
Commencement June 2020
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Charles Zachary Koutnik, Author
ACKNOWLEDGEMENTS

I am very thankful to so many people for helping me throughout this process. First, I would like to thank my advisor, Dr. Ed Weber, for his undying support and guidance – both on academic and personal levels. I would like to thank Dr. Emily Jane Davis from the College of Forestry for her professional work with forest collaboratives and support. I would also like to thank my committee member, Dr. Scott Akins for his support with the methods section, and advice throughout the process. I simply would not have succeeded without the help and support from these three professors. I also want to thank Dr. Steel for everything he does as the director of this amazing program; his leadership and compassion are both second to none.

I am eternally grateful to all of my friends and co-workers who helped me through this, but specifically: Zac Petty, Blake Arrowsmith, Gavin Colbert, Anthony Agostini, Greg Stelmach, Jacob Putney, and Kyle Tolosano. These individuals always answered the phone and let me bounce ideas and frustrations off of them, and whose mentorship and friendship have helped me greatly along the way.

Finally, to my parents, Carl and Marilyn, and my sister Madeline. Without your support over the last seven years to leave Redding and pursue my academic goals in Oregon, I would have never reached the finish line. I cannot tell you three how thankful I am, and how much I love you.
Abstract

Wildfires across the Western United States, specifically in California have increased in size and intensity in recent decades. These fires are encroaching on California’s Wildland Urban-Interface (WUI), often with devastating results. Most recently, these destructive results were displayed in the 2018 fire season in the Camp and Carr Fires and the communities of Redding and Paradise, California. Catastrophic wildfire fits the description of wicked problems, with collaborative governance, specifically collaboration, potentially holding unique solutions. This research targets a wildfire collaborative in the Lake Tahoe Basin in Northern California known as the Tahoe Fire and Fuels Team, which was created after the Angora Fire in 2007. A qualitative methodology was applied and semi-structured interviews revealed a number of specific successes to combatting catastrophic wildfire in the Lake Tahoe Basin. Findings suggest that successful collaboration can exist within a multitude of systems, even ones that scholars may have previously found diametrically opposed. Creating a collaborative forum increases the chances of finding solutions that reach across landscape boundaries that are inherent in wicked problems. Using collaboration increases public education and support for primary goals. Finally, a diversity in positions and styles of leadership enhance and cultivate continued success in the collaborative setting. The Tahoe Fire and Fuels Team have utilized these collaborative elements to inspect 42,059 parcels and treat 66,885 acres in the Tahoe Basin and make the WUI space more resistant and resilient to catastrophic wildfire in the future.
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Introduction

Our nation’s wildfire problem and its origin can be traced back to 1910 and the Big Burn, when some three million acres across Montana, Idaho, and Washington were scorched. This led to the formation of the United States Forest Service. Following the Big Burn, the newly formed Forest Service pressured Congress for legislation and funds to implement sustainable forest management on the new national forest system (Pyne, 2001). One of these new policies was the suppression of all fires, as they were now known to kill trees, reducing or eliminating their commercial value (Show & Kotok, 1924). The desire to suppress all wildfires became the main-focus of the Forest Service and they became exceptionally good at accomplishing this task. “While the Forest Service and its firefighting partners are able to suppress or manage 98 percent of fires, catastrophic mega-fires burn through the agencies resources: 1–2 percent of fires consume 30 percent or more of annual costs” (USDA, 2015, p. 2). The fire suppression ideology of the Forest Service was further perpetuated with the iconic Smokey Bear, who was created in the 1940’s as a wartime effort to help combat the potential wildfire threat that was posed by enemy bombings. After World War II Smokey Bear became the poster child for the United States Forest Service, appearing on signs, Disney Movies, schools, and at public events (Rice,
This trend towards suppression cast wildfire as a negative phenomenon, rather than a naturally occurring one. This negative categorization of fire has allowed for a blanket suppression policy that has been applied to all forested landscapes in the west.

These forest management policies clearly altered federal and state forest’s historic fire regimes (Calkin, et al., 2014). The increasing application of environmental and ecosystem protection rules, beginning with the federal Endangered Species Act of 1973 also came into play in the late 1980s and accelerated during the 1990s. The new protections were representative of the “[p]ersistent uncertainties and conflicting social values [that] led to widespread disputes and a period of gridlock in environmental management in the 1980s and 1990s” (Kraft, 2004; McGrory & Sousa, 2012; Gray, 1989; Weber, 1998). Together with the 20th Century fire management policies, the end result has been a buildup of fuels (timber and other vegetation) in Western U.S. forests that most scientists consider excessive, dangerous, and key contributors to the growing number, frequency, and intensity, often catastrophic in ecological terms, of forest fires (Charney, et al., 2015, p.1). Coupled with hotter, drier summers due to climate change, massive and numerous forest fires are becoming commonplace (USFS, 2018).

This means that growing numbers of these fires are encroaching into the Wildland Urban Interface or WUI, where people, development, and forests inter-mix. “This is in large, partially because almost 10% of all land in the contiguous United States fits the wildland–urban interface (WUI) classification” (Theobald & Romme, 2007; USDA, 2015, p. 8). In fact, as the 2017 fire season came to a close, California experienced the most devastating series of wildfires in the state’s history, with particularly devastating impacts on the WUI. In October of 2017 the Tubbs
Fire and a series of others in California’s iconic Napa Valley destroyed over 8400 structures, killed 42 people, and caused over one billion dollars in damages and suppression costs (CAL Fire, 2019). The Thomas Fire, the second largest in California’s history, burned over 277,000 acres and cost over 177 million dollars to suppress. It burned over 700 homes and resulted in the death of one firefighter (CAL Fire, 2019). The catastrophic damage done by the Thomas Fire was then followed by mudslides from heavy rain and the lack of vegetation due to the fire. The mudslides resulted in the deaths of over 20 people and caused several million dollars in additional damage to the already devastated community (Almasy & Hamasaki, 2018).

In 2018, an even more catastrophic fire season struck Northern California. In late July the Carr Fire began west of Redding, California. The blaze scorched over 229,000 acres, burning over 1500 residences and structures and killing three firefighters and three citizens (CAL Fire, 2019). On November, 8th the Camp Fire was ignited, devastating the mountain town of Paradise, California. The fire burned over a 153,000 acres, destroying over 14,000 residences and structures and killing 85 civilians, injuring 3 firefighters. This made the Camp Fire the most destructive in California State history (CAL Fire, 2019).

As a policy issue, the complexity of managing forests in WUI areas, including reducing fuel densities, and suppressing wildfires, is greatly increased when you add the political and economic factors associated with WUI areas. The WUI wildfire policy problem fits the idea of a wicked problem as described by Weber, Lach, and Steel (2017). Wicked problems are defined as being unstructured, cross-cutting, and relentless. They are unstructured in that they are hard to define, and difficult to locate a definitive cause; they also require a high degree of knowledge
transfer, and have very little consensus on what a viable solution could be. They cut across multiple jurisdictions involving a diverse array of stakeholders and perspectives. They are relentless in that they do not have a definitive solution (Weber, 2008). Fires such as the Tubbs, Thomas, Carr, and Camp burn across multiple jurisdictions, involving county, private, state, and federal resources (Calkin, et al., 2014).

One of the elements that makes combatting catastrophic wildfire in the WUI especially difficult is the diverse, fragmented, private and public land ownership pattern that is typical in Western states. Given that these fires can start anywhere and consequently spread across a vast array of land-ownerships points to the unstructured, cross-cutting nature of catastrophic wildfire in the WUI. The mix of rural working landscapes such as ranches, farms, along with federal, state, and private forest lands and densely occupied small residential properties creates a complex puzzle (Calkin, et al., 2014). This puzzle includes a multitude of stakeholders with regards to the WUI fire problem and complicates forming consensus on how to deal with the threat of these fires. There is an immense amount of information and knowledge sharing required among affected citizens, public officials, politicians, and firefighters, to decide on where, when, and how to implement fuel treatment areas. In addition to this, fuel reduction can be costly, especially in the WUI space where the cost can be largely born by the landowner. Private landowners may not have the financial or physical means to implement these treatments, understanding what preparing their properties to be fire-wise/fire resistant can often be confusing as well (Tremblay, 2002).
Uncertainty is extremely high as well, given the difficulty of knowing when and where a fire will break out, much less how it will progress given the daily, shifting complications from varied topography, vegetation types, weather, and wind patterns. The quickness in which the Carr and Camp fires entered the communities of Redding and Paradise, especially the high number of civilian fatalities in the Camp fire showed that these communities were not prepared from an evacuation perspective. Community preparedness in the WUI space can be very complicated, leading to a high degree of uncertainty and, ultimately, ineffectiveness during a WUI fire situation (Calkin, et al., 2014). Finally, even with an increasing fire suppression budget, state of the art suppression technology and machines, catastrophic wildfires in the Western U.S. WUI areas have grown more frequent in recent years, often with the devastating effects described above. As people continue to settle in forested areas in the West, specifically California, the conclusion of the 2018 fire season demonstrates that our current forest and wildfire policies are not effective and that catastrophic wildfire in the WUI is seemingly relentless and likely to remain so going into the future given the challenges posed by warming temperatures, changing precipitation, and other items related to climate change (Weber, 2017).

What can be done to improve the management of overstocked forests in order to cope successfully with the myriad of challenges posed by this wicked problem? More specifically, what kinds of policies and approaches are best suited to reducing the massive fuel loads found in forests located in the WUI, thus making the WUI safer and decreasing the likelihood of continuing massive and catastrophic wildfires that not only destroy human communities, but also release significant amounts of carbon into the atmosphere every year?
For some, including many fire scientists and other forestry experts, the answer involves the adoption of science-based, technical “fuel treatment” approaches that focus tightly on the physical problem of high fuel loads in drying forests. Thinning forests, or mechanical treatments, by logging overstocked stands, is a primary method for reducing vegetation on the landscape. A second technical approach is prescribed fire, the act of intentionally lighting fires under appropriate conditions to burn vegetation, thereby reducing fuel loads (Calkin, et al., 2014). A third method of fuel reduction that has specific importance to this research is the 100 Foot Defensible Space program in California, which focuses tightly on the spaces immediately adjacent to private homes and businesses in the WUI (Cal Fire, 2018).

For a growing number of forest managers, policymakers, and stakeholders, however, the technical and budgetary approaches, while likely necessary for eventual policy success, are too narrow in scope, while also tending to run into political opposition and disuse if not carefully managed. And careful management now often means that the complex wicked character of the wildfire in the WUI problem requires new management approaches grounded in collaborative governance.

The promise of the collaborative approach has led citizens and agencies in several WUI areas to create their own collaboratives to craft solutions unique to their problem and environment. This research targets one of these collaboratives in Northern California on the Tahoe National Forest known as the Tahoe Fire and Fuels Team Collaborative (TFFT). The intent of this research is to provide a pragmatic look at what the TFFT is doing from an implementation perspective to address the wicked problem of wildfire in the WUI, as well as to
examine the role that collaboration is playing to resolve the threat of catastrophic wildfire in the Lake Tahoe Basin (Tahoe Resource Conservation District, 2019). Before exploring the case of the TFFT, the research first discusses the wicked problem of wildfire in the WUI and various approaches to it.

**Technical and Targeted Approaches to the Problem**

*Mechanical Treatment:*

Nearly all of the literature on improving the management of wildfire and the WUI in the Western US points to the necessity of some form of fuel treatments. The amount of acreage that could receive or benefit from some form of fuel treatment that would lessen the frequency and risks from these catastrophic fires is daunting from a management perspective. “In the 15 Western States there are at least 28 million acres of forest that could benefit from some type of mechanical treatment to reduce hazardous fuel loading” (Rummer, 2005, p. 1). Mechanically treating acres is largely influenced by economic factors. “Elements of forest and local industry infrastructure (mills, access, and bioenergy) can all influence whether a particular area is treated” (Jain, et al., 2012, p. 5). While biomass energy can be a lure by generating energy from wood sources, it is largely unpopular in the state of California because of the public perception of logging and the biomass being burned in a similar technique as coal to produce energy. The economic element can be problematic in California, whose timber industry and resulting infrastructure has greatly declined since the 1970’s and the implementation of the 1969 National Environmental Policy Act (NEPA) and the 1973 Endangered Species Act (ESA). This was further engrained in the 1994 Northwest Forest Plan (Carrol & Daniels, 2017, p.99).
Prescribed Fire:

The second primary method to reduce fuel levels on public lands is prescribed fire. While typically being much cheaper and an easy way to treat a larger number of acres, prescribed fire comes with its own limitations. Prescribed fire can be the preferred method in many settings but, can be difficult to implement due to its complexity and risk. A prescribed fire consists of a set number of acres that are planned to be burned by experienced land-management personnel under a set of appropriate conditions. Fuel breaks are typically constructed and trained personnel use drip torches and other firing devices to set an intentional fire to burn and remove understory brush. A successful prescribed fire is dependent upon a number of factors such as terrain, weather, fuel level moisture, etc. It also can be negatively perceived by the public because of smoke in the air, and in the event that a controlled burn turns into an actual wildfire (Calkin. et al., 2014). The Clean Air Act (CAA) also limits prescribed fire on the landscape. According to John Cambell, the Biscuit fire which burned over 200,000 acres in 2002 (roughly the same size as California’s Thomas Fire) emitted over 16 times Oregon’s annual net production of carbon into the atmosphere (2005). While prescribed fire is a tool used to treat fuel levels on public lands, it still emits carbon and particulate into the atmosphere. The CAA gives anyone a regulatory tool to circumscribe the use, frequency, and timing of prescribed burns due to human health issue/small particulate matter from fires, especially in the WUI. While prescribed fire can be an efficient tool in treating a large number of acres and reducing fuel levels, there are a number of variables that dictate whether it can be implemented or not (Jain, et al., 2012, p. 1-12).

Community Wildfire Protection: Creating Defensible Spaces in the WUI
The two policies listed above have been created to alter wildfire at a landscape level, but lawmakers in California, building from existing federal policy, also have employed the 100 Foot Defensible Space Policy, an approach specifically targeting the WUI. In 2003 the federal government implemented the Healthy Forests Restoration Act (HFRA). It called for communities in fire prone areas to develop community wildfire protection plans (CWPP). The intent of this act was to develop hazardous fuel reduction strategies in WUI areas, by collaboratively involving local, state, and federal actors (Grayzeck-Souter, 2009). As stated previously, California took this federal policy in 2005 and embellished it into a mandatory state policy that came in the form of the 100 Foot Defensible Space Program. While the 100 Foot defensible space policy is a top down rigid enforcement policy that may lack collaboration in its language, it strongly echoes CAL Fire’s strict suppression mission statement.

Understanding the difficulties associated with implementing broad scale fuel reduction treatments in California, lawmakers created a more localized policy dealing specifically with fuel reduction in the WUI. This policy places a burden of responsibility on landowners in the WUI environment. In 2005 California implemented a mandatory 100 ft. defensible space policy to help homeowners prepare their houses and property and assist the department in its ability to defend structures in a fire. This policy requires homeowners to remove vegetation and flammable debris from 100 ft. surrounding their residence, they are then subject to inspections and fines by CAL Fire. This policy has been widely accepted and adopted among citizens in California in the face of wildfire (Cal Fire, 2018).

**Moving Toward Collaboration**
Traditionally, government agencies and the forestry experts within them would have simply selected and implemented the technical and targeted approaches as they saw fit. They had the authority, they knew best about forest management, and while they did solicit public comment using mandated forest management planning processes such as the 1976 National Forest Management Act, hierarchical control of decision-making by the agencies was standard practice (Mulhern, 1978). As the cost of wildfire’s continue to grow, the federal fire suppression budget has struggled to keep up, leading to constraints with the USFS.

The Forest Service’s budget is dictated by fire suppression. Between 2000 and 2013 the average annual fire suppression budget for the Forest Service was 1.5 billion dollars (NIFC, 2017). According to the USDA the suppression bill in 2017 was over 2 billion dollars. In contrast the fuels budget for the Forest Service was $289 million annually between 2002 and 2014 (USDA, 2017). Not only is the fire suppression budget greater than any of the other budgets within the Forest Service; during years where the fire suppression budget is exceeded, it borrows from other department’s budgets within the Forest Service (Wyden, 2017).

In addition to the environmental and social problems that wildfires create, they are also immensely expensive. As stated previously, the Forest Service’s Suppression budget exceeded two billion dollars. This figure is one that has steadily risen over the previous decades. It strongly influences how the Forest Service is monetarily structured and their ability to proactively address land management. In 2013 Oregon’s Senator Ron Wyden crafted a bi-partisan bill to help break the cycle of fire suppression spending. Senator Wyden’s Wildfire Disaster Funding Act would allow the Forest Service to set a fire suppression budget, and when
that budget is exceeded, disaster funding such as FEMA would pay for the costs. This would put an effective stop to the fire suppression budget borrowing from other budgets within the agency, allowing the Forest Service’s other departments, such as fuels, biology, range, etc. to function at a normal capacity. This would allow for a more proactive way to address the wildfire problem by allowing more dollars for prescribed fire and mechanical treatment (Wyden, 2017).

Resolving the USFS’s budgetary problems is not enough to fix the current wildfire problem. This rising cost and loss of federal capacity has led the general trend in forest management over the past 20 years. The federal government and many state agencies have moved toward more adaptive, comprehensive and collaborative approaches. The Good Neighbor Authority (GNA) and Collaborative Forest Landscape Restoration Program (CFLRP) are good examples of the shift towards collaboration within the forest management realm. In addition, a growing number of forest management collaboratives have emerged in local communities across the West, including a number focused on rising potential of catastrophic WUI fires.

**Good Neighbor Authority**

The constraints associated with the fuel treatments and social elements mentioned above have not been lost upon legislatures. In an attempt to enhance fuel reduction and forest restoration a broad federal policy named Good Neighbor Authority was initiated in 2001. It was initially appropriated for five years. Designed and written to be broad and ambiguous in its interpretation, it allows state agency partners to assist and add capacity to federal agencies in the form of forest restoration. Much of this restoration has morphed into the form of hazardous fuel reduction and to make ecosystems both fire resilient and resistant. Since 2014, the program has
been made a permanent part of the Farm Bill. As of 2019 continues to grow in implementation
and acceptance and is now being utilized by six Western States, including California (Briggs, et
al., 2018).

Understanding the constraints both in a personnel and monetary capacity from the Forest
Service, state agencies have been asked to assist their federal partners in accomplishing this. A
large number of these treatment activities that fall under the restoration umbrella ranging from
hazardous fuels reduction, restoring/creating fire resilient and resistant ecosystem restoration,
commercial and non-commercial unit layout, etc. In addition to these restoration activities, the
concept of a Good Neighbor Timber Sale was born. This was created under the idea that while
the Forest Service and BLM can suffer monetary constraints, these agencies can be resource
wealthy, especially in the form of commercial timber. The money generated from a GNA timber
sale would be re-invested back into the federal treasury for further restoration projects on that
specific forest (Riggs, et al., 2018).

The first state to enter into a Good Neighbor Authority agreement was Colorado, but the
authority has since grown to six states including Washington, Oregon, Montana, California and
Idaho. The Forest Service and each state enter into a master supplemental project agreement
(SPA). This Master Agreement has a contract duration of 10 years. Under the master agreement
individual agreements are broken down into more specific service SPA’s, usually between a
specific forest and a state partner(s). Under these service SPA agreements, a budget and more
specific set of restoration activities are outlined. These service SPA’s can also be modified at any
time to add to the budget or different forms of restoration work. For a GNA timber sale to be
completed, a separate timber SPA must be initiated (Riggs, et al., 2018). For example, if a GNA timber sale is competed on the Tahoe National Forest; a GNA timber SPA must be created for the timber sale to occur. Once the state has re-cooped its cost for the timber sale administration, any additional income is then given back to the Tahoe National Forest.

Across the six states federal, state, and third-party individuals were interviewed and a few common challenges emerged. The first issue is both federal and state agencies were found to be lacking certain positions to help enable GNA. The second is a knowledge barrier about what exactly GNA is and how it is to be implemented in the most effective way. Finally, time effectiveness was noted. All of the states that use GNA have relied on existing staff members. This has led them to have to take on an additional work load. However, since the project has been well received overall, positions specific to GNA within state agencies have been created to offset this additional workload.

**Collaborative Forest Landscape Restoration Program:**

While Good Neighbor Authority recognizes that an increase to the pace and scale of federal forest restoration is necessary, it lacks the collaborative element in its implementation. The Collaborative Forest Landscape Restoration Program (CFLRP) was initiated to ensure just this.

As science and technical expertise guides forest management in a certain direction, without social consensus, especially in the form of collaboration, it falls short in being implemented. “CFLRP projects must aim to reduce wildland fire-management costs, enhance ecological health, and promote the use of small-diameter woody biomass as well as engage in
collaboration with multiple stakeholders throughout planning, implementation, and monitoring” (Butler, 2015). This multiple stakeholder engagement represents a key element in the success of implementing these forest management techniques. “The policy has been lauded as an innovative turn in forest management policy due to the focus on landscape scale restoration and requirements for collaboration in all phases of implementing the law” (Schultz, et al., 2012, p. 23). This is because the cross-cutting nature of the wicked wildfire problem requires the engagement of a multitude of actors, not just those that represent agencies. With strong community and social consensus behind these projects, they become less controversial and more successful in their implementation.

With CFLRP in place, then restoration policies such as Good Neighbor Authority that aim to capture the landscape level management can be done in a more transparent, inclusive way. “At the same time, CFLRP provides opportunities to overcome legal barriers and to strengthen both accountability and adaptive management” (Butler, 2015, p. 575). The social consensus that is provided by CFLRP also lends legal support to many of the public land restoration efforts. If a project has local collaborative consensus behind it, then it is less likely to be litigated as it is implemented. It is also a way for collaboratives to be not only involved but, engrained in the way federal forests are shaped in the future, especially when gravitating towards becoming fire resilient and fire resistant in the WUI.

Localized Forest and Firewise Collaboratives

Many grassroots forest collaboratives formed in the 1990’s in California and Oregon in response to the National Environmental Policy Act, Endangered Species Act, and the collapse of
the timber industry in the West. In 1992 the first forest collaborative to emerge was in the
Applegate Valley on the California/Oregon border. This was known as the Applegate Partnership,
which committed to managing resources in an ecologically beneficial way, while still
contributing to economic stability within the community (Koontz, 2004). This small grassroots
evolution towards collaboration has blossomed into over two dozen functioning forest
collaboratives in the state of Oregon. “Approximately 25 forest collaborative groups currently
operate in the state of Oregon. They first began in 1992 and more than half have emerged only
since 2011” (Davis, et al., 2017, p. 910). Many of these forest collaboratives were created in
response to the ecological and economic forest-based problems their communities faced, to form
solutions with their state and federal partners. As the threat of catastrophic wildfire in the West
continues to grow, many of these forest-based collaboratives have had to incorporate plans to
combat it into their efforts or, evolve into an entirely new form of collaborative.

Much like the federal Good Neighbor and CFLRP initiatives described above, forest-
based collaborative groups have been created to help form social consensus, prevent litigation,
navigate federal policies such as NEPA, improve local economies, reduce hazardous fuel levels
to make both fire resistant and fire resilient ecosystems, and generate forest restoration projects
with improved ecological benefits on federal forest lands. (Davis, et al., 2017; Oregon Solutions.
2013). The primary focus of this research incorporates all of these elements as it works to shape
and influence forest restoration and fuel reduction projects, but importantly also focuses on
catastrophic wildfire in the WUI space.
Another collaborative effort began in the late 1990’s. The Fire-wise Community Program was created to address the wildland-urban interface. “In 1999 by the National Wildland/Urban Interface Fire Working Team to help reduce the staggering impact of wildfire through sound land-use planning, creative mitigation, supportive community infrastructures, and collaborative decision-making” (Tremblay, 2002, p.1). In-order to expand the ideas behind Fire-wise, a workshop was created to help broaden its reaches. Designed to be cooperative and collaborative in nature, Fire-wise is centralized around the idea that WUI wildfire is everyone’s responsibility, that no specific agency, fire department, or community should bear the full responsibility. “A single homeowner may not be able to achieve success, but a neighborhood working together may-and for less money” (2002, p. 2). This echoes the concept described previously that many individual land-owners may not have the financial or physical means to undertake fuel reduction treatments on their property, but that collectively it becomes much more achievable.

As an example, Perry Park, Colorado undertook a community exercise and realized that while residents understood that there was a fire risk to the community, they were unaware of how to deal with it appropriately. "I can sum up our program as planning, advertising, education, and mitigation" (2002, p. 4). In Santa Fe County, New Mexico, the fire-wise workshop had the county pair with Forest Service to add capacity in the form of equipment and personnel. In addition to this, the Fire-wise program can also produce educational videos through their website other social media platforms to increase information sharing. They can also help create advanced mapping of specific communities to help generate visual representation to fuel treatment areas around the WUI (Tremblay, 2002).
Why the Move Toward Collaboration?

Running throughout the dilemma of catastrophic wildfires in the WUI is the realization that technical solutions alone, such as mechanical forest thinning or prescribed fires, are not sufficient to meet the challenge because of the social, political, and economic challenges described above. While the technical solutions can be effective (and the science supports this conclusion), the competing societal and policy demands for pristine “natural” forests, saving species and ecosystems, outdoor recreation, and maintaining clean air, etc. make clear that the wicked problem of wildfire in the WUI is firmly embedded within a policy world requiring more than simply a technical solution.

Yet, as the growing number of catastrophic wildfires in WUI spaces in California attest, finding a way forward amid political conflict such that enough of the technical solutions can be implemented has proven to be a difficult task indeed. Moreover, forestry agencies in other states and the USFS at the federal level, as noted previously, are coming to the realization that collaborative problem solving processes are well suited to complex, or “wicked” problems such as forestry management and, in the case of the TFFT, the problem of wildfire in the WUI (Weber, Lach and Steel 2017). The literature finds that this is because the unstructured, cross-cutting, relentless character of these problems place a premium on:

- cooperation among interdependent groups, citizens and government agencies
- the use and transfer of critical knowledge (science and practice-based expertise)
- leaders skilled at facilitation, integration, synthesis, innovation, and communication
- the development of long-term problem-solving capacity, and
the promise of mutual gain, or positive sum outcomes (Weber & Khademian, 2008).

Wicked Problems

Wicked problems have existed in varying capacities for decades. “As early as 1967, scholars and practitioners from different disciplines recognized that the dynamic complexity of many public problems defies the confines of established "stove-piped" [administrative] systems of problem definition, administration, and resolution” (Churchman, 1967; Rittel & Webber 1973). However, it is only recently that the concept has become widespread in its application to public problems in the policy and public administration literatures (Roberts, 1997, 2000, 2002; Weber, Lach & Steel, 2017).

Wicked problems are defined by their unstructured, cross-cutting, and relentless character. They are unstructured in that they are hard to define and locate a definitive cause. They require a high degree of knowledge and knowledge transferring among disparate groups, and there is little consensus on either problem definition or viable solutions. They also cut across multiple jurisdictions, which necessitates the involvement of a diverse array of stakeholders and perspectives, it also increases the potential for conflict and disagreement. Finally, they are relentless in that they do not have a definitive solution, which also means that change is a constant for stakeholders, managers, and policymakers (Weber & Khademian, 2008). In this sense, the wicked problem concept matches closely with Wheatley’s (2006) argument that most of the modern era’s problems faced by the private and public sectors are better treated as emanating from “organic, living systems,” with which current fragmented, siloed system
arrangements are a poor match. Put differently, if we are to be effective at system and problem management we need to start viewing our institutions as a collective system of agencies, parties, and actors rather than as individual components. “We now speak in earnest of more fluid, organic structures, of boundaryless and seamless organizations” that are always changing, adapting and evolving (Wheatley, 2006, p. 8-9, 15).

According to Wheatley, it is precisely the lack of fluidity and ambiguity that restricts our current rigid, fragmented and siloed public agencies, as well as the people who work in and shape their decisions and outcomes. It is then intuitive that we need to generate and create more participation, not just in our organizations, but as a collective society. “It would seem that the more participants we engage in this participative universe, the more we can access its potentials and the wiser we become” (Wheatley, 2006, p. 67). This participation only occurs when we start to reach out and form relationships. This isn’t just participation from more individuals, but different organizations and actors that can present ideas and solutions, or re-frame the problem through a different lens. “We live in a universe where relationships are primary. Nothing happens in the quantum world without something encountering something else” (2006, p. 69). Once we engage this additional or external participation and create these relationships, then we can start to have collective ownership. This is best represented by the collaborative inter-agency relationships forming between state and federal actors, legislators, external parties, and concerned citizens.

Similarly, the wicked problem literature recognizes that a central key to effective management is the use of collaborative governance that engages the broad array of stakeholders
affected by the cross-cutting character of the wicked problem (Weber & Khademian, 2008; Weber, Lach & Steel 2017; see also Kamarck, 2007).

Collaboration and Interdependence

Interdependence among actors in the collaborative setting must exist to successfully build problem solving capacity and produce successful solutions. Interdependence means that all stakeholders have a mutual stake in the problem in question and are unlikely to achieve their individual goals if they tackle the problem-solving exercise all by themselves. As Daniels and Walker state in their study of natural resource/forestry collaborations, “without interdependence, or mutual dependence, there is little need or opportunity for meaningful interaction” (2001, p.31; Innes & Booher, 2010). “Sources of interdependence can include shared need for the natural resource(s) in question and/or the benefits anticipated from sharing risks, uncertainty and costs” (Weber, 2016, p. 7; Thomson & Perry, 2006; Ostrom, 1990). Yet, it is only when the actors in a collaborative realize and acknowledge that there is an equal dependency upon each other that true interdependence exists (Ansell, 2008).

Knowledge Transfer

Knowledge transfer in the face of wicked problems is not only essential in crafting solutions, but also another element of collaboration that leaves it highly suited to dealing with them. Carlile refers to this knowledge transfer in two categories; the first is known as “syntactic.” Collaboratives provide the setting for a common language or code which is necessary to overcome the boundaries in which many agencies and personnel have initially in the collaborative process. Once this common language is understood or agreed upon, then the ability
for knowledge to be transferred becomes much more rapid. The second advantage that collaboratives provide with knowledge transfer is known as “semantic” (2002). This relates to how collaborative actors receive knowledge. Weber and Khademian describe this as “a children’s game of telephone” (2008, p. 339). The simpler or clearer the story, especially with a common language established, the easier it is for the knowledge to transferred and retained. A third obstacle collaboratives help overcome is known as a “pragmatic view of knowledge” or “local knowledge” (Weber, 2008, p. 339). This is practical knowledge accrued during work or in a rapidly changing environment which Scott (1998) coins as “metis.” Collaboratives provide a forum to make knowledge clearer, easier to transfer and retain, and help to transfer a more dynamic form of knowledge known at metis, which can help in the face of wicked problems which are inherently dynamic themselves.

Communication and knowledge transfer in collaborative forums are viewed as crucial to eventual success. As wicked problems are cross-cutting and require the highest degree of knowledge transfer, then collaboratives need to create deliberative forums where information sharing is both open and abundant. “Beyond the need to accumulate and integrate these myriad sources of knowledge into collaborative governance processes, the rules for successful collaborative design necessarily encompass open access, or transparency, and sharing of information and expertise among all members” (Weber, 2016, p. 5; Leach, Pelkey, 2001; Dietz, Stern, 2008). The diversity represented in a collaborative could result in a much broader array of technical knowledge and idea sharing, but also help in the formation of unique solutions to that specific collaborative. Providing access to the same information for all of the parties involved...
can also build trust, while engaging a broader array of experts is likely to produce more comprehensive ideas and solutions (Daniels & Walker, 2001; Weber, 1998).

In many collaboratives, the exchange of information is crucial not just between members of the collaborative and agency personnel, but between the broader community/public and the government agency and non-profit representatives inside the collaborative. This works in two ways: providing a broader array of technical and agency-based solutions to both the collaborative and the public; and allowing the broader community to express their concerns and offer support to the collaborative and involved agencies to prevent litigation and expedite the implementation process.

In addition, Wheatley notes that information is a dynamic, changing entity, not static and unchanging, not “controllable, stable, and obedient” (2006, p. 94). The ambiguity, or uncertainty, that this introduces to any kind of decision-making has the potential to be overcome in a collaborative because of the clear, concise common language, (syntactic) knowledge transfer and retention (semantic), and practical, on the ground knowledge (metis) (Carlile, 2002).

Leadership

The collaborative governance literature notes that there are many different styles of leadership, but that successful leadership within a collaborative governance arrangement requires a certain set of identifiable traits and practices. “Collaboration both demands and cultivates opportunities for multiple types of leadership over the course of the endeavor” (Emerson, 2015, p.47; Carlson, 2007). The University of Kentucky Community Toolbox Workstation outlines these traits in three distinct categories. The first is collaborative problem solving and decision
making. The leader keeps the collaborative focused on the task and allows the group to form solutions. The second is known as open process. The leader does not have specific goals in mind, but rather allows the group to collaboratively make decisions and decide when and end-point has been reached. The third and final is leadership of the process. This means that the individual is to be a leader of the collaborative process and not that specific collaborative (Rabinowitz, 2018). Ansell and Gash argue that collaborative leaders “must have the skills to (1) promote broad and active participation, (2) ensure broad based influence and control, (3) facilitate productive group dynamics, and (4) extend the scope of the process” (2008, p. 554). Before the collaborative is even formed, and these leadership traits are displayed, a specific type of leadership often takes place first which Emerson & Nabatchi have termed as “initiating leadership” (2015).

Initiating leaders can come from a broad spectrum of places. Either private or public organizations, non-governmental organizations, the public, political arena, etc. “Initiating leaders appreciate the challenge of the system context and recognize the presence and pressure of the other three drivers: the uncertainty of future conditions, the interdependence between actors, and the consequences of (in)action” (Emerson & Nabatchi, 2015, p. 47). These initiating leaders often have a strong presence in the community and use this advantageously to spark motivation and become a strong driver towards collaboration and cooperation between actors (2015). Initiating leaders are significant to the formulating of collaboratives, the continued collaborative effort through the long-term is also captured by Weber & Khademian as a Collaborative Capacity Builder (CCB) (2008).
Once knowledge sharing and interdependence are created, it is crucial for the identification and establishment of a leader to facilitate the collaborative process. This person can also be known as a collaborative capacity leader (CCB). These leaders need to possess a number of different qualities including an in-depth understanding of what collaboration is from a theoretical and practical standpoint. A CCB is someone who can lead the network or collaborative in problem solving exercises, directs information and has a long-term stake in the success of the collaborative (Weber, 2008). Not only this, but maintain a neutral, objective stance that enhances trust and interdependence (Ostrom, 1990; Leach & Pelkey, 2001; Sabatier et al. 2005; Matthews & Missingham, 2009). They need to have strong communication and people skills, as they will be interacting with many different actors and agencies, which will be essential to the success of the collaborative. “The collaborative leader must also maintain a big picture approach to help keep the collaborative on track as part of a larger whole and be successful in getting parties to commit to the process for the long term and endure through the hardships that will present themselves along the way” (Weber, 2017, p. 211).

Across the literature collaborative leadership, whether it is the initiating leader or the CCB are a critical component to the success and progress of collaboration. These leaders use key traits and qualities to bring multiple actors and agencies together and keep them focused on the goals and tasks they have set forth to accomplish. They also foster the collaborative process, leading this collective action, rather than simply leading the group.

The Development of Long-Term Problem-Solving Capacity
The successful treatment of wicked problems requires management and funding efforts over a longer time span than may be generally understood. Solutions to these problems take years to develop and find consensus on; only then can the strategic implementation begin. “Developing strategic plans to successfully tackle watershed restoration, or ecologically sensitive forestry, for example, often take a year or two by themselves… and even after program implementation, results in such complex settings do not appear overnight” (Weber, 2017, p. 209).

Developing long-term problem-solving capacity involves uncovering and implementing solutions and relationship forming, but also with funding. Many agency budgets are only approved for one fiscal year. To undo over a century of fire suppression and decades of mismanaged forests, funding across a longer time scale could be more appropriate. “Ultimate success requires a new funding model designed to match the needs of these emergent problem-solving strategies and institutions” (Weber, 2017, p. 210). More specifically these new funding models can be broken into three phases: information gathering and trust building (one to three years), priority-setting (two to five years), long term targeted results (three to ten years) (Weber, 2017, p. 210). The transition of funding from an annual to a longer-term model could enhance strategies of public land management agencies in the implementation of plans that require a longer span of time, especially with regards to forest management.

The longer time-scale essential to crafting long-term, effective solutions applies to relationship building as well. Relationships, especially trust between agencies and actors in response to complex problems through the formation of interdependence take considerable time. (Weber, 2017). Understanding that many solutions to resolving catastrophic wildfire in the WUI
will not occur over a short-periods of time circles back to the importance of strong interdependence and leadership. Without strong leadership, the lack of understanding that a longer time-frame is needed to combat wicked problems can directly impact the ability for collaboratives to have access to greater resource capacity, which can be the life-line to potential solutions.

In addition, understanding the community problem-solving capacity of that specific collaborative can help to realistically highlight the potential constraints and where additional resources or funding could be best utilized. While collaboration may not be completely contingent upon material or monetary support, research supports the idea that the larger the variety of resources--monetary aid, training, and funding mechanisms, etc.--can directly impact whether collaboratives experience success (Leach & Pelkey, 2001; Sabatier, et al., 2005; Bryson et al., 2006). While the resources listed above are not mandatory criteria, to the extent communities and collaboratives have access to a larger, more abundant pool of resources, the likelihood of collaborative and implementation success increases (Weber, 2017).

An increase in resource capacity can also offer the collaborative access to a wealth of forestry information, funds, different land management strategies and tactics to which to draw from when implementing strategies to prevent fire in the WUI in the future. Using the policies described previously such as GNA and CFLRP, each specific collaborative and the involved agencies will likely need to become creative in exploring ways to generate funding mechanisms and expand resource capacity to accomplish their objectives as it relates to their unique situation. When faced with the necessity for a longer time-scale and the possibility of resource capacity
constraints, positive-sum outcomes are beneficial to keeping the collaborative focused on its accomplishments.

Positive Sum Outcomes

Top-down technical approaches often fall short in providing adequate solutions to all members of a group or collaborative. Perhaps one of the strongest reasons for choosing collaboration is the lure of positive sum outcomes. These are also known as win-win-win outcomes where all of the involved parties are left with better outcomes than prior to the collaboration. “The term "collaborative governance" promises a sweet reward” (Ansell & Gash, 2008, p. 561). While these positive sum outcomes are certainly attainable through successful collaboration, they can often times be the most difficult to measure or capture. (Weber, et al. 2017; Sabatier. et al. 2005; Emerson, et al. 2011).

Measuring success of the overall collaborative, or in the long-term can be illusive to obtain and capture. Sabatier et al. describes outcomes as being the most important to realize but are usually the most difficult to measure due to the complex nature of collaboration (2005). There are multiple challenges when it comes to measuring success and outcomes in a collaborative. “The complexity of the cross-cutting policy character that is tied directly to the focus on win-win-win outcomes complicates the task of identifying and operationalizing appropriate outcomes as opposed to impacts or outputs” (Weber, et al. 2016, p. 17; Emerson et al. 2011). Conley describes that a single criteria approach to measure the success of a complex entity system falls short (Conley & Moote. 2003; Gray, 2000). The ambiguous, amorphous form that collaborations can take cause a lack of clear, concise definitions, which further confuses and
blurs what exactly should be measurable criteria for success (O’Leary & Vij, 2012). Researchers have however, suggested broad areas of which successful criteria can be identified and measured.

Monitoring systems to help measure the success or lack there-of within a collaborative are often created. Weber suggests this can be accomplished by “setting a measurable set of indicators that can be monitored and used as an evaluation tool” (2017, p. 211). Some researchers suggest a social approach where “important procedural outcomes include, but are not limited to, good faith negotiation, achievement of consensus, satisfaction with process” (Ansell & Gash, 2008). While others gravitate towards environmental indicators. “In particular, provide examples of appropriate substantive environmental outcomes, including changes in environmental quality, biological diversity, vegetative cover and type, and land use” (Weber, et al. 2016, p. 16; Koontz & Thomas, 2006). Whatever the criteria being used, measuring outcomes of a collaborative is a critical function. To the extent a collaborative has established measurement indicators and protocols, and agreed on monitoring programs that employ such measures, the chances for understanding progress are greatly increased, which also increases the success of the overall collaborative effort.

**Methods**

This research is a case study and targeted a wildfire collaborative network in Northern California located in the Lake Tahoe Basin and surrounding private lands. The Tahoe Fire and Fuels Team (TFFT) was created following the Angora fire in 2007 to address catastrophic wildfire in the Lake Tahoe Basin WUI. The collaborative spans across two states, five counties,
and involves over 80 actors or agency-based entities. It is composed of local citizens, members of the United States Forest Service’s Tahoe National Forest, California’s state fire department (CAL Fire), Nevada Division of Forestry, five rural fire districts, University of California and Nevada Cooperative Extensions, the Tahoe Regional Planning Agency, the U.S. Forest Service, conservation districts from both states, the California Tahoe Conservancy, the Lahontan Regional Water Quality Control Board and many more. The collaborative was designed to protect the lives, homes, and environment of the Tahoe Basin in the event of catastrophic wildfire (Tahoe Resource Conservation District, 2018).

The TFFT in the Lake Tahoe Basin has been chosen as a case study by this researcher to be looked at for a number of reasons. The Lake Tahoe Basin has undergone a catastrophic fire in the WUI (Angora Fire), which resulted in the formation of the TFFT. According to Yin case study research involves the study of a case (or cases) within a real-life, contemporary context or setting (2014). Situated within the current wildfire situation that plagues California every summer, this makes the case for the TFFT and their approach to making the Lake Tahoe Basin resistant to another catastrophic wildfire appropriate to analyze. Creswell & Poth state that “this case may be a concrete entity, such as an individual, small group, an organization, or a partnership…examples of a case-study are an individual, a community, a decision process, or an event” (2018, p. 96-97). The TFFT is composed of all of these, being able to analyze and examine the different layers that compose the TFFT helps to paint a broader picture of exactly what the collaborative is and why it is relevant to the research question. “Your case study is defined not so much by the methods that you are using to do the study, but the edges you put around the case” (Stake, 2005; Thomas, 2015, p. 21). The edges, parameters, or side boards
referred to here have led this researcher to utilize semi-structured interviews which were done using purposive and snowball sampling. The intent of this research is to provide a pragmatic look at what the TFFT is doing from an implementation perspective, as well as to examine the role that collaboration is playing to resolve the threat of catastrophic wildfire in the Lake Tahoe Basin.

Representatives from the TFFT as well as key officials and experts in WUI firefighting from both the Forest Service and CAL Fire who work in the Tahoe Basin and are involved with, or actively serve on the TFFT were interviewed. Active members have been determined using the 2019-2020 TFFT Incident Action Plan. There are currently 23 active-members, eleven of which have been interviewed. An active member was defined by holding a position on the TFFT based upon the IAP structure and are involved in the TFFT decision making process A copy of the IAP has been excluded from this document to protect the confidentiality of the respondents. At the time of the first round of interviews, eleven of the twelve respondents were “active members” of the TFFT. At the time of the second round of interviews, one respondent had accepted a new position and was no longer affiliated with the TFFT, but his extensive background with the team still allowed him to provide valuable and relevant information (Incident Action Plan, 2019).

My eleven years in the field as a wild-land firefighter creates two main advantages for this part of the data collection process. I can tap an extensive professional network of firefighting experts through my occupational connections, while also gleaning hard to access insights into an occupation that can be resistant to outsiders. This is because hotshot crews, helitack crews, and smoke jumpers are a reclusive community and can be difficult for academics and social scientists
to access. While academia offers unique strategies and information to the wildfire problem, being able to sit down and talk with firefighters at the top tier within the occupation likely will lend a different perspective. Therefore, while an academic approach can offer solutions grounded in data and science, these may not be as applicable to real life as they appear on paper or in the collaborative’s decision-making. Blending the practical knowledge from highly experienced firefighters with the science and data produced from academia increases the probability that more robust, effective solutions to the problem can be found (Scott, 1998; Weber, Lach & Steel 2017).

In addition to the semi-structured interviews, an exploratory review of the TFFT website revealed concepts about defensible space and community preparedness. Anecdotally these webpages were used to enhance messages and themes from the interviews as it related to key concepts from the TFFT. Overlap between elements of the semi-structured interviews and the webpage led this researcher to include it, but no official analysis of the TFFT webpage was conducted.

Patton describes purposeful sampling as a technique commonly used in qualitative research in the identification and selection of information-rich cases for the most effective use of limited resources (2002). This is particularly the case with the TFFT, it was important to attempt to target members that were previously or are actively involved as key members of the TFFT. In addition to this, the limited number of potential interviewees associated with the TFFT made it necessary to target them in a way that was both intentional and specific. This is why purposive sampling was chosen over other methodologies. Cresswell et. al. notes “this involves identifying
and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest” (2011). This started with respondent 1, who is a former supervisor and a division chief for the USFS on the Tahoe Basin. He told me about the TFFT and gave some me some of the initial contacts. 12 individuals were interviewed, with interviews ranging in time from thirty to ninety minutes with three follow up interviews to gain a deeper understanding of the role of collaboration within the TFFT.

It is also important to note that while my previous fire-fighting experience has helped me by creating an avenue or “in” to the body of research that is the TFFT, it is not a convenience sample. Respondent 1 is the only interviewee that I personally knew prior to the interviews being conducted and when after conversations about wanting to research forest and fire collaboratives, he suggested the TFFT would be an interesting case to research as it related to the topic. This turned into reaching out to members of the TFFT via email and telephone. Twelve TFFT members responded and I sent the questions approved by IRB in advance of the interviews.

Interviews were conducted either in-person or over the phone using a recording/transcription app on my phone as well as a traditional recording device. The semi-structured nature of these allowed them to evolve and transform into much richer conversations than a more rigid structure would have allowed. With this being said, the conversations were always steered back to the interview questions that had been designed and approved and all questions were asked to each respondent in a consistent manner (i.e. This researcher followed the interview protocol during each and every interview but when the natural flow of the conversation directed
me to ask additional questions that were “off script” I did so, though always returned to the question protocol once this thread of questioning reached its natural end). Then interviews were transcribed using both recording devices. Interviews were then summarized. These summaries were compared to a codebook which was created utilizing specific collaborative terms from the literature review. These included: Interdependence, knowledge transfer, leadership, problem-solving capacity, and positive-sum outcomes. These specific collaborative themes were used in coordination with the structure and processes of the TFFT to tease out the role that collaboration plays in making the TFFT effective in reducing catastrophic wildfire in the Lake Tahoe Basin WUI. After the first round of interviews, it was determined that a smaller second round of interviews should be conducted to gain a further understanding of the TFFT structure and role of the collaborative elements described above. All of the respondents wanted to remain confidential.

Understanding the Tahoe Fire and Fuels Team

Lake Tahoe, California is located high in the Sierra Nevada Mountain Range. Lake Tahoe is often portrayed with incredible skiing at the many winter resorts that surround the Tahoe Basin, or with summer-time lake activities. Lake Tahoe is one of the most desirable vacation destinations in the state, as well as in the country. In such a beautiful setting the combination of high fuel loads and hot dry conditions was easy to overlook, this created the potential for a catastrophic wildfire. The Angora Fire started in late June 2007. It was caused by an escaped camp fire and was driven by strong winds and the steep terrain of the Sierra...
Mountains, burning 3100 acres and destroying 254 residences in the South Lake Tahoe Basin (CAL Fire, 2019).

Following the Angora Fire, the Tahoe Fire and Fuels Team (TFFT) emerged in 2007 to begin to address the potential of catastrophic wildfire in the Lake Tahoe WUI. Initially the TFFT was brought together by officials representing its many agencies (many of which are fire departments) to help better understand the factors contributing to catastrophic wildfire in the WUI, but more importantly how to prevent and prepare for it. To adequately address the complexity of the WUI space around the Tahoe Basin, the TFFT brought together the diverse array of agencies and actors listed above. The diverse land ownership around the Lake Tahoe Basin creates a true checker-boarded map and heightens the level of complexity when it comes to collectively reducing fuel levels in the WUI space. The creation of the TFFT also points to how complex the WUI wildfire problem really is and why technical solutions from individual agencies are not enough on their own to resolve it (Tahoe Resource Conservation District, 2019).

The Angora Fire was undoubtedly the catalyst for the TFFT, however, talks about how to reduce fuel levels and improve the health of the forests in the Tahoe Basin had been going on before the Angora Fire. Prior to the Angora Fire fuel reduction strategies were undertaken within individual bureaucratic silos, existing only within specific agencies’ budget, personnel, and land management areas. This led to multiple agencies competing for the same funding, contractors, grants, resources, etc. While this could potentially address the fuel reduction issue on particular parcels of land, it neglected the broader, interconnected, interdependent ecosystems and forestlands existing at the larger landscape level, which is where treatments are required in order
to reduce the potential for large-scale catastrophic wildfire in the Tahoe Basin and particularly as it concerns the focus of this research, the wildland urban interface (WUI). With multiple agency officials recognizing the inefficiency of the fragmented, piecemeal approach, talks of how to work together in order to maximize the benefits of broader landscape treatments began to occur (Tahoe Resource Conservation District, 2019).

The Angora Fire highlighted the necessity for land management agencies to recognize and capitalize on their interdependence if they were to begin to cohesively and effectively work to reduce the threat of another catastrophic wildfire in the Lake Tahoe Basin. The Tahoe Basin is checker-boarded with different land ownership between numerous agencies and two states creating one of the most unique and complex WUI spaces in not only the state, but the country. In addition to this, the Tahoe Basin experiences massive recreational use during all four seasons of the year, thus adding complexity to forest management efforts. One of the major challenges for the TFFT involves how to treat the WUI space as part of the larger contiguous landscape and have fuel treatments within the WUI transition into the surrounding forest areas to create a true fire resilient and resistant landscape (Tahoe Resource Conservation District, 2019). To accomplish this task, it requires the collaborative to act as both a forest-based and Firewise collaborative as described previously.

**TFFT Achievements**

The TFFT’s primary goal is treating the WUI around the Tahoe Basin. Their mission statement is: “To protect lives, property and the environment of the Lake Tahoe Basin from wildfire by implementing prioritized fuels reduction projects and engaging the public in
becoming a Fire Adapted Community” (Incident Action Plan, 2019). Behind this statement are a number of detailed accomplishments and a strong collaborative element that make this mission statement a reality. The TFFT has created a set of unified goals and a common language that all of the involved agencies share support for.

Perhaps the most obvious sign of TFFT success is the fact that since the Angora Fire in 2007, the Lake Tahoe Basin has avoided another major fire in the WUI space. This, of course, contrasts dramatically with the increasing frequency of major WUI wildfire conflagrations in the rest of California, particularly since 2015. The argument here is that while the overarching complexity of wildfire is such that the shift in management approach to collaboration is unable to take all the credit for this outcome, once one understands the many different achievements of the TFFT, it is clear that the major accomplishment of avoided fire in the WUI space is unlikely to have occurred without the successes of the new collaborative approach. The achievements by the TFFT that contribute to the lower risk of wildfire in the WUI include:

- Community preparation for wildfire: evacuation drills and pre-attack mapping (Tahoe Resource Conservation District, 2019).

- Creating a Fire Adapted Community
  - Protecting private property: education, resources, and new services adopting the 100-foot defensible space policy: 42,059 parcels inspected and counting (Tahoe Regional Planning Agency, 2020).
Increased Fuel Treatments: integrated, systematic mapping system/overview, prescribed burns, mechanical treatments, broadcast burns: 62,885 acres treated and counting (Tahoe Regional Planning Agency, 2020).

- Creating new institutions, adding fire management capacity, and a landscape level approach - the Lake Tahoe West Collaborative, free curbside chipping, home inspections, etc (Tahoe Resource Conservation District, 2019).

There is stronger consensus on California’s wildfire problem than ever before. Understanding that a change in our forest practices could help reduce the likelihood of these catastrophic wildfires has been thrust into the national spotlight over the last few years given disasters such as the Camp Fire in 2018, where “18,804 homes … burned down, leading to the worst air quality in the world in San Francisco” (Respondent 4, 2019). An even stronger understanding that communities are intertwined into this environment and are susceptible to these events has led the broader public to engage agencies and lawmakers with new levels of concern. And while this is essential in a place as highly recreated as the Tahoe Basin where a true multiple-use forest landscape exists, the fact remains that the TFFT came to these new understandings, consensus among the many stakeholders, and changes in practices many years prior to the catastrophic California fires that captured the nation’s attention starting back in 2015.

**Community Preparation for Wildfire**

Fire professionals and fire science now agree that minimizing the chances of catastrophic forest fire in the WUI space means having a community that is fire adapted as well as fire
prepared. Conversely, a lack of preparedness is considered key to the fatalities in Paradise during the Camp Fire. Key to community preparedness are well designed and practiced evacuation plans, as well as advanced, pre-attack maps to assist firefighters. The TFFT has been at the forefront in both areas.

One of the unique community preparation techniques that the TFFT utilizes is a new advanced form of mapping. “This advanced approach to mapping and creating evacuation plans and routes for the communities in the basin is bolstered even more with two communities participating in actual evacuation drills” (Respondent 9, 2019). This will likely increase the effectiveness of any evacuation effort in these communities during an actual wildfire with the already advanced mapping and route system that is in place. One of the main concerns is that during the event of an actual wildfire in a WUI space, how well is the community actually prepared for this event? Respondent 3 asked “looking at where you're going to have challenges in terms of access and egress and where homes are located, where you're going to have command posts, where hospitals and schools are and how well protected are they?” (2019). The maps of the Tahoe Basin display a variety of layers and are compatible with Avenza Maps, which is the preferred mapping/GPS technology used by the Forest Service and CAL Fire on wildfires in California. These maps show evacuation, entrance, and egress routes; where evacuation centers are being set up, the incident command post, hospitals, etc. The potential also exists to show real-time color-coded traffic conditions similar to what exists on Google or Apple maps. The TFFT’s proactive approach to these pre-planned evacuation drills and mapping should alleviate much of the chaos and confusion during an actual evacuation during a wildfire.
“I feel things like the evacuation drills and the pre attack plan and mapping are a result of collaboration and connections between people that were formed at the TFFT because frankly that forum existed, it provided an opportunity for people to be working together productively and not in an adversarial manner” (Respondent 5, 2019). Interactions and the pre-attack plan would have likely occurred between residences, citizens, and local fire agencies regardless of the TFFT, but the TFFT provided a forum for this to become a Basin-wide reality by allowing for connections and interactions to exist that previously did not.

In order to successfully treat both the WUI space and larger forested landscape around the Tahoe Basin, more than just successful communication and mapping is necessary. These tools come in the form of education, funding, incentives, operational capacity, etc. It requires the TFFT to be able to coordinate with a multitude of departments and representatives, as well as local communities and the public. Increasing the variables described above in addition to successful multi-agency coordination and public outreach is the first step in creating a community that is not only fire prepared, but fire adapted.

**Creating a Fire Adapted Community**

The second key to minimizing the prospect for catastrophic wildfire in at risk communities involved the creation of a fire-adapted community. Again, TFFT has been a leader in this area for years.

*Public Education and Community Acceptance*

One of the most difficult aspects of fuel reduction treatments and implementing technical, agency-based solutions in order to lessen the risk of wildfire is increasing public education and
involvement and gaining community acceptance of the need to change established practices in the WUI space. This may be where the TFFT has excelled and separated itself from other forest-based and Firewise collaboratives the most.

The TFFT has done an extensive job helping to educate the broader community on the importance of fuel reduction. The TFFT has created a common language and easily understood concepts that would likely be considered complex, technical forestry solutions to many, especially to communities or members of the public without a forestry or fire background. Not only does the TFFT create a common language and terminology for the public and involved agencies, they provide detailed information about fuel reduction methods in the WUI and larger forest landscape in the Tahoe Basin. The best example of this is the TFFT’s Fire Public Information Team (Fire Pit) concept found on the TFFT’s website.

Prior to the Angora Fire, the message about forest and fire management could vary greatly across the Tahoe Basin. All of the different agencies including the Forest Service, Tahoe Basin Fire Agencies and CAL Fire were competing to get the same message out, but using different verbiage. This lack of a cohesive, uniformed message often confused the public. The Fire PIT provided the forum to create one common language about all things forest and fire management related, while utilizing all of the TFFT different platforms to share this message. “In a place where you could work and live in two different counties or fire districts or any number of those things, a common message is crucial” (Respondent 12, 2020).

The Fire PIT not only helps unify the message about fuel treatments and defensible space in the Tahoe Basin, they also help jointly plan all of the events surrounding these topics, from
prescribed fire workshops in the spring to defensible space meetings. “So the people who would attend the event on behalf of agencies for a panel are all generally fire PIT members. So the Public Information Officer (PIO’s) of all of the districts or the forest service. So those collaborations are hugely important, especially in that communications realm and that event planning realm” (Respondent 12, 2020). It is important to have different agency representation at these types of meetings in order to help answer any questions that might arise, especially with the nuances between agency mission statement or with regards to how different agencies work within the Fire PIT’s collaborative message.

One of the more controversial fuel treatments is prescribed fire. Recognizing this, the Fire PIT puts together a collective message so that whichever agency implements the burn has the full support of the TFFT. “So if any agency, in either California or Nevada wants to implement a prescribed burn, they create a completed spreadsheet and send it to a member of the Fire PIT who works for the Forest Service and she updates it into the TFFT’s website into their online mapping data base” (Respondent 12, 2020). From here the TFFT issues a joint press release and all of the involved agencies also do an outreach to the Tahoe Basin using their respective social media and communication methods. “I mean, I really can't imagine doing the work that I do without having the fire PIT support” (Respondent 11, 2020).

The joint outreach from the Fire PIT is also having a direct impact on residences of the Tahoe Basin. “We just had meeting yesterday. Everybody is having to hire more defensible space inspectors next year. And so the momentum of that program is definitely resulting in more
defensible space inspections” (Respondent 12, 2020). The more residences and parcels that are inspected and are defensible space compliant, the closer the community becomes to truly being fire adapted.

Under the Fire Pit, the TFFT website uses two distinct categories: *prepared* and *informed* to help Tahoe Basin residents have a clear collective message on defensible space and what to do in the event of a wildfire. The intent is to prepare residents and their homes in the event of a wildfire, while informing them of potential strategies and techniques to help improve their residences and communities as well as the broader forested landscape surrounding them. This includes information about forest management techniques such as prescribed fire, pile burning, and mechanical treatment. The website provides detailed images that simplify the concepts and make it clear and easy to understand the intricacies of mechanical and prescribed fire treatments as well as creating defensible space.

*Protecting Private Property*

*Prepared*

As stated previously, the State of California implemented the 100 Ft. Defensible Space Policy starting in 2005. This policy is designed to help fire agencies accomplish their job when tackling wildfire in the WUI, but also give citizens the ability to proactively prepare their property to stand the best chance of survival when a wildfire occurs. The TFFT has also provided detailed information about understanding which rural fire districts citizens live in, and how to best prepare in the event of a wildfire in the WUI. They describe what to do before a fire to improve on defensible space around a home, understanding easy entrance and exits within a
neighborhood, knowing quick, safe, evacuation routes, and finally, what to do after a wildfire occurs in your community or neighborhood. Understanding that fuel reduction can be a costly and physically challenging task, the TFFT goes further to offer resources available in the Lake Tahoe Basin to help accomplish this which are discussed in greater detail later.

Even in the event of a catastrophic wildfire, the Tahoe Basin is well prepared from the WUI perspective through the 100 Ft. Defensible Space that has been well received throughout the community.

“I would say, in some sense the TFFT acts as a learning network. The clear benefit in my mind is that we have successfully standardized our messaging around defensible space and other wildfire preparation activities so that each of our agencies communicating about preparation and mitigation activities are conveying the same message” (Respondent 4, 2019). In addition to social media, the Fire PIT utilizes billboards to advertise and enhance the repeatability of the defensible space message. Further proof of this accomplishment is the contrast in defensible space inspections completed in the Tahoe Basin in 2008 with just 938 parcels inspected. Currently there have been 42,059 parcels inspected in 2020 only thirteen years later, with that number continuing to grow (Tahoe Regional Planning Agency, 2020).

One of the broad goals of the TFFT is to have “95% of the home-owners in the Tahoe Basin to be in compliance with the 100-foot defensible space policy in the next five years” (Respondent 4, 2019.) In fact, the Forest Service and the TFFT are five years from all WUI fuel projects in the Tahoe Basin being ready to implement, this includes private and federal lands, as well as maintenance on existing projects. The reality of this accomplishment speaks to
the success that the TFFT has had in the broader community with regards to public education and making communities conscious when living in a fire prone area. It also demonstrates a strong interdependence and connection between the fire districts, TFFT, and surrounding communities. Communication and outreach are vital to the 100-foot defensible space policy but, more importantly, for communities and private landowners to implement their own defensible space at their personal residences, providing tools and resources is essential.

Since the 100-foot defensible space is a cost or burden undertaken by the home-owner, offering additional resources to help accomplish this to members of the public is critical. “Fire districts in Lake Tahoe provide many services to help residents and visitors prepare for wildfire such as free curbside chipping, free defensible space evaluations, and working with neighborhoods to develop fire adapted communities” (Tahoe Resource Conservation District, 2019). These services are unique to the TFFT and the Tahoe Basin, where most home-owners in California are subject to the 100-foot defensible space compliance on an individual basis. Offering additional resources and capacities greatly increases the likelihood of the TFFT and the Tahoe Basin reaching their 95% goal by 2023.

Informed:

One of the strongest elements of successful collaboration is knowledge sharing. The TFFT uses their platform to exchange ideas between the involved agencies (primarily fire districts) to create common goals and plans for future and current projects. The TFFT also utilizes this knowledge sharing within the public and surrounding communities and is a strong
example of how they have created a common language and act as a bridge between technical agency expertise and on-the ground implementation in local communities.

The TFFT provides detailed descriptions of how forests and houses burn, the impacts of fire on the forest, and how to reduce fire severity. They assert that while the dramatic flame fronts that ripped through Paradise and Redding, California can most certainly occur, it is largely embers and radiant heat that result in the loss of structures. Given this, the fire science indicates that 100 feet of defensible space around buildings can mitigate these types of fire threat almost entirely. The TFFT also informs homeowners and other stakeholders and describes the differences and links between surface, ladder, and crown fuels—critical distinctions that can affect the type and intensity of forest fires. For example, removing or reducing surface and ladder fuels greatly reduces the likelihood of a high-intensity or crown fire that occurs at the top of tree stands and that also increase the probability that fire will spread, and even jump, across large swaths of adjacent forests (Tahoe Resource Conservation District, 2019).

Similarly, the TFFT has created and provides informational materials on the different forest impacts of high and low severity fire. Low severity fire is largely burned at the ground level and can reduce fuel loading and has a number of ecological benefits that can actually increase biodiversity and improve forests’ long term resilience, while high severity, or intense and catastrophic fire often results in high tree mortality and transform into harder to control crown fires (Tahoe Resource Conservation District, 2019).

Finally, TFFT documents describe the significance and potential of both mechanical and prescribed fire treatments as mentioned above. These techniques, especially when used together,
can positively impact forest health and reduce the likelihood and incidence of high severity fire. Due to the high density of outdoor recreation activities in the Tahoe Basin, there is also detailed information about how to properly extinguish camp fires (the cause of the Angora Fire) and the prevention of illegal firework use (Tahoe Resource Conservation District, 2019). These last two items are of critical importance because the majority of forest fires are human-caused.

Moreover, in an age dominated by social media, the TFFT realizes that a website with pertinent fire management information is not enough. The TFFT ensures that all phases of fuel treatments are reported through social media to the community. Allowing community members to know where and when prescribed burns will be conducted gives a heightened level of awareness and inclusion. Taken together, the TFFT approach has led to the Tahoe Basin and its communities being much more prepared within the WUI space, but also educating the public on the significance of the treatment of the larger forested landscape.

Social Media allows for the TFFT to help enhance knowledge sharing among fire districts in the Tahoe Basin. Outreach and increasing awareness are vital components in raising awareness, but actually knocking on doors and performing inspections and walking residents through creating defensible space and providing resources to accomplish this are how actual change is made. “So we didn't want to just send a basin wide message. We wanted to make sure that we had those assistance services available basin wide in order to support better outreach, which in turn supports better delivery of services” (Respondent 5, 2019). In addition to the increase in home inspections over the last 12 years, the Tahoe Basin has also seen an increase in acres treated as well.
Increased Fuel Treatments

The combination of preparedness in the WUI space around the Tahoe Basin as well as the advanced mapping and evacuation plans points to a high level of communication and relationship building between the TFFT, its agency partners, and the surrounding communities. All respondents in some context pointed to the significance of the outreach and transparent display of fuels treatments over social media. The TFFT website posts current up-to-date evacuation drills, prescribed fire events, fire weather forecasts, and additional fuels treatments. They also do community outreach through Twitter, Instagram, and Facebook. The TFFT’s in-depth understanding that the WUI and these communities are part of the broader forested landscape and should be treated as part of the larger contiguous fuel treatment plans. Making communities part of the landscape level treatment allows for a much better opportunity to suppress a fire in these areas. It also helps the public and communities to become much more engaged and educated on what fuel treatments are and why they are a necessity. This has made treatments outside of the WUI also easier to undertake with strong public support. The TFFT has been very effective in a number of ways, from the WUI space to the broader landscape that surrounds the Tahoe Basin. The proof of this claim lies in the 62,885 acres of forested land that has undergone some form of fuel treatment described above in the Tahoe Basin. Beginning in 2007, the TFFT has helped orchestrate, record and compile treated acreage data. These acres vary from state, federal, and private lands, but point to the larger contiguous landscape and the broader understanding that regardless of ownership, fuel treatments must be increased across the Tahoe Basin (Tahoe Regional Planning Agency, 2020).
The significance of these treated acres should not take away from the essentialness of continued engagement and outreach to the public. The crux of this public outreach is helping to explain that forest management from a mechanical and prescribed fire treatment perspective have evolved into sophisticated, science-based treatments that stemmed from previous techniques that led to many of the current stigmas associated with logging and prescribed fire. “It's not to say that we're going back to the days of the types of management that resulted in some of the NEPA and SEQA laws” (Respondent 3, 2019). Through this communication and education more acreage has been treated than through the historic siloed, technical, top-down agency approach. “we've gotten a lot of work done honestly, for how big we are and the amount of land we've treated. I don't think that there's another place that can say that they've been able to treat as much state, private and federal land in such a small area in such a short amount of time” (Respondent 2, 2019).

One of the largest concerns with prescribed fire, whether landscape level or pile burning, is the smoke produced. This could be in the form of violations concerning the CAA or by simply introducing smoke into highly recreated areas such as the Tahoe Basin where the tourist community would not want to be outside during periods of dense smoke. This has historically led to public complaints about the communities being filled with smoke during the prescribed fire season. The TFFT’s community education and public outreach led to the 2018 fall prescribed fire season concluding without any smoke complaints. It also led to a 75-acre meadow restoration that was completed using a broadcast burning style of prescribed fire that can treat a much larger number of acres than pile burning; it was the first in nearly 15 years in the Tahoe Basin on federal lands (Respondent 1, 2019).
Landscape level fuel treatments require large sums of money and calls for the infrastructure, agency and contractor capacity to be in place prior to receiving a large grant or sum of money. This allows the treatments to be implemented in a much smoother fashion. Another unique advantageous trait of the TFFT is their ability to deal with large amounts of funding. “When you have all the partners sitting around the table and you're trying to figure out where the work is going to be completed, how its actually going to get done, and the funding mechanisms that are going to be used and who could be the pass through entities for the funding, or who could actually have the capacity to be able to handle a $6 million grant or hire additional personnel or contract out the work” (Respondent 4). To date the total cost of treating the 62,885 acres described above is $98,949,847 across all of the involved agencies in the Tahoe Basin. This makes it essential for the TFFT to be able to handle the large dollar grants that they may be awarded (Tahoe Regional Planning Agency, 2020).

These fuel treatment projects are being done across a variety of agencies in the Tahoe Basin. The TFFT being able to open the line of communication between agencies allows for these fuel treatments to be strategic, rather than arbitrary treatments on a map. “We'll be aligning our work in the neighborhoods to be adjacent to those projects… so if the California Tahoe Conservation and the Forest Service have an urban lot they need to treat, they need to treat those at the same time that we're in there doing defensible space inspections and educating the public in that neighborhood” (Respondent 12, 2020). This is how the TFFT can successfully connect the public to the larger continuous picture of fuel treatments in the Tahoe Basin, as well as get the most out of their fuel treatments.
**Adding Fire Management Capacity and New Institutions**

Understanding that current fuel treatments are not sufficient to alter landscape level or catastrophic wildfire is becoming the consensus within the wildfire community and broader body of the public. The TFFT has enhanced and generated ways to treat more forest acreage in the Tahoe Basin, thus making the WUI and surrounding landscape more resistant to high intensity wildfire.

The TFFT maps will show current and prior fuel treatments on the landscape, which is very advantageous from an operational standpoint. A visual representation of these checkerboarded land ownerships also provides a sense of responsibility to each individual agency that acts as part of the whole TFFT. They act to “add administrative capacity and to leverage what every single organization can bring to the table” (Respondent 3, 2019).

Catastrophic fires in the WUI have demonstrated time and time again that they do not burn within boundaries. Understanding where previous fuel treatments and potential could exist through an advanced mapping system allows for strategic decisions to be made with regards to suppressing a fire. This understanding that fires do no burn within borders helps the TFFT visually understand where new fuel treatments are needed with the mapping system, but this visual representation can only provide so much. While the TFFT primarily is in charge of WUI treatments within the Basin, realizing that in order to effectively treat the large amount of forested acreage that surround the Lake Tahoe Basin, new institutions that specifically add operational fire management capacity are necessary.
It is important to understand how intertwined fire adapted communities and fire resilient landscapes are from a social and ecological standpoint. Understanding that a fire adapted community would likely support an increase in prescribed or managed fire at a landscape level not only better prepares the community from a practical and knowledge-based standpoint, but will increase support for treatments at an increased level that could potentially alter landscape level fire.

Recognizing this need, the TFFT has acted as a catalyst in the genesis of the Lake Tahoe West Collaborative that is specifically designed to treat and restore 59,013 acres surrounding the west shore of the Lake Tahoe Basin. “So I think it'd be accurate to say that, TFFT was a catalyst or kind of an enabling condition which allowed or, at least supported Lake Tahoe West in moving forward” (Respondent 3, 2019). The TFFT and its multi-jurisdictional strategy is almost exclusively focused on the wild land urban interface and on neighborhoods. So an ecological landscape level approach was needed to complete the comprehensive picture of fuel reduction strategy. The Lake Tahoe West Collaborative is specifically designed to address a more ecological and restoration-based approach to the surrounding landscape by treating uplands forest outside of the WUI space, an urgent need, as recent catastrophic WUI wildfires in California have demonstrated. The Lake Tahoe West Collaborative began plans in 2019 and expects on the ground implementation beginning in 2022 and costing an estimated 13 million dollars annually. In order to restore the landscape the Tahoe West Collaborative has outlined six distinct goals:

1. Forests recover from fire, drought, and insect outbreaks.
2. Fires burn at primarily low to moderate severities and provide ecological benefits.

3. Terrestrial and aquatic ecosystems support native species.

4. Healthy creeks and floodplains provide clean water, complex habitat, and buffering from floods and droughts.

5. People live safely with fire and enjoy and steward the landscape.

6. Restoration is efficient, collaborative, and supports a strong economy (Lake Tahoe West, 2020). These goals closely model some of the broad themes from the TFFT and help to strengthen the interconnectedness between the forested landscape and surrounding Lake Tahoe Basin communities.

The TFFT also recognizes that not all of the five fire districts surrounding the Lake Tahoe Basin have the same resources or capacity. The TFFT allows gaps or voids to be filled and add capacity when other fire agencies cannot. When one fire district was not able to support the fire adaptive communities program, the teamwork and cohesiveness of the TFFT allowed other fire agencies to step in and add capacity and fill the void. This also includes lending chipping crews or defensible space inspectors to other fire districts when there is a need.

These achievements by the TFFT demonstrate what building a fire adapted and fire resistant community looks like through a collaborative effort. The TFFT employs a emergency management structure common to all wildfire agencies known as the Incident Command System. A detailed understanding of this system, how the TFFT collaboratively functions within it to
decide on projects and the role of leadership are required to understand just how the TFFT has achieved all of the accomplishments described above.

**TFFT Structure: The Incident Command System and a Collaborative Dynamic**

Given that many fire professionals consider the wildfire in the WUI problem as a specific type of emergency, utilizing an emergency management system or structure strikes them as an appropriate way to manage in their attempts to resolve it (Respondent 4, 2019). Engaging and informing the public on fuel reduction strategies in the WUI and broader forested landscape is critical, yet being able to function symbiotically with the many fire agencies involved in the Tahoe Basin is equally important. Since the TFFT initially was composed of many different wildfire agencies, they have structured the team to mimic the Incident Command System (ICS) that all fire agencies use to organize and manage personnel on a wildfire in order to be able to react quickly and efficiently at the time a fire breaks out.

This is because the ICS system is a traditional top-down, hierarchical system in which different agencies hold specific, distinct responsibilities. It is designed to accomplish a goal or mission in a streamlined, efficient way by providing a clear, concise, linear structure to configure fire agencies and personnel for wildfire management. (See attached figure 1) The TFFT has molded this into a system that fits the team in a unique creative way, while using it to streamline communication, assign accountability, and make their decision-making processes more efficient. (Tahoe Resource Conservation District, 2019).
While the ICS system is rigid and hierarchical on an actual wildfire, the TFFT utilizes it in a more fluid context. As a long-time leader in the TFFT states: “the ICS system as it applies to the TFFT is highly symbolic outside of actual fire emergencies” (Respondent 3, 2019). Instead, it is used as a way to structure, assign responsibility, accountability, and maintain clear communication during the planning and preparation processes described above (Respondent 3, 2019). In this sense, the top leader, the Incident Commander, of the TFFT doesn’t necessarily have authority outside of emergencies over someone else on the team. Which means that accomplishing the goals described above requires significant coordination and collaboration across agencies within the TFFT’s ICS structure. “You really need to be able to work across all jurisdictions, and be able to prioritize regardless of what the patches say on your shoulder to be able to make it work” (Respondent 4, 2019). This also incentivized smaller agencies to join the
TFFT for numerous reasons. Participating in the TFFT allowed agencies to “be able to draw from some of the financial and staff support resources of the total resource conservation district, which means that you now have the people in the time that are needed to actually be able to be put forward in the planning and hosting and coordinating an event” (Respondent 3, 2019). It allowed for agencies to collectively navigate and “eased the path” when dealing with regulatory agencies and local policy constraints that exist within the Tahoe Basin. It also helped relieve external pressures with regards to implementing real solutions in their respective communities (Respondent 4, 2019).

The TFFT also utilizes an Incident Action Plan (IAP). On wildfires an IAP is provided daily so fire personnel understand what the tasks and goals for that shift are from a daily and long term outlook. The TFFT utilizes an IAP to illustrate common goals, tasks, specific assignments, and roles for fuel reduction projects under the ICS. This is done on an annual basis and outlines all of the current and future projects that the team is working on and who the leads are with their respective roles. “I was able to send that to them and they know exactly what every group is working on, who are the leads, how it all fits together” (Respondent 12, 2020). This allows not only for a clear line of communication, but for accountability. The IAP also helps outline the decision making process that the TFFT uses to choose fuel reduction projects and how the actual implementation happens.

Deciding on where to implement projects across the Tahoe Basin can be a challenging decision. “the clearest example is through some of our joint funding sources that can be applied basin-wide, where we really do need to make some difficult decisions in terms of priorities and who gets money for which project and knowing that we can't fund every single
project” (Respondent 4, 2019). This starts by looking at the “base map” created by the Tahoe Resource Conservation Partners. The base map provides a look at where future priority fuel treatments have been designated by the community wildfire protection plan. Understanding which areas to treat can be designated by technical expertise lend from fire fighting professionals who express concern over certain areas and local factors (local weather events, tourist destinations, topography, etc). This is where the blend of multiple partners under the ICS jurisdiction makes transitions to a collaborative decision-making process, rather than a hierarchal one.

The second form of project designation comes from several multidisciplinary work groups that will break out and try to give some assessments in terms of what would be highest priority for a funding request and what would be lowest priority. “These groups rank projects from 1-3 for priority and then decide on which to move forward with” (Respondent 4, 2019). Ideally there is a strong sense of consensus between work groups and partners, leading to a collective decision on projects. “You really do have to look at what's the best for the Tahoe Basin and not what's best for you or your organization” (Respondent 4, 2019). Consideration is also given to sustaining already pre-existing capacity. For example it would be detrimental to cut funding to an already existing crew or piece of equipment such as a chipper, to provide funding to a new project, so sustainability of capacity and work force is also taken into account when deciding on a project. Without effective collaboration between the TFFT partners under the ICS structure, collective decision making on where to implement projects while retaining existing capacity would likely not occur.
Once a project(s) is collectively decided upon it is presented to the Multi-Agency Coordination Group or MAC. The MAC group and IC meet once or twice a year to decide upon and outline projects around the Tahoe Basin. This is where coordinated projects and their funding streams are presented for MAC approval. Once approved by the MAC, they are brought to the initiation phase. The MAC consists of 16 agency representatives, with 7 of these 16 representatives being fire department chiefs: “consider the Forest Service, they own over three quarters of the land in the basin, but they are one seat at that table” (Respondent 2, 2019). This diverse and balanced group of representatives helps to the focus projects that strongly favor the well-being and benefit of the local Tahoe Basin communities. “You have to be very cognizant of the fact that our decision makers are really our agency decision makers and we're operating as a partnership” (Respondent 3, 2019). This collaborative, partnered approach creates common goals and projects that were chosen under a clear, concise implementation plan to provide treatments that blur agency jurisdiction and organizational boundaries that truly provide a benefit to the Tahoe Basin.

One of the most important contributing factors to the successes of the TFFT is strong leadership. While the ICS may appear to favor the Incident Commander by giving top-down control to this individual, the TFFT has woven leadership through all levels of the ICS, which will be described in the following paragraphs.

**TFFT Leadership**

Instrumental to the the TFFT and most successful collaboration is the presence of effective leadership. The collaborative literature, specifically Weber & Khademian's
identification of the Collaborative Capacity Builder (CCB) point to strong leadership and it being crucial in successful collaboration (2008). In the case of the TFFT it was the presence of two highly influential, but different leaders that were largely responsible for its creation. Norb Zurich a local fire chief and Elwood Miller PhD, Coordinator of the Nevada Network of Fire Adapted Communities, came together to help spawn the beginning of what would become the TFFT. “Having Dr. Elwood Miller, the-living-with-fire guru coming to the table with an ops chief from a fire department enabled both the science-based and the operational pieces to come together. This ensured that those two pieces existed harmoniously, this was huge in getting it off the ground and the leadership hasn't really fallen short of that since” (Respondent 11, 2020). They helped instill the motto “do the right things for the right reasons and the right way” which is still used to guide and set the tone for the TFFT.

The current Incident Commander for the TFFT, comes with an extensive background in fire and forest management from a local agency and has been involved with the TFFT since nearly the beginning. This background is helpful, but it is a number of other leadership traits that likely contribute to the success of the TFFT. Multiple respondents used the following adjectives or phrases to describe the current Incident Commander: “Articulate, knowledgeable, strong communicator, history of the area, comprehensive understanding of process for project implementation, good at pursuing money and understanding grant processes” (2020). These are strong leadership characteristics, but also exemplify many of the characteristics of a CCB: big picture approach, instilling and growing interdependence, keeping the collaborative on task, and a long term invested approach, but perhaps the most successful trait is this individual’s ability to place trust and responsibility in others within the TFFT (Weber & Khademian, 2008).
“I think what makes him successful in that position is that he does put a lot of trust in other people to do things” (Respondent 12, 2020). This has led to the TFFT having multiple leads and co-leads which helps not only instill trust into people, but maintain a level of accountability and communication so that the burden of the TFFT is not solely placed on the IC. “I feel like he has really set the tone, to make sure that everybody is relying on each other” (Respondent 11, 2020). This form of trust-sharing instills an interdependence between individuals on the TFFT from different agencies. This also means that leadership doesn’t stop at the IC position within the TFFT. Many of the leads and co-leads are local fire chiefs, which creates its own set of unique leadership traits to help enhance the effectiveness of the TFFT.

Fire agency leaders have to answer to constituents as well as the public. This external pressure helps bring all of the fire districts to the table, it also applies continuous pressure to produce results for that specific district as well as the TFFT. More importantly, is the tie between fire chiefs and their local communities which is a connection that has existed since the creation of the TFFT. “The previous two TFFT Incident Commanders (fire chiefs) put their communities’ protection above all else in terms of priority and that link and bond and trust between them and their communities as elected officials helped bridge the trust between them and the public” (Respondent 4, 2019). This selflessness and sense of community has helped maintain the momentum needed to continue to produce fuel treatments around the Tahoe Basin at an expedited pace. It also further instills trust and interdependence between agencies and the public, strengthening the effectiveness of the TFFT in the Basin. The TFFT has taken leadership one step further by instilling members of the public to be leaders within their neighborhoods and communities.
Given the comprehensive nature of wicked problems, involving and empowering leadership at multiple levels gives the potential to craft effective solutions. Each community and neighborhood is unique and instilling leadership within the local citizens that live within them will help craft solutions to meet those specific needs. “So we're empowering them to actually do something about it in their neighborhoods, I think it's been really successful” (Respondent 12, 2020). Using neighborhood leaders that are local citizens to help push the message and include their neighborhoods in the effort helps perpetuate the comprehensive WUI treatments the TFFT seeks to accomplish. Respondent 4 states “great leadership that has helped form the relationships between external agencies” (2019). It has been essential to the fuel treatment successes of the TFFT within the Lake Tahoe Basin WUI. The multitude of leadership styles that exist within the TFFT characterize traits that exist across much of the collaborative literature. The IC of the TFFT is in many ways synonymous with the CCB described by Weber & Khademian. The common leadership traits described above and “trickle-down” leadership that occurs through all levels of the TFFT is largely responsible for the successful collaboration and other accomplishments described previously, as well as providing a positive outlook for the future.

**Obstacles/Recommendations**

The collaborative dynamic of the TFFT has reduced transaction costs and created the kind of holistic, coordinated resources that assist with strategic decisions such as the pre-attack plan and evacuation mapping systems. It also created new synergies that allow for multiple agencies to join together more effectively to find new sources of funding. Despite these accomplishments, TFFT members interviewed for this research still believe they can benefit
significantly from additional capacity in their battle against wildfire in the WUI. Obstacles to successfully reducing catastrophic wildfire in the WUI fall under two main categories: capacity and regulatory policies. These obstacles have been identified by members of the TFFT and will continue to pose challenges to the team in the future.

**Capacity:**

The first obstacle noted is a lack of capacity to implement all necessary fuel treatments within the Tahoe Basin. Capacity as it relates to fuel management is broad in its definition, but the following paragraphs will address the specific types of capacity that respondents feel are still hindering the TFFT from more fully reducing the threat of catastrophic wildfire in the Tahoe Basin’s WUI spaces. As stated previously the loss of funding and decentralization of the USFS has led to the lack of personnel to adequately treat the forested landscape at the pace and scale that is being asked of them. This has led the USFS to outsource to other agencies and third-party contractors, and the TFFT collaborative has lowered the transaction costs and facilitated the expansion of USFS capacity in this regard. “The Forest Service [by itself] doesn't have the personnel to do it. One, the government way is to stimulate small business and not take over everything. So part of that collaboration as well is we [the USFS] get the grants and then we give that money out to other entities to help our department” (Respondent 1, 2019). Yet, even with the additional capacity provided by TFFT and adequate funding, which the Feinstein budgetary borrowing act of 2017 was designed to address, having adequate employees is still essential to implementing fuel projects across the landscape. “We don't have enough people to do those
projects. Sometimes we have the money, we just don't have the staff to be able to do it” (Respondent 2, 2019).

In addition to lacking trained agency personnel, the general lack of contractors, machinery, and forest product infrastructure also present constraints to increasing the degree of fuel treatments required to adequately contain the wildfire in the WUI threat. As one key TFFT member explained, “there's a general recognition that even more treatment is needed. So the obstacle to that is … just [that] the infrastructure to process material is lacking. Whether it's a mill or a biomass facility, or the hand crews that that are needed just to simply go burn piles” (Respondent 4, 2019). In addition, “[t]he other challenge is qualified contractors or qualified fire crews. Sometimes we'll get a window and you know, late November, but there's nobody to conduct the burn” (Respondent 7, 2019). As might be expected, neighboring fire departments and agencies have offered up their resources as a temporary fix to fill the voids, but respondents do not consider this as an adequate long-term solution. Moreover, while the TFFT has the capacity to help its partners handle large sums of money and identify projects to apply the funds, increasing these specific fuel management capacities in the Tahoe region can facilitate a better, more effective distribution of resources and funding secured by the collaborative. Doing so likely can mitigate “the primary obstacle that we are trying to deal with right now--building durable forest capacity at a greatly increased scale” (Respondent 3, 2019). In short, even though the collaborative dynamic of the TFFT has increased capacity in all the areas described above, it is still not enough according to the experts familiar with the Tahoe forest landscape.

Recommendation:
The TFFT has identified where many of the capacity constraints within the Tahoe Basin exist. This in itself is a significant step in the right direction to resolving this. The TFFT should continue to search for ways to appropriate funding to fire districts and agencies to build capacity, while not sacrificing already existing capacities in other areas of the Tahoe Basin. Agencies such as the USFS should look too incentivize ways for employees to stay in positions for longer periods of time, or look to increase recruitment into vacant positions.

Policies:

One of the advantages to being a part of the TFFT was the ability to work with regulatory agencies and gain a better understanding of how to navigate the regulatory policies that dictate treatments across a forested landscape. Members of the TFFT still found this to be one of the primary obstacles to deal with and multiple respondents noted the difficulties and complexities associated with navigating the NEPA, CEQA, and CAA processes.

The NEPA process can be complicated and time intensive to navigate when implementing a project on the federal landscape. "If we didn't have to spend years getting a project through a certain process, NEPA, or other things like that, then we could go in and do what's right for the land" (Respondent 1, 2019). California took federal regulatory policy one step further in 1970 when they created the state equivalent, which is known as the California Environmental Quality Act (CEQA). CEQA has been described as “The tail that wags the planning dog in California. There is nothing quite like it anywhere else in America” (Fulton, 2015, p.13). Respondents noted that it can also pose complications for projects implemented on state lands. “One obstacle
certainly is permitting and we have to find a way to streamline the permitting process for projects across the landscape” (Respondent 4, 2019).

In addition to these broad landscape level policies, the Clean Air Act (CAA) poses constraints in California associated with emission and particulate matter which can be problematic as it relates to prescribed fire. Fire officials in California often speak to the difficulties associated with implementing prescribed fire due to air quality concerns (Baggett, 1993). The CAA can hinder the amount of smoke being emitted through prescribed fire, so even while social consensus can be high for an increase in both pile and prescribed burns across the state, the CAA can still hinder the amount of implementation done with this form of fuel treatment. “There are only a certain number of days that would otherwise be okay to burn because of air quality concerns” (Respondent 8, 2019). In addition to the CAA, respondents also noted that even when air quality conditions are in favorable for prescribed fire, other conditions such as local weather factors or a lack of personnel to conduct the burn can effect the ability to implement it. “The biggest hurdle is that we don't often get enough of a burning window” (Respondent 7, 2019).

**Recommendation:**

This recommendation will require more than the TFFT to resolve and will involve policy and lawmakers. The TFFT has provided a forum for agencies to come together and collectively reduce the cost of navigating regulatory policies as they relate to fuel reduction. The TFFT needs to continue to collectively present their policy concerns and constraints to lawmakers. External
pressure applied to lawmakers by groups such as the TFFT should help to continue to shift regulatory policies in California in favor of reducing fuel loading across the landscape.

**Conclusion/Lessons Learned:**

**LESSON #1: Creating a common forum employing a collaborative dynamic increases the chances of solutions that reach across landscape boundaries that are inherent in wicked problems.**

What has the TFFT done to reduce the threat of catastrophic wildfire in the Lake Tahoe WUI space? The TFFT serves as a decision-making and problem-solving forum that reduces transaction costs and lower barriers to collective action, thus facilitating action(s) that otherwise would not have occurred, with both horizontal and vertical movement. Horizontal in that TFFT works across broad geographic and agency layers to accomplish the same goal. Vertical in that as it runs up the chain of command and ICS structure it is comprehensive enough to not miss critical pieces or leave fire vulnerable areas. “The only way it is going to be effective is if we blur the lines between jurisdiction” (Respondent 1, 2019). This research suggests there are more effective solutions when there are more actors involved.

These achievements demonstrate specific instances in which the TFFT and its partners are utilizing a collaborative approach to make the Lake Tahoe Basin better prepared for a catastrophic wildfire. The TFFT has brought a checker-boarded map of diverse ownerships, land management agencies, and fire departments to the same table. “After 20 years of working on the checkerboard approach, you start to fill in all the gaps. So what was the checkerboard doesn't really look like a checkerboard anymore” (Respondent 4, 2019). This has generated
interdependence between all of the actors involved echoing concepts described by Weber, 2016; Thomson & Perry, 2006; Ostrom, 1990. This interdependence has allowed the TFFT to direct grant dollars, helping the team take on larger, more continuous projects than would have previously been possible.

Collaborative governance in this case proves to offer real solutions to resolving wicked problems as they relate to catastrophic wildfire. Collaboration provides a forum for a multitude of stakeholders to blur boundaries and create common goals, whereas a singular approach can create adversarial conditions. Creating a forum, getting everyone to the same table and creating a set of common goals that lended itself to implementing comprehensive solutions was essential with the TFFT and the multitude of agencies associated with it (Daniels & Walker, 2001; Weber, 1998).

**LESSON #2: Using collaboration increases public education and support for primary goals.**

The TFFT effectively demonstrates knowledge-sharing and communication between the public and agency partners. This transparency and open line of communication has not only proved to be critical in the successful execution of collective fuel reduction projects, but is also another crucial piece to successful collaboration. It has allowed all of the fire departments and land management agencies in the Tahoe Basin to collectively create a message to send to the public and use the TFFT’s Fire PIT as a platform to effectively do so. This has in turn heightened the education of both the public and like agencies in the Tahoe Basin, allowing for stronger agency and public support to reduce high fuel loading across the landscape.
LESSON #3: Hierarchy and collaborative processes may not be as diametrically opposed as many scholars and practitioners have led us to believe.

The TFFT helps illuminate the flexibility of collaborative governance and its ability to work effectively within bureaucratic systems defined by fragmentation and separation. The use of the top down, hierarchical ICS “emergency management” structure to pull all the agencies and stakeholders into a decision-making system with a common purpose will undoubtedly be useful when the next major fire in the Tahoe WUI occurs. It also shows that this uncommon marriage between a top down structure and the defining collaborative dynamic inside of the TFFT in non-emergency settings can provide significant success, as the many program successes of TFFT demonstrate.

LESSON #4: A diversity in positions and styles of leadership enhance and cultivate continued success in the collaborative setting.

Across the literature there is consensus that strong leadership adds to the collaborative element. The opportunity for a multitude of leadership styles to exist within a collaborative setting described by Emerson in 2015 has been evident in the case of the TFFT. The strong presence in the community, ability to spark motivation, and drive to create cooperation between actors was emulated by Dr. Miller and Chief Zurich, who acted as initiating leaders and were instrumental in the creation and initial successes of the TFFT (Emerson, 2015). Continued success of the TFFT was also largely driven by the last two incident commanders who demonstrated numerous qualities of a collaborative capacity builder (CCB). The long-term invested approach, strong communication skills, fostering interdependence and the ability to keep the collaborative on task have all been present throughout the existence of the TFFT (Weber
& Khademian, 2008). The TFFT takes leadership one step further. Utilizing the ICS system, leadership has been instilled at every level of the TFFT, trickling all the way down to members of local communities and neighborhoods. The diversity and encompassing styles of leadership displayed by the TFFT demonstrate that not only can elements of collaboration be successful in unorthodox systems, but so too can multiple styles of leadership.

Whether it be an initiating leader, the collaborative capacity builder, or the Incident Commander of the TFFT; leadership must be present (Emerson & Nabatchi, 2015; Weber & Khademian, 2008). The TFFT demonstrated numerous types of leadership throughout different layers and phases. Each of those leaders being influential in the successes in the Tahoe Basin. By instilling leadership at multiple levels, you can help generate motivation among stakeholders and sustain the sense of “urgency” needed to combat wicked problems. The TFFT has created a strong structure that allows leaders from multiple agencies to come together and collectively give their leaders intent.

The combination of all these collaborative factors has led to a number of positive-sum outcomes for the TFFT. The “sweet reward” from collaborative governance described by Ansell has helped contribute to 42,059 parcels inspected and 66,885 acres treated in the Tahoe Basin (2008). This, with all of the other achievements described previously, has helped the TFFT reduce the threat of catastrophic wildfire in the Lake Tahoe Basin.

*Future Research:*

Future studies on this topic should look to the Lake Tahoe West Collaborative as it develops and draw comparisons between it and the TFFT to examine the nuances between a
collaborative that deals with the WUI space and one that deals with a forest landscape level effort. Identifying other wildfire collaboratives and performing similar studies across the state could help to provide common themes and ways to standardize success as it relates to the topic and potentially make it more replicable. “If Tahoe can do it, anyone can” (Respondent 11, 2020).

The TFFT was born after the Angora Fire, towns that have experienced catastrophic wildfire in recent years such as Redding and Paradise should be researched to see how they have responded to these events. If collaborative or wildfire teams similar the TFFT have been established in the wake of these fires in places across the state, then exploring the structures and goals associated with potential wildfire collaboratives could be analyzed and compared. As these “mega fires” are a relatively new phenomenon, there should be significant opportunity to explore community resilience in the wake of them.

Identifying forest and fire collaboratives across the West and examining the influence they have had on state and federal regulatory policies as well as policymakers could help illuminate factors as they relate to fuel treatments across the landscape. Future research should also examine the role of leadership and the links between it and successful collaboration and the relationship to reducing catastrophic fire in the WUI.
References


http://calfire.ca.gov/about/downloads/Strategic_Plan/StrategicPlan_Mission.pdf

https://www.fs.fed.us/about-agency/what-we-believe


