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WA State DNR Summer Wildfire Fighting

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Internship Title: Washington State Department of Natural Resources, Northeast Region, Summer Wildland Firefighting

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Learning Objectives

I have done numerous reports on the environmental impacts of wildfires prior to this internship. On topics ranging from increased erosion rates after wildfires, higher amounts of dissolved organic carbon, increased suspended solids in bodys of water, various negative impacts on aquatic invertebrates; the loss of riparian vegetation that is accompanied by exposure to extreme heat, as well as decreased levels of dissolved oxygen amongst many other things. Before this internship my learning objectives for the summer were numerous, but the main focus was to see first hand the ways in which wildfires are mitigated; there is no foreseeable end to the ways climate change will make wildfires worse so the focus on preventative measures is essential to the preservation of our forests. Overall some of my other learning objectives included studying various wildfire suppression techniques, learning about post wildfire rehabilitation strategies, gaining a greater understanding of forest ecology, learning about how different wildland firefighting teams are deployed along with the strategies associated with wildland firefighting in general, viewing how natural water resources are used and affected by wildfires as well as seeing firsthand how different water quality parameters are impacted by wildfires. In addition to these learning objectives I planned on this experience to help contribute to my educational goals by providing me with a foundation that will allow me to pursue many other careers and fields within natural resources and forestry, along with training and observations that will help further my knowledge of environmental science as a whole.

Background

The Washington State Department of Natural Resources (DNR) has six different regions in which wildland firefighters are employed statewide; they are the Olympic, Northwest, South Puget Sound, Pacific Cascade, Northeast, and Southeast Regions. I was in the Northeast region which covers Okanogan, Ferry, Stevens, Pend Oreille, Spokane and half of Lincoln county. Within the Northeast region there are DNR wildland firefighting units in the Highlands, North Columbia, and South Okanogan areas. All of these locations have a different array of wildland firefighting teams. The South Okanagan location has entirely engine crews, each of these engines gets assigned to different areas they are primarily responsible for patrolling, the engine I was assigned to was one of three engines in the Methow Valley area, which extends North from the town of Pateros, up to Mazama, as well as the Western side of Loup Loup pass. The towns we were responsible for covering were Methow, Carlton, Twisp, Winthrop, and Mazama. DNR jurisdiction is as far as ten miles laterally from some of these towns, before it becomes forest service land. In many instances multiple agencies would respond to fires, but only one would be responsible for the fire once contained. On a day to day basis each of the three engines in the Methow would be assigned to patrolling their own portion of the Methow, North valley, South

Valley, and the Loup Loup area, the engine assigned to each area would spend a majority of their day there.

Wildland Firefighting Modules

Within wildland firefighting there are numerous jobs, with varying skill sets and overall objectives. Hand crews and Hotshot crews have many similarities, they are made up of 18-22 personnel, they are essentially the same thing but the main thing that separates the two is the amount of qualifications each crew has. Hotshot crews are required to have more qualifications amongst the members of the crew and with that almost always comes more wildfire experience. Both types of crews are held to high fitness standards but hotshot crews are slightly more demanding. While not on fires handcrews and hotshots do project work which consists of forest thinning along the sides of roads, prescribed burns, and physical training. While on fires hand crews and hotshots are very versatile, they both can both construct handline, perform burnout operations, and perform initial attack, which is when the first resource to be deployed to a fire fights aggressively to put it out before the fire has an opportunity to grow large and out of the stage where it can be out out in a timely manner.

(Figure 1. Going on hikes as a unit is a frequent forum of physical training)

Another type of wildland firefighting is helitak and rappelling which are quite different but similar in the way that they both surround the use of helicopters. Helitak is when there is a helicopter capable of doing bucket drops of either flame retardant or water on a fire, on a helitak crew there is a pilot and firefighters which are dropped off near the location of the fire and communicate with the pilot to direct the bucket drops. Helitak may be used for initial attack on small fires but they are frequently utilized on large fires as well.

Rapellers are ground based firefighters that utilize helicopters to be transported to remote fires. Rapellers, like their name suggests, repel from the helicopter down to the fire, this allows them to get very close to a fire in various types of rough terrain including heavy timber, many of these places are inaccessible to other types of firefighters. After rapellers have reached a fire they can control it with different hand tools as well as the use of helicopters for bucket drops. When rapellers are deployed to a fire they need to bring the adequate resources with them to be self-sufficient on the fire, and while it is easy to rappel into rough terrain it is often difficult to carry everything out. This in turn makes rappelling very physically demanding, rapellers are held to high fitness standards annually, with an arduous rookie training bootcamp to get into the program in the first place. Rapellers are required to have quick response times to fires, their main purpose is to serve as initial attack for small local fires, in turn when rapellers are not on fires they primarily wait and do physical training to maintain their quick response times to new fires.

Smokejumping is one of the most selective types of wildland firefighting, there are only nine smokejumper bases nationally, it is also a very well known type of wildland firefighting. It is very similar to rappelling in that its sole purpose is to serve as an initial attack on small fires in very remote locations. The key difference though is that smokejumpers are deployed by jumping out of a plane using a parachute to get to fires. Like rapellers, smokejumpers need to be self sufficient for even longer durations of time, they also need to be constantly available for rapid deployment to small fires. Smokejumpers need to maintain very high levels of fitness, when leaving fires they need to hike long distances back to roads rather than a helicopter pick up point, often carrying a large amount of weight. When they jump there is a separate box of cargo dropped, also attached to a parachute, that holds all of the necessary equipment needed to control the fire. This cargo includes chainsaws, hand tools, gasoline, food and water to sustain the jumpers for multiple days, as well as many more pounds of other cargo.

There are multiple types of fixed wing aircrafts used for aerial firefighting, with varying sizes ranging from type 3 to type 1 and then the largest being very large air tankers (VLATs) which can carry over 8,000 gallons of water or retardant. Aircrafts are commonly used on all sizes of fires, they typically require a firefighter to be on scene to direct the drops. Maintaining constant radio communication with pilots during drop operations is essential due to the high consequence of a drop landing on firefighters on the ground. Planes can refill their tanks in

bodys of water by flying low and scooping water while moving, which makes them a very efficient resource. Aircrafts can also provide a good visual of the fire for firefighters on the ground, especially when fires get large.

Engines

Wildland firefighting engines are large trucks that come well equipped with various tools so they can deal with a wide array of circumstances, particularly fires with nearby road access. Engines are made up of three to four crewmembers. They typically carry hand tools, chainsaws and a tank of water on the back of the truck. There are many different sizes of engines, but ours carried 450 gallons of water, to be used sparingly. The purpose of engines are to serve primarily as initial attack, but most commonly in locations where they can drive, usually surrounding the urban wildland interface.

(Figure 2 and 3. Our engine has multiple compartments on each side, with a large water tank between the compartments. Luckily our engine was brand new)

While engines are required to have short response times to fires, they are essentially always mobile, this allows for engine crews to do physical training as needed and work on tree thinning while not on fires or when there is no need to patrol. Engines are very good at providing the initial attack for small fires, largely due to the water they carry, engines in turn have a large amount of hose. It is essential to train rigorously on hose deployments in order to knock down a fire in a fast and efficient manner, so training on hose lays is a common occurrence.

(Figure 4. One of the side boxes is for hose rolls, one roll has a nozzle pre connected for speed, the green packs are filled with two different sizes of hose as well as a nozell and a Y valve for when the fire calls for a progressive hose lay. It is a lot funner to get the hoses out of the hose packs then get them back in)

Engines can also be deployed to large incidents as they are capable of constructing handlines and doing burnout operations just like any other wildfire crew. While engines do carry water, overall it is very little so engines can easily run out and be required to resort to other means. On the back of the engine there is a pump that engine crewmembers need to become very familiar with, when dispatched to a fire, it will frequently be someone's job to run the pump.

When a fire is too far from an engine to make a hoselay practical, we resort to using hand tools and chainsaws, as well as things called bladder bags, essentially a backpack full of water.

(Figure 5. The pump has multiple discharges, and can also be used for drafting water into the tank, which is when you suck water out of a nearby water body, you can even do this while actively spraying water on a fire using one of the discharges and a hoselay. The control panel for the pump is pictured at to the right. Pump operators will pay special attention to the psi in order to not blow the pump)

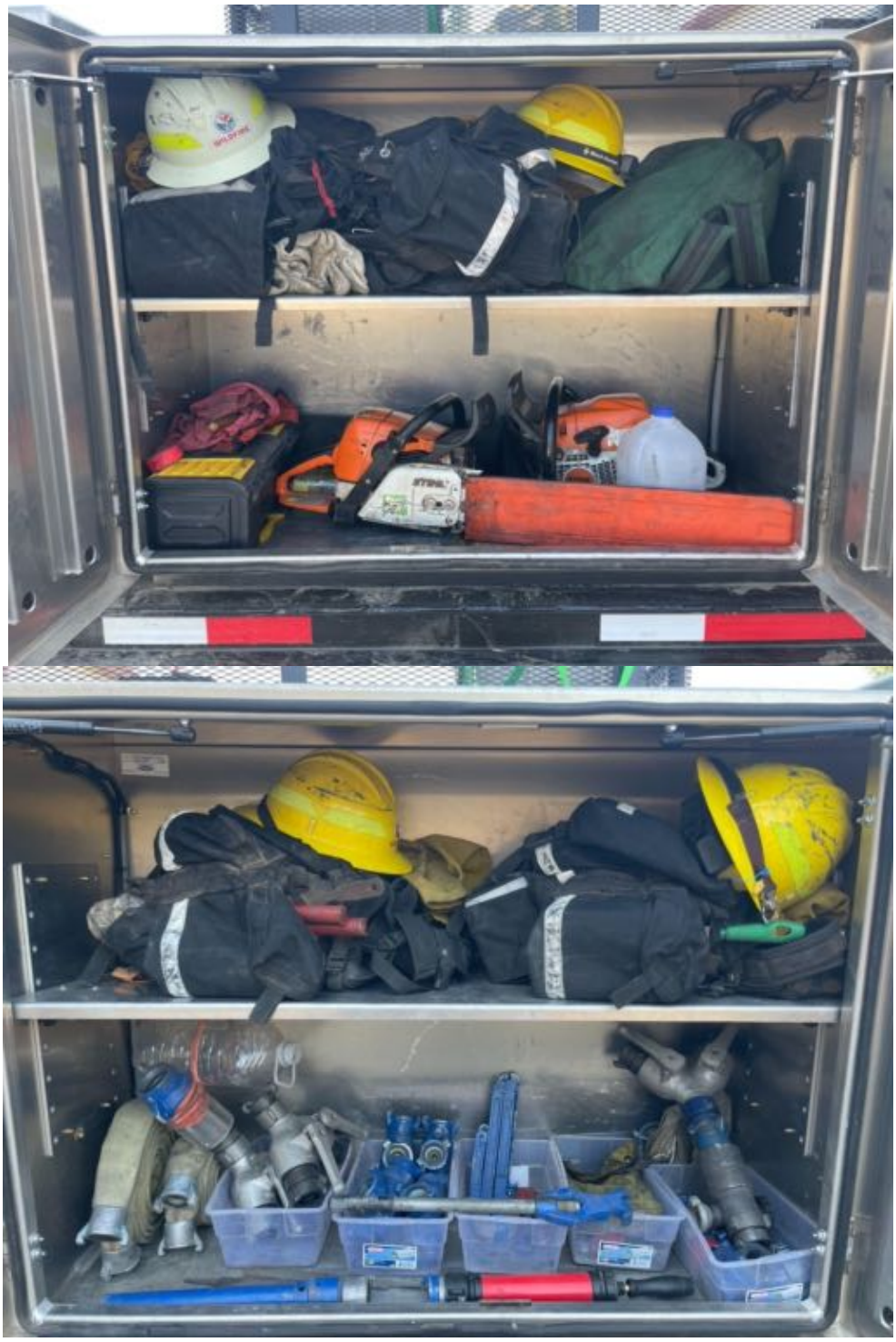
(Figure 6. The live reel, the live reel is a hose an inch in diameter that can easily be pulled out of the drum, it is mainly used when fires are very small and nearby the engine. One of the downsides of the live reel is it is very hard to retract fast, so if a fire grows and you need to change locations that can present difficulties)

(Figure 7. Each engine has an assortment of hand tools, when crewmembers hike into a fire they generally carry a variety of hand tools to best construct the handline. Figure 8. The bladder bag is a backpack that hold 8 gallons of water, the end of the tube connects to the pack and water is sprayed out of the brass nozzle when it is pumped, they are heavy and leak)

The Job

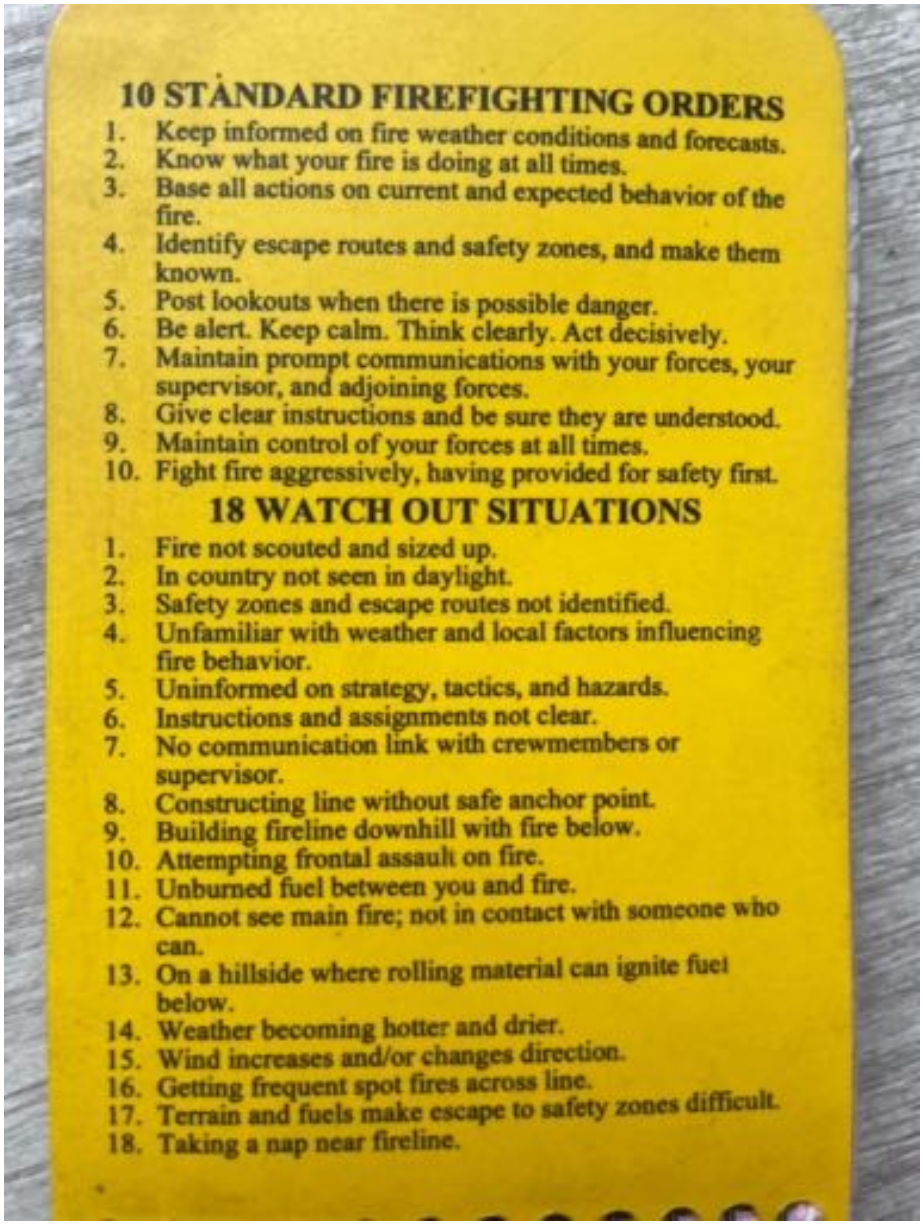
When I got to Omak in mid June the fire danger was very low, it was actually quite cold and wet, considering it would at times over 110 degrees fahrenheit. The first few days were very introductory, most of it involved classroom type learning on things like safety and policies with intermittent physical training. Prior to beginning work everyone was required to take a total of five courses online, the FEMA ICS-100, introduction to the incident command system, FEMA NIMS-700 introduction to the national incident management system, L-180 Human Factors in The Wildland Fire Service, S-130, Firefighter Training, and S-190 Introduction to Wildland Fire Behavior. So there was not a whole lot of basic things left to learn, mostly familiarization with the equipment we needed to use. After a few days of that we were assigned to our engines, mine would be in the Methow valley, where I would eventually move to. Shortly after that we had something called a field day, which is when we go out and have a mock fire where we dig

handline then have to deploy our fire shelters. Deploying the fire shelters was very eye opening and hot, it will forever be a reminder that I never want to be trapped in a burnover.



(Figure 9 and 10. The upper compartments on the sides of our truck are for packs and other protective equipment. On one side we keep a toolbox as well as our two chainsaws. The bottom of the other side is used to store all of the fittings for our hoselays, as well as hose clamps, Y valves, ball check valves to prevent water from flowing backwards through the pump. A foot valve for drafting from water sources, as well as a hydrant wrench and a plethora of different types of nozzles)

For the rest of June me and the other members of the engines in the Methow remained in Omak to train on doing different types of hose lays, drafting and using hosepacks. We would do physical training every day, which usually consisted of running on the airstrip, calisthenics, or going on hikes with our gear. We were required to take a CPR and first aid class as well, as this job can be slightly dangerous at times there is a large emphasis on safety. Every day we go over a weather briefing, which also covers fire activity nationally and locally. On top of this we go over something called six minutes for safety which is about past mishaps or hazards and how they can be avoided. Every firefighter is issued an Incident Response Pocket Guide (IRPG) and they are required to keep it with them at all times. It is a great resource for firefighters as it has so much pertinent information, we would frequently discuss the 10 standard firefighting orders and 18 watch out situations on the back cover.



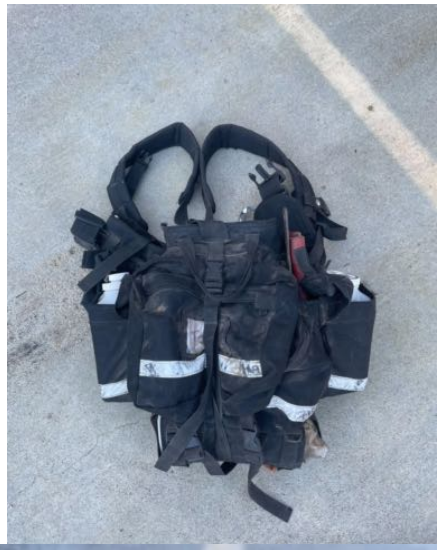
10 STANDARD FIREFIGHTING ORDERS

1. Keep informed on fire weather conditions and forecasts.
2. Know what your fire is doing at all times.
3. Base all actions on current and expected behavior of the fire.
4. Identify escape routes and safety zones, and make them known.
5. Post lookouts when there is possible danger.
6. Be alert. Keep calm. Think clearly. Act decisively.
7. Maintain prompt communications with your forces, your supervisor, and adjoining forces.
8. Give clear instructions and be sure they are understood.
9. Maintain control of your forces at all times.
10. Fight fire aggressively, having provided for safety first.

18 WATCH OUT SITUATIONS

1. Fire not scouted and sized up.
2. In country not seen in daylight.
3. Safety zones and escape routes not identified.
4. Unfamiliar with weather and local factors influencing fire behavior.
5. Uninformed on strategy, tactics, and hazards.
6. Instructions and assignments not clear.
7. No communication link with crewmembers or supervisor.
8. Constructing line without safe anchor point.
9. Building fireline downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and fire.
12. Cannot see main fire; not in contact with someone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather becoming hotter and drier.
15. Wind increases and/or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. Taking a nap near fireline.

(Figure 11. The 10 standard firefighting orders, the first three have to do with weather, fire status and fire behavior, the next three emphasize the safety of personnel, the next three are about proper communication and the last cannot be completed if the previous nine have not. The 18 watch out situations are things that firefighters should be alert for and are more cautionary)



(Figure 12,13, and 14. Personal protective equipment is heavily emphasized, at all times on fires we need to have fire resistant nomex pants and a nomex long sleeve shirt on, called our yellows and greens, because the shirts are yellow and the pants are green. We also have a minimum of 8 inch high fire resistant boots that are usually made out of durable leather, eye protection is also required along with a hardhat and earplugs for people working with a chainsaw. Our packs, also called line gear, are outfitted with a minimum of 4 quarts of water, a file for sharpening tools, a first aid kit, two fuses, and lastly everyone carries a fire shelter. Anything extra in the pack is up to the crewmember, although more things such as food and spare things like gloves and boot laces are highly very recommended)

In the beginning of July we had the chance to take a chainsaw class, where we learned about chainsaw maintenance, proper cutting techniques and safety. It was very interesting and informative. Shortly after that we began to work entirely in the Methow valley, mainly doing project work and becoming familiar with the area. Project work is essentially wildfire mitigation, we go to portions of state land and cut down all the small trees and leave the larger ones, this makes the forest less dense and susceptible to large burns, it also leaves more nutrients available for the larger trees so they can grow more. Most of the trees in Eastern Washington are either Ponderosa pine, Western larch, Lodgepole pine, and Douglas fir, when these trees get large, specifically the Ponderosa, and Larch the limbs closer to the ground die and fall off as a preventative adaptation to fire lighting the canopy of the tree. As we cut the small trees down, we cut them into 6-8 foot long pieces and pile them, to be burned in the late fall or early spring, to reduce the fuels on the ground if a fire were to burn through the area. We mainly did thinning along the sides of roads, not very deep into the forest, this is because roads act as a barrier for fire, and if there is reduced fuels on each side of a road it is less likely for a fire to jump the road. Thinning the entire forest would be ideal but is completely futile. In total amongst the eight people I regularly worked with, we probably thinned less than three miles of area, it is time consuming and when the fire danger goes up we are required to either shut the chainsaws off for the afternoon or not allowed to run them at all. Another thing we will do for project work is fell trees deemed hazardous, usually along the roads of previously burned areas, so they don't fall on anyone using the road. It was actually a lot of fun learning how to fell trees and use a chainsaw.

(Figure 15. The two chainsaws we kept on the truck, a Stihl 290 and 362, the 362 was to only be sharpened by the engine lead, it was also called the fire saw, because if we were on a fire we would only run the 362. The 290 could be sharpened and cleaned by crew members)

(Figure 16 and 17. The green bag pictured is called the saw bag, we would take it out with us everytime we were cutting, it contained two pairs of chaps, an extra chain, multiple files for sharpening the chain, a few extra parts for the chainsaw, different size wedges for felling large trees, a tourniquet with a few more dressings and two sig bottles, one filled with two stroke gas and the other filled with oil for the bar of the chainsaw. When we went to fires this would also come with us, however the larger gas also called the dolmar, and falling ax would not. The dolmar has two compartments, one for two stroke gas and the other for bar oil. The falling ax was mainly used for sounding trees and pounding in wedges. Sounding trees is when you cut off a chunk of bark and then hit the butt side of the ax against the tree to see if it sounds solid or rotten, if it is rotten you will likely reevaluate if it needs to be cut. Larger trees occasionally need to have wedges put in, with smaller trees you can usually put a cut in them and then give them a gentle push to cause them to fall, when cutting larger trees placing wedges and hitting them in takes the place of pushing them over by hand.

Over the course of the remainder of the internship we thoroughly trained on hoselays and other necessary training, such as running the pump, drafting, radio communications and things like mock fire drills. We also continued to do project work regularly until there were a few incidents in the unit which sadly limited the amount of saw work we could do, luckily no one was injured. As project work is really the only mitigation strategy that is feasible for us to do, I found it frustrating that we were unable to do it at times, due to the accidents the whole unit was shut down from doing saw work unless a highly qualified cutter was present, which there were very few of. However on the days we were able to cut, I made sure to make the most of it.

With limited amounts of project work, we began doing slightly more physical training, along with slightly more sitting around and waiting for fires. Once we began to have fires in the area it was interesting actually getting to apply the training we had received. When we first arrive at the fire we either knock the flames down with water or call in an airdrop. This prevents the fire from spreading while we encircle it in a handline with our tools and chainsaw, if there are any still burning spots or chucks of log we put them out with either more water or cut the logs up and piling them. Next if there is any large spots of unburned fuel between the fire and

(Figure 18. It is important to learn about radio communications, we use radios constantly, to check in, in the morning and out in the evening, as well as give frequent updates on our location and status so dispatch knows what units are available and closest to incidents. Each engine gets two handheld radios, along with another in the truck, as well as a CB radio in the truck. Getting familiar with the different zones and channels is especially important when going to fires. Just remember, everyone is listening)

the handline they need to be burned out, a burnout is as the name suggests, when you take a drip torch or a fuse, and light the fuels on fire. This only happens when it is necessary and when there is a low likelihood of the fire blowing up and jumping the line. After all the unburned fuels have been burned or removed, and there are no active flames, the next thing to do is mop up. Mop up is when everyone gets in a line on the fire, sometimes many people are required for this to happen, and they walk in a line, called gridding. Each person holds the back of their hand above the ground and waits until they feel heat, when they do they yell out and everyone stops, then they disperse the heat with their hand tool. Once there is no longer heat, the line moves again until more heat is found or you reach the other end of the fire. After the fire has been mopped up, it will be gridded several more times until it is officially called out. We became very familiar with mopping up.

All but one of the fires we went to were caused by lightning, it is a big concern when lightning storms come through the valley. When they do we usually patrol directly after and for the next few days following the storms. The Methow valley area has had very large fires in the past, so people are very cautious, after lighting storms we usually had many false alarms that people called in thinking a cloud or fog was smoke. It is very common for large amounts of wetting rain to accompany lighting storms, although dry lighting does happen. Sometimes lighting strikes can hold over for multiple weeks until smoke or flames show, these are called holdover fires. While some fires are man made, the people who start them can get caught. Unless the cause of the fire is obviously natural then an investigator will come, there have been very large fires caused by arson in the recent past.

Over the last few weeks of the internship the weather gradually began to change, it got cooler. There were a few lightning storms but it was too wet for anything to start. We continued to do project work when we could, hike, and patrol the lighting strike areas when there was a need to. When there was free time we would train on less general things that we would still encounter like how to go about medical evacuations, calling in aerial support, and things like tree and plant identification, as well as learning about some of the local insects. While patrolling it was very interesting seeing all of the land burned by previous fires, there were many fires that all had different levels of regrowth. The size of some of the fires is incredible and in some cases hard to imagine what it was like when it was all on fire. Growing up on the Westside I was used to the smoke in the late summer but the communities in the Methow have an entirely different view, fires can have tremendous impacts, from destroying homes or making the valley hardly inhabitable from smoke. Seeing these past burns made it clear to me that when the fire wants to move, nothing can stop it.

(Figures 19-22. Drip torches are canisters filled with a 4 or 3:1 ratio of diesel and gasoline, they are transported with the spout inside and are very easy to set up. Fuses are similar to flairs but burn hotter and are not as bright, but don't worry they smell just as toxic)

(Figure 23. Snags, and trees with dead limbs or tops, often called widow makers, can be hazardous to firefighters walking under them or cutting them down. In post burn areas you will frequently hear dead snags fall. Figure 24. A hangup is when a tree falls and catches on another, making it difficult to bring to the ground and dangerous to be near. Figure 25. A stumphole is when a tree burns so intensely that the roots continue to burn making large tunnels that can collapse when walked on, this is especially dangerous when the fire has recently burned and the stumphole is filled with embers. Stump Holes have caused many firefighters to require a medivac for burns to their legs)

(Figure 26 and 27. While conducting burnout operations multiple people need to watch the handline to make sure no fire jumps the line. While lighting more things on fire may seem counterproductive, it is very effective. We learned in training that the safest place you can be in a fire is usually the hard black- where the fuels have already burned intensely, opposed to the green, which refers to areas containing unburned fuels)

(Figure 28 and 29. Fires often have the highest rates of spread on hillsides. This particular fire started from a lightning strike hitting a tree. If it had not been called in as quickly as it did and we didn't get an airdrop on it by a plane, it would have spread quickly up the hillside. Some lighting struck trees have been known to blow up, in this case it ripped a strip out of the bark all the way from the base to very top)

Conclusion

Overall I thought the summer was a great experience, I learned about many things that were completely new to me. This summer has given me a great amount of insight into how wildland fires are dealt with and what feasible mitigation strategies are. In the reports I have previously written regarding more of the environmental science side of things it was very easy to see what I thought was the solution; however by actually getting out and doing it I have gained a much better understanding of what our realistic possibilities are for fire mitigation, and how there should be a more of a focus on fire suppression before large mitigation strategies are implemented.

Before the season was up for me I knew I would want to do this again. This first season has given me the experience to pursue many different pathways and job opportunities within wildfire, some of which are very interesting. I greatly enjoyed being able to work outside all day, on top of that being in such a beautiful place. Having a job that allows you to hike, something I do in my free time makes it not feel like a job. As I have been getting closer to graduating I have begun to look for job opportunities after school. This season of wildfire has been a great thing to add to my resume, especially if I decide to continue to pursue a career in environmental science. Having wildfire experience while applying to many environmental science jobs that I have been interested in will be advantageous.

Everything I learned this summer, including the classes I had to take to get the required certifications, were all very different from school but at the same time very related to them. While there is a large emphasis on safety, most of what we do has to do with the environment. It is definitely less science based, but it has to deal with the cause of many environmental impacts that I have previously studied, which made the whole summer much more interesting for me. After the season was over I enjoyed looking back and connecting my previous coursework to the experiences I had this summer. I really want to take more classes, like forest ecology and plant soil interactions, and connect these courses with wildfire to further understand the environmental impacts of wildfires. It is hard to emphasize how meaningful I thought this internship was, I feel very lucky to have had the opportunity to go do it and learn the things I did. What really made it worth it was the group of people that I met. You can't say the job is enjoyable at all times, but I think the people I worked with could make anything fun. I couldn't ask for much more than learning some amazing things and making some life long friends.

Week	Hours	CondensedSummary
1. 6/16-6/22	**59.5**	General training and introduction, PT, assigned to engines, field day.
2. 6/25-6/30	**53.5**	Hose lay training, thinning, drafting, patrolling.
3. 7/3-7/6	**34**	Patrolling lighting strikes, CPR and first aid.
4. 7/11-7/14	**34**	Driver training, S212 class and field day.
5. 7/17-7/21	**42.5**	Sawwork and hose lay training.
6. 7/24-7/29	**54**	Sawwork, mop up, and hose packs.
7. 7/31-8/5	**59**	Chainsaw safety briefing, mop up, and smoke check.
8. 8/7-8/12	**59.5**	Patrol lightning strikes, drip torch training.
9. 8/14-8/19	**53**	Lookout, weather, and medevac training, smoke checks.
10. 8/21-8/26	**63.5**	Road brushing and sawwork, mop up.
11. 8/28-9/1	**43.5**	Patrol status, sawwork, checkout in Omak.