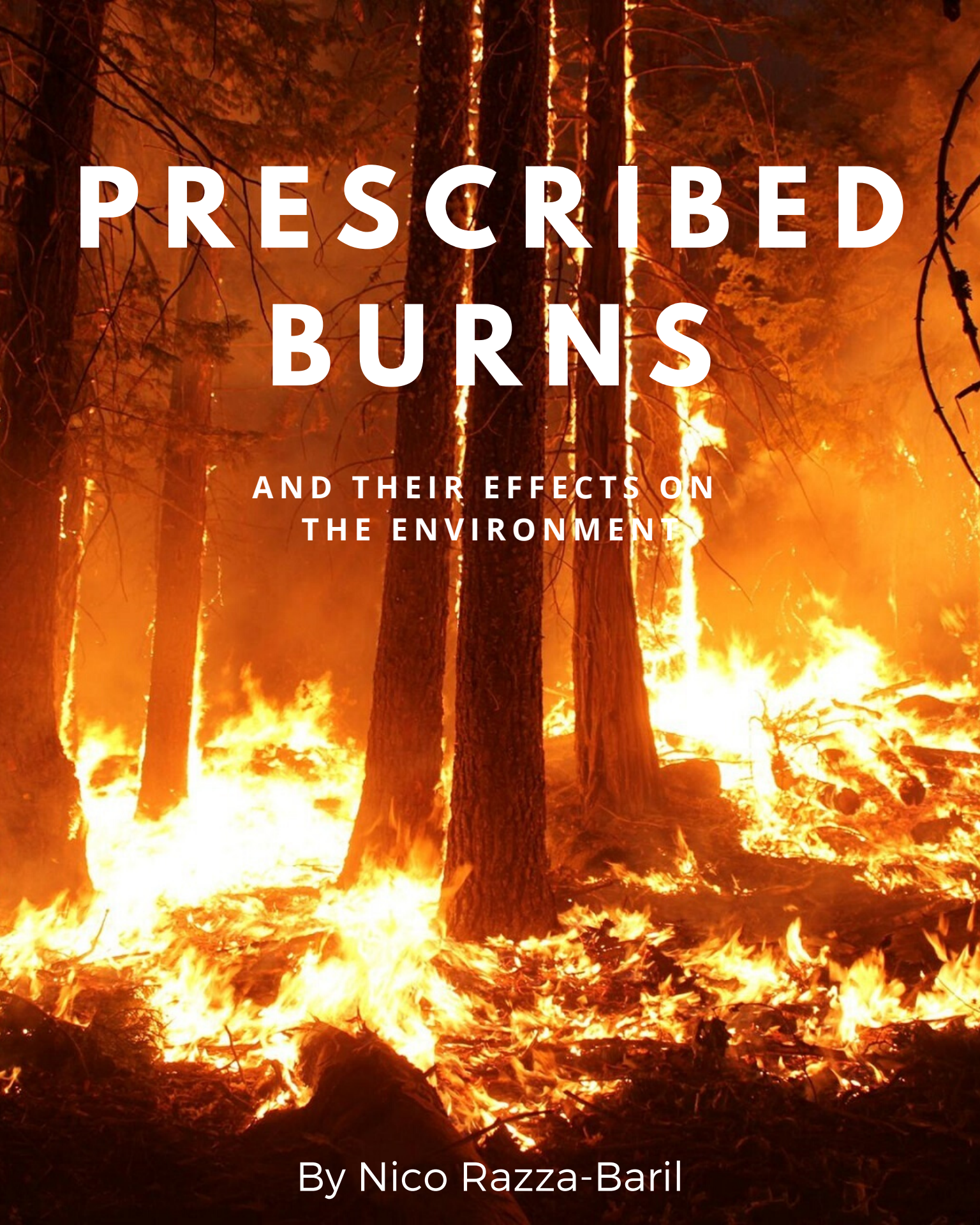


PRESCRIBED BURNS

AND THEIR EFFECTS ON THE ENVIRONMENT

By Nico Razza-Baril

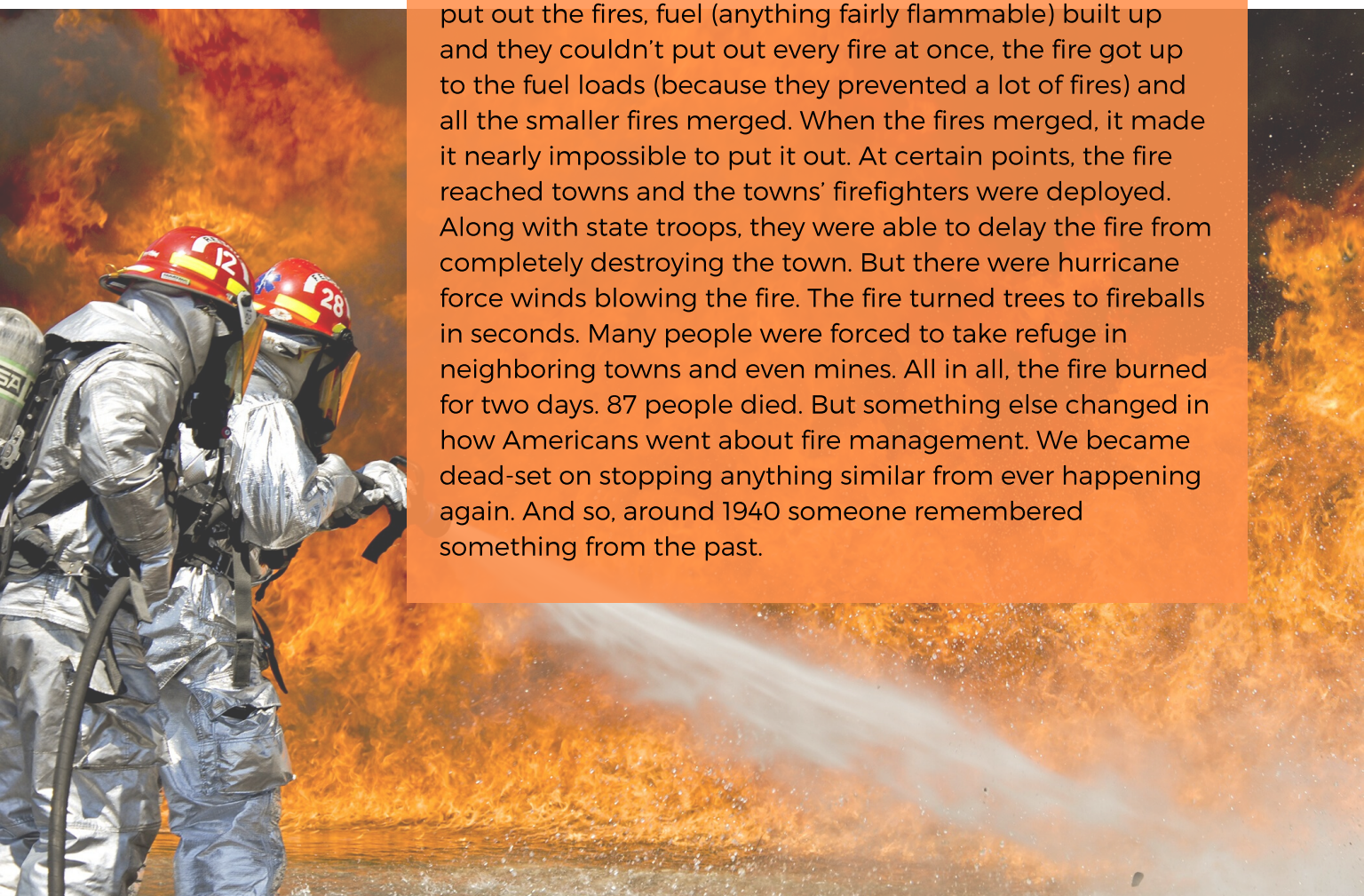
INTRODUCTION

Hi my name is Nico and my topic is prescribed burns. I chose prescribed burns because I have always been interested by fire. I first became interested with fire because of its unpredictability. While it's possible to predict how a fire will move you can never be sure, and that's the beauty of fire. My topic is related to sustainability because if you don't conduct prescribed burns the land becomes barren and there are a lot of fires (as discussed in my paper). While this is a little counterintuitive, if you understand how fire works it makes a lot of sense. Some of the things I'm still wondering about my topic are questions like, is anything not flammable no matter the temperature and do wood and leaves melt? One of the challenges I encountered during my independent study was a lack of sources that had rich information (specifically at the beginning and online). I'm really proud that I was able to get some good interviews in before the stay at home order.



THE BIG BURN

The Big Burn of 1910 was a massive forest fire composed of many dozens of smaller, normally inconsequential fires, but because of the number of tiny fires, it created an infernal furnace 4700 sq miles large. That's almost the size of Connecticut. It likely hit north Idaho and western Montana the hardest. Many of the smaller fires it was made up of were started by trains powered by coal spraying sparks onto the arid ground and trees that had less than 3 meters of water. In fact, the land was so dry, and so many fires kept starting, that the train company hired firefighters to put the fires out. The U.S. Government recognized the fires and deployed 4,000 state troops to put out the fires but even they couldn't put all of the fires out. This was largely due to the sheer number of fires big or small. So, as the firefighters put out the fires, fuel (anything fairly flammable) built up and they couldn't put out every fire at once, the fire got up to the fuel loads (because they prevented a lot of fires) and all the smaller fires merged. When the fires merged, it made it nearly impossible to put it out. At certain points, the fire reached towns and the towns' firefighters were deployed. Along with state troops, they were able to delay the fire from completely destroying the town. But there were hurricane force winds blowing the fire. The fire turned trees to fireballs in seconds. Many people were forced to take refuge in neighboring towns and even mines. All in all, the fire burned for two days. 87 people died. But something else changed in how Americans went about fire management. We became dead-set on stopping anything similar from ever happening again. And so, around 1940 someone remembered something from the past.



THE NATIVE AMERICANS HAD IT ALL FIGURED OUT

The term ‘prescribed burn’ (also known as controlled burn, controlled fire, and prescribed fire) refers to intentionally set fires for the purpose of clearing the ground of dead plant matter and fuel, and using fire to allow certain types of plants to reproduce. They are used to mimic the effects of natural fires. As I said at the beginning of my paper, someone in 1940 remembered prescribed burns. He didn’t invent them. (I’m saying “he” because it was not common for a woman to be a firefighter at that time). In fact, the Native Americans used prescribed burns thousands of years before the Europeans came around. The Native Americans mostly used prescribed burns to clear fields of dead grass and decrease the risk of wildfire. This allowed other plants to grow, and helped clear the land of debris. It is unlikely that they would use it to mimic wildfires, there were plenty of those already. Native Americans were able to control the burns in a similar fashion to those we see today. When it’s damp the fire’s less hot. The fire’s slower coming down a hill. It’s harder for the fire to move against the wind. These are some environmental controls to keep prescribed burns fairly safe. The more they did this, the safer prescribed burns became. Now that they could control prescribed burns, they were able conduct more without the high risk of the fire escaping into villages and towns. When you conduct as many fires as they did, the land starts becoming more dependent on prescribed burns. When one takes them away, the dead plants start to pile up, which is not at all helped by the fact that there aren’t natural fires to burn some of the brush. When the colonists came to North America, they saw fire as dangerous and evil. That’s it. To douse at all times. And we kept the tradition of always killing fires because the Europeans conquerors were able to defeat the Native Americans, and that means we remember them being the good guys. And so prescribed burns became illegal.



WILDFIRE

A wildfire is any fire that a human did not intentionally set. For instance, when someone lights a property (including state properties) on fire without checking with the authorities, this is arson. However, when they check with authorities and sign any necessary paperwork, this is a prescribed burn. A wildfire can be started by natural causes, such as lightning, or extreme amounts of heat. However, it can also result from human recklessness, for instance, throwing away a lit match or lighter or dropping a lit cigarette onto dry grass. If an area has a dry climate, the risk of fire is higher. But the important thing about wildfires, that many people do not realize, is that there are ecological benefits to burning a forest. For example after a wildfire there are fewer dead shrubs and more room for young plants to establish themselves and get more light for the young plants allowing them to grow faster. But, fire that's beneficial in California would be destructive in Connecticut. This is because when you introduce a new element into a new ecosystem the ecosystem suffers. For examples, pigs aren't native to the Americas and wild pigs can seriously damage the ecosystem if left unchecked. In fact they may have actually indirectly killed birds by eating much of the birds' food.

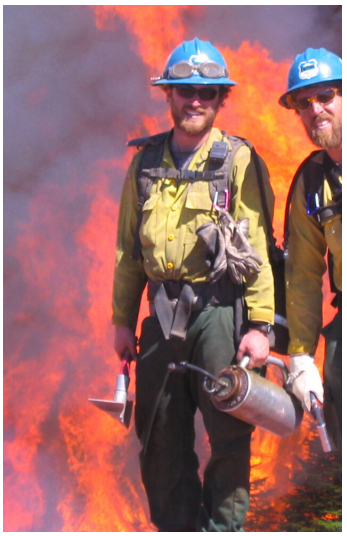


WHY DO PEOPLE MESS EVERYTHING UP?

We just learned about why humans need the natural fire cycle, right? But did you stop to wonder, “Hey I wonder what happens when humans put out wildfires?” Well if you did, great, because I’m going to explain it to you. When we interrupt the natural fire cycle by extinguishing naturally occurring wildfires, certain types of plants (and less frequently, animals) may die. For example, in Australia some plant’s seeds like Eucalyptus are coated in wax that melts off when there are fires. When this happens the seeds plant. They just found a way to grow tall while barely having to compete for sunlight. And when we come in with our prescribed burns we can overlook these things (for instance, this flower needs low-intensity fire, even though this tree needs high-intensity fires). But, as you might know, there are also benefits to interrupting the natural fire cycle. For starters, putting out fires keeps humans safer in the short term. Another benefit is being able to protect endangered species by making sure the fires don’t wipe them out.



INTERVIEW WITH ZEV BALSEN



Interview 1

Zev was a firefighter in California.
This is part of an interveiw I had with him.

About staying relatively safe in fires:

Zev: It's just going to be burning around the edge because as it spreads out the part in the middle runs out of grass, so what you end up with is this ring of fire and in the middle is just black, from fired grass. There's a grassy field and a ring of flames, so what you would do is, if you where standing here (around the fire), and the fire was spreading out too quickly, you couldn't run away from it, what else could you do?

Ripley: You could jump right through to get to the center?

Zev: Exactly, you could jump through the flame. If you happened to have water with you, you could spray some water, to cool down that part right in front of you and then go through it back into–so firefighters call that "keeping one foot in the black," meaning you always want to be close enough to that you can get back into the fire–counterintuitive, you're right–so you can back into the fire.

Nico: How do you know if the inside of a fire has burned out enough?

Zev: If it's like, cool enough for you?

Nico: Yeah.

Zev: So you don't know, necessarily, but it's almost always better then being in what we call "the green" which is like the part that hasn't burned yet, because that always has more potential to burn then the part inside does.

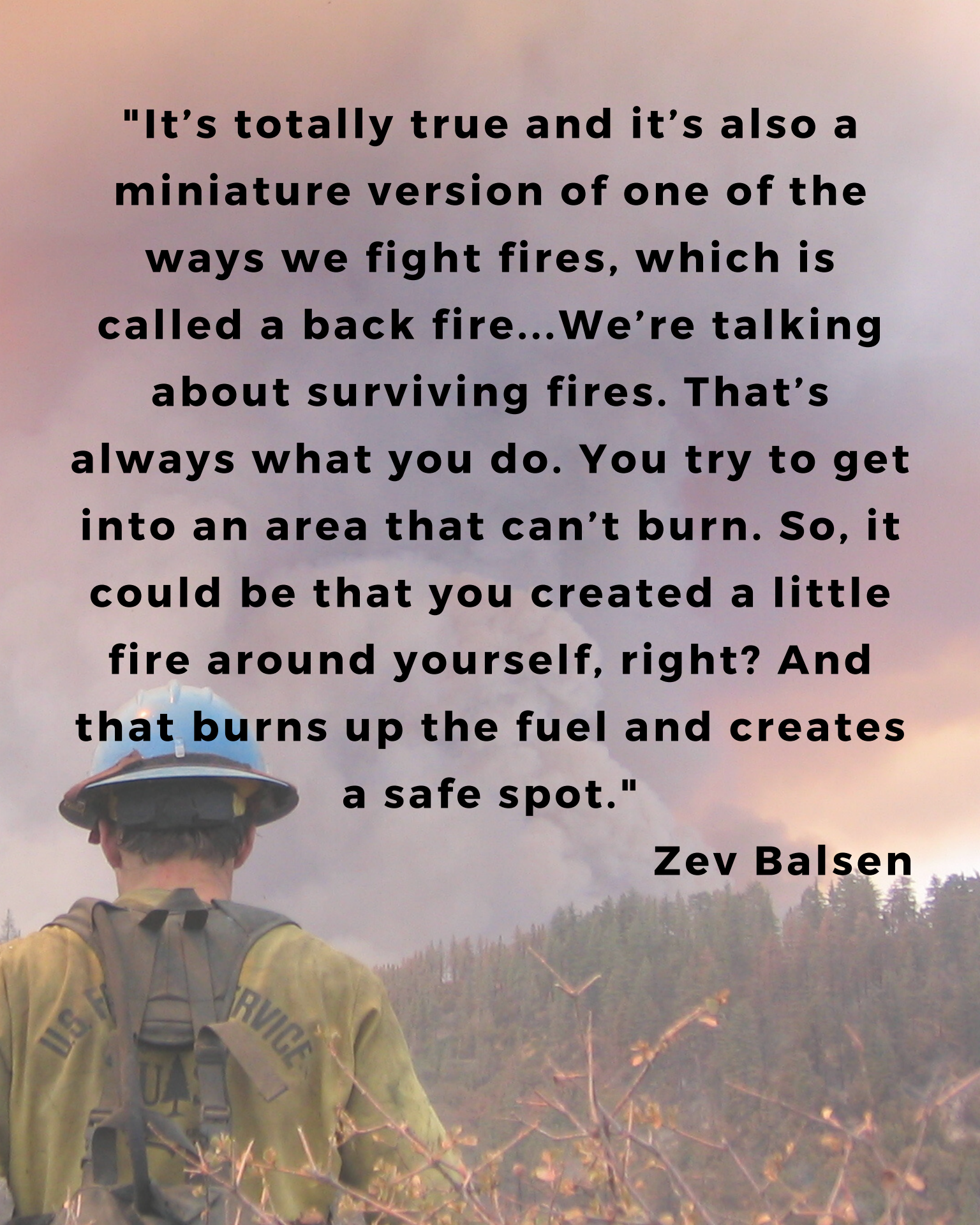
Nico: What if it's already burning, how would you know if it's burning or not?

Zev: The part inside, you can see it, so if it was grass,–like you hopefully shouldn't be up close to it if the flames are only a few feet tall, you don't – can't really get close to it if it's a fire that's more than a three or four feet tall, once it gets taller than that you can't really get anywhere near it. So you'd be able to see past it at that point because it's not very tall, so then you would try to cool it down then jump through into the black part.

Ripley: I don't know if this is true, but I heard a story about a firefighter who was–there's this spreading fire going outwards and it was just surrounding him, but what he did was apparently a knack and he burnt up one area and he stood in that and the fir went around that.

Zev: Exactly, so it's totally true, so remember how we talked about how I read that book called Young Men and Fire? It's about that. You know we also talked about we have a hill with grass and wind and that's the worst situation you're in – that's the situation he was in. So he was a smokejumper in the 40's and smokejumpers don't actually jump into the fires, they just use parachutes to get closer. So if the fire is out in the wilderness, and it would take to long to hike, they fly out and then they jump out of the airplane and then they parachute down. So that's what he did and so the fire in that situation was down at the bottom of the hill and he parachuted in and was up here. And he started – they went – he and his crew went down and they went to the fire, but then the weather changed and the fire started to spread up and a couple of the guys were able to run quickly enough that the got to the other side and they were okay and he – on the spot had this idea to light a match and set the grass on fire around him and so then it spread out in front of him and created a buffer so by the time it got to him he was safe and he survived.

Zev: It's totally true and it's also a miniature version of one of the ways we fight fires which is called a back fire which we'll come back to in a second because we're talking about surviving fires that's always what you do you try to is you try to get into an area that can't burn, so it could be that you created a little fire around yourself, right? And that burns up the fuel and creates a safe spot. It could be that you're on a road because there's no fuel on a road, or like you're in a dirt field that doesn't have any grass in it, just dirt but there's still a lot of heat so what firefighters carry now is called a fire shelter, and it looks like a sleeping bag made out of tinfoil, kind of, and so it packs down into a little box like this and you can pop it open real quick and you can get inside of it and you lie with it over you and you kind of look like a baked potato and because it's silver and reflects heat away from you so that won't let you survive like you couldn't just be in the middle of that was on fire with that but if you're already on a road or something and the fire can burn directly against you but it's still hot that will protect you from some of the heat.



"It’s totally true and it’s also a miniature version of one of the ways we fight fires, which is called a back fire...We’re talking about surviving fires. That’s always what you do. You try to get into an area that can’t burn. So, it could be that you created a little fire around yourself, right? And that burns up the fuel and creates a safe spot."

Zev Balsen

Ripley: And about the Nomex suit, could you survive in the middle of the fire like how long would you be able to?

Zev: The Nomex suit doesn't do a whole lot, like if you're firefighter wearing just jeans and a T-shirt, he wouldn't notice much difference between that and the Nomex. The main difference between Nomex and that is cotton doesn't burn very well but cotton and gets very sweaty and wet. I saw you want to use synthetic clothing when you are when you're doing this kind of work because you're very sweaty but most like, Patagonia stuff like this is made out of nylon and things. Do you know what happens when this stuff goes at all hot like when you're at a campfire and a spark gets on it? It just melts immediately so you can't wear these kinds of things because if any little bit of heat or spark gets on them, so Nomex is kind of like nylon It doesn't get all sweaty and wet but but it doesn't burn so it's kind of a cotton like that it kind of just looks like a cotton shirt and it won't melt but if it's directly in a fire it will burn.

Ripley: Couldn't you make something out of those fire shelters?

Zev: Yes, but a big problem with that kind of thing is you're like generating so much heat because -- working so hards that it sweats a lot and that's like the only problem with it. Firefighters in cities that are going inside of a house that's on fire, they wear much more protective equipment so it keeps all of the body heat and the sweat they're only in the fire for a few minutes so they can tolerate getting really hot and sweaty for a little while but a wildland firefighter is working continuously for like 16 hours so you would overheat and get a heat stroke. So that's like what a city firefighters wears.

Nico: How often are prescribed burns the cause of wild fires?

Zev: So when you say wildfires, you mean how often do they escape and get out and just burn stuff people don't want to burn?

Nico: Yeah.

Zev: It doesn't happen that often. So, for example I was part of a lot of prescribed fires and we did it frequently and we never had them escape. It's a big problem when they escape. What are the things you have to take into account – when you do a prescribed fire there is a lot of planning because you don't want it to escape. What are some of the things are you want to consider when you're conducting a prescribed fire?

Ripley: You would want to get rid of the fuel.

Nico: I was going to say to dig a ditch. Like to dig a ditch around the area. I would also pull out a lot of brush from the surrounding area and put it into the area you are going to be burning. I would also try not to include many trees because they keep the soil firm and prevent mudslides.

Zev: So, you started talking about how to put out a forest fire and I think we should talk about that. Alright so we kinda talked about how you could do flyswatters you could do water. But do you have a sense of the main way we put out forest fires?

Nico: I would say removing fuel would probably be easiest.

Zev: Exactly. And so you cut what's called, "fire line" which looks exactly like a trail, you make a trail right around the edge of the fire.

Ripley: But would you do a bulldozer around the fire?

Zev: You sometimes use a bulldozer.

Ripley: Wouldn't that be kind of dangerous?

Zev: It's pretty dangerous, yes. So depending on how steep things are you can sometimes use a bulldozer. But most of the time you can't use a bulldozer. So then you have to use a hand crew (like I was on) comes through and the way it works is, so picture – you guys have been hiking, like in Connecticut – picture a trail but if the trail is not already there the way it would work is the guy in the front would have a chainsaw – the first few people in front would have chainsaws and what they do is, they go through and every big log that's going across from where you want your trail to go, they're going to cut that log so that they can move it, right? The people behind them are going to have axes so they can cut all the roots and the little trees and the people after them are going to have hoes and rakes and shovels and they're gong to move all of the trees out and little twigs.

Ripley: Couldn't a spark fly over?

Zev: We'll come back to that too. So basically they're going to create a dirt path right around the fire and you're going to make it narrower or wider depending on the conditions, the wind and hot the fire is, depending on how dry the land is. But you're right. Sparks can fly across and start spot fires which we talked about in that email a little bit. And how likely that is to happen is going to depend on how steep it is, how windy it is, how hot it is, how dry it is, and what the fuels on the other side are. So if the spark go across your line and lands in grass, it's pretty likely to start – all it takes is a tiny spark that lands in grass, but if it goes across your line and it lands in a bunch of dead leaves and logs that's a lot harder to start. So that's why you have people that walk back and forth across the line controlling it and look for sparks that have jumped over it and because when they're little they are much easier to put out so you can go over and pour some water on it before it gets big and you can pick it up with a shovel and put it in the other fire.

Zev: In a second it might get really big and it would be too late.

Ripley: And then what would you do?

Zev: Then you'd be in trouble. You'd try to-- With grass, you really need to make sure it can't jump over the line. So, with grass what you need to do is--

Ripley: Wouldn't you just try--if there's grass in the surrounding area, couldn't you just shovel it out?

Zev: You could, but it could so quickly get so big. So the thing with grass is--let's say we're on flat ground and it's windy, you can't really go and try to put a line in front of the front of the fire because it will immediately just jump over it. That's called the head of the fire, where it's heading. And so you never go and try to put out the head of the fire. You come in the back and take the tail of the fire, because the wind's coming in this way. So you start at the back. Let's say the fire is going like this and the wind is blowing like that. If there's no wind then it's spreading in all direction then that makes it a lot less like the spark's going to jump over because most of the sparks are going to go up and then go straight back down. But there's usually going to be some wind.

Nico: Wait, so did you try to put water on the fire after you dug out the ditches?

Zev: No because what you do is, let's say this square is the fire. You'd go right along the edge, literally be like touching the flame and you would make a trail--a fire line, it's called--right next to it. And, so, then it only needs to burn like another inch and then it runs into that dirt you just put there and it burns itself out so you don't need to put any water on it. Sometimes when--let's say it's burning in this direction, let's say it's on a hill, right?--it's burning up the hill. It starts at the bottom, you're working your way up around the sides. Then when you get up to the top, that's the hottest part, right?

Ripley: Yeah, because of the flames.

Zev: Yeah, that part it might be too hot to get up close to it, so you might have to put water on just that part to cool it so you can get close enough to make the fire line. And the way you put water on it is you might have guys who have an engine who are running a hose behind you and laying long--like hundreds and hundreds or maybe even miles of hose to pump water through to get water to the front. Or you could call and talk to a helicopter on the radio and tell the helicopter--helicopters have huge buckets, like the size of this room, that they dip in a lake to fill up the size of this room and then they can drop--the bucket can open up on the bottom--and then they can drop it on the front of the fire to cool it down. It won't put it out because there's so much heat but it will cool it down enough that you can get close to it.

Nico: Wouldn't it make sense if they drop the whole box so that it would smother out the fire?

Zev: But then they would only go there once.

Nico: Yes. And they could catch firefighters.

Zev: They could. And sometimes they drop water on the firefighters and you much rather get hit by water than by the bucket.

Nico: So when you create the fire lines, how fast did you go?

Zev: So it would depend on what kind of fuel you were in. If you were in trees and stuff and you had to have somebody at the front with a chainsaw, that would take a long time. But if you're in grass, sometimes for grass all you had to do to make the fire line was have somebody with those flyswatters because as soon as you would put out the fire, what's left right where that grass was burning?

Nico: Black char.

Zev: Yeah, just char and it won't restart. So sometime you don't even need to cut. When it's grass, you'd just go along the sides of it and just smack it out with one of those giant fly swatters.

Ripley: So what do you do if the fire just gets too big and it's like 200 feet high?

Zev: Uh...then you just kind of have to wait. That's why the most important thing is that people like don't build their houses at the top of a hill among a bunch of dry grass because when that fire's going there's nothing you can do. You have to--basically what you have to--if that fire's 200 feet tall, you have to wait until it gets to the top of the ridge. Once it gets to the top of the ridge and it's getting ready to try to go down the other side, it won't be as big, so you'll be able to put it out then. But when it's on its way up, it's running up the mountain, you won't be able to stop it.

Ripley: If it's going--let's say there's a really big fire--would you try to put it out at the edges, build a fire line, or what would you do?

Zev: Yes, that's exactly what you do. You always--you start at the back and you start to put it out around the edges so that you start--at least it's only going straight and it can't keep spreading out. And usually--a lot of fires get so big, they're like thousands and thousands of acres, so they're going up and over numerous hills and mountains and rivers and stuff. So then, once they're getting that big, you might even find a road and it's burning up close to that road and you try to stop it. You just wait basically at the road and when it hits the road then all you need to do is just--every spark that jumps over, you need to put those out. But the other thing you can do is, you could go to that road and - let's say the fire is here and you have a road right here - you could start another fire right along the edge of the road and it will burn back towards the main fire and then when they hit each other, it will stop because they both consumed all the fuel behind them. Can you picture that?

Nico: Yes



Ripley: But what if the one that you were burning--would you need to make a trail around the one that you were burnng? Like here's the road and here's the main fire and you were going to burn a fire here, wouldn't you have to make another trail behind that so that it doesn't go to far?

Zev: Wait show me again.

Ripley: So here's the road, here's the main fire, here's the fire you're going to be burning, would you need to put...

Zev: So you're talking about if there's a --

Ripley: Would you put a fire line here, because here it could ...

Zev: It could, right. So you would---So let's say this is a fire and this is a road, you would start a fire here, so this one will burn this way and this one will burn this way.

Ripley: But could sparks go off that way?

Zev: They could and so you have to plan it really carefully. Ideally the wind will be blowing this way. If the wind is blowing this way and you start a fire here, it's just going to jump right over your road. But the other thing is, let's say if there's no wind, fires can make so much heat that the air is rising really fast and when the air rises up, you create a vacuum there. If the air rises up, creates a vacuum - and so, what fills that vacuum? All the air from the sides. So what it will do is this air rises up and it pulls air in from the sides, so if you start a fire here, it will pull this fire into itself. And so - and as this one gets bigger, it will also add to the heat and so it will accelerate and so sometimes they'll get - If you do this, let's say - this looks really close, but sometimes you might do this like a mile away and so like by the time they get to each other they've built up so much speed and so much heat that they slam into each other and its like a big explosion and it goes right out. But you've got to be really careful that it doesn't...

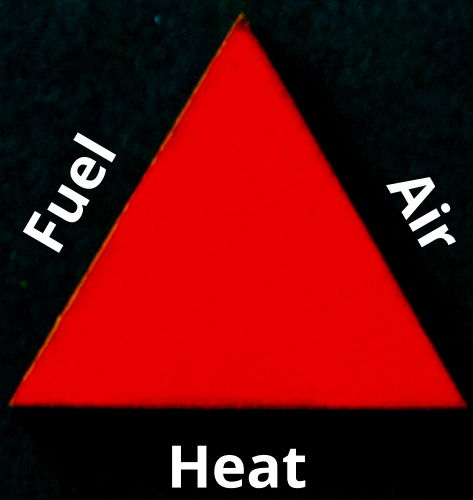




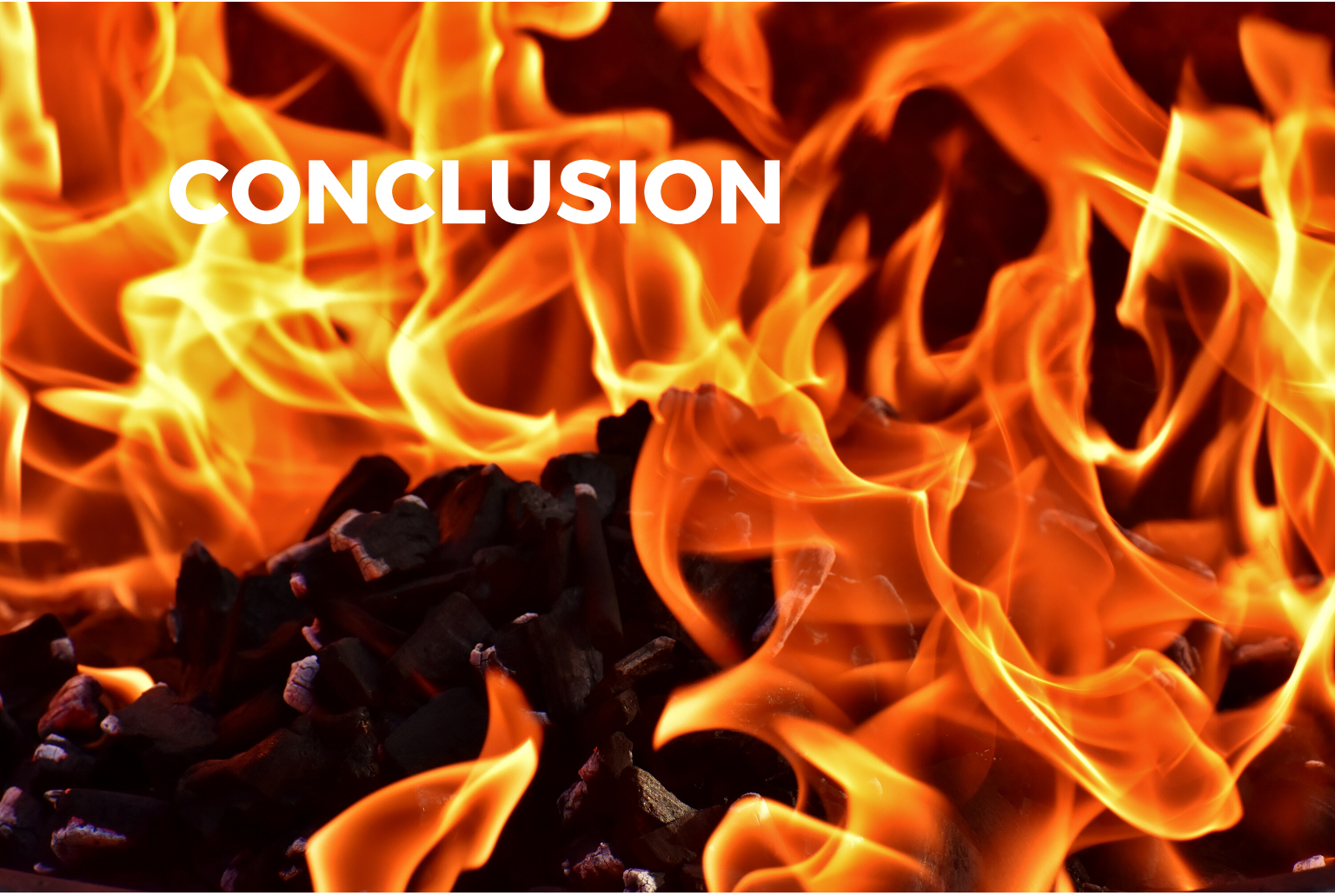




THE FIRE TRIANGLE



Fire has three key components: Fuel (anything with carbon), heat, and air (oxygen). This is called the fire triangle. The fire triangle is important because when it gets hot enough to start a fire there has to be fuel and oxygen, otherwise the heat can't start a fire. Fire makes three things by using fuel, heat and oxygen. But in order to understand the fire triangle first we must understand heat. Heat is molecules in an object moving around. If it's hotter it will move the molecules around faster. They sometimes end up smashing together and bonding into molecules. So in fire (since fire is hot) the molecules of the object that's being burned and the oxygen mix and you get: CO_2, H_2O, and more heat. And if you think about it, it makes sense (most fuel has water so that's where it gets the hydrogen (and in a smaller sense the air) that we get water vapor since the water vapor is jerked out of fuel and the fuel gets more dry. More oxygen makes fire hotter because when you increase one pillar of the fire triangle, the fire changes and gains some sort of benefit. Another example of this is carbon. Carbon is in all fuel for a fire. When there's more fuel (and subsequently more carbon) the fire can burn for longer and get bigger.



CONCLUSION

We NEED fire. Letting small fires burn eats up fuel that builds up over time. When you put out all the small fires as quickly as you can, when you (inevitably) can't, because of the build up, the fire gets huge. This is paramount, it can ruin cities and damage countries. It has destroyed the wild and cities and will destroy again. Prescribed burns can help us but there aren't enough resources to conduct enough of them. We may need to draft firefighters to fight fire's and conduct prescribed burns. We simply don't have enough firefighters to successfully conduct enough prescribed burns to help regenerate forests and heal the land.