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NURS 429 – Concepts in Climate Change and Public Health Preparedness

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I

Climate change has been a key factor in increasing the risk and extent of wildfires in the Western United States. As we have learned wildfire risk depends on several factors, including temperature, soil moisture, and the presence of trees, shrubs, and other sources of fuel. These factors have to either have a direct or indirect relationship with climate variability and climate change. Climate change causes forest fuels (the organic matter that burns and spreads wildfire) to be drier, and has doubled the number of large fires between 1984 and 2015 in the western United States (Wildfires and Climate Change 2020).

As wildfires ravage in the West, in 2019 -2020 California alone has had five of the largest forest fires on record burning more than 2.5 million acres. Washington State has seen more than 300, 000 acres burn, and 80% of the town Malden. In Colorado more than 200,000 acres have burned. Arizona has lost 100,000 acres have burned and two major fires threaten and have caused forced evacuations in the town of Globe. Utah has five active fires with more than 9,000 acres burned. In New Mexico currently there are four active fires and 4,400 acres are ablaze. As worsening wildfire disasters impact the United States there has to be a new approach to managing fire in the decades to come. As global warming is creating hotter, drier environments, this means the likelihood of more extensive fires.

Research shows that changes in climate that create warmer, drier conditions, increased drought, and a longer fire season are boosting these increases in wildfire risk. For much of the U.S. West, projections show that an average annual 1 degree C temperature increase would increase the median burned area per year as much as 600 percent in some types of forests. In the Southeastern United States modeling suggests increased fire risk and a longer fire season, with at

least a 30 percent increase from 2011 in the area burned by lightning-ignited wildfire by 2060 (Wildfires and Climate Change 2020).

New Mexico's climate is getting hotter and drier, driven by regional and global warming trends (Climate Change in New Mexico 2019). New Mexico is the sixth-fastest-warming state in the nation. The average annual temperature has increased about 0.6°F per decade since 1970 or about 2.7°F over 45 years (Tebaldi et al. 2012). What does this mean? As we have already started to see, springs come earlier, summers are getting hotter, less precipitation and winters become less predictable. This means more intense droughts, fluctuation weather patterns, and less snow packs. With less snow packs means less water available especially when needed the most. With the reduction of available water this will have negative economic and environmental consequences. In preparation for the expected impacts of these climate trends, New Mexico must anticipate and prepare to mitigate the potential consequences of less water, excessive heat, loss of live and property from wildfires, increased health impacts, while trying to safeguarding the state's natural resources.

In the past 40 years the fire season in New Mexico went from five months to seven, and the fires of more than 1,000 acres occur twice of often. With this increase, in wildfires, there is an increase in heat-trapping gases in the atmosphere. As New Mexico continues to warm, the burn area across the region is projected to rise dramatically. The regions hit hardest are likely to see a six-fold increase or more in the average area burned each year (Jason, Bernett-Lorro, Rising, & Deyette, 2019).

II

As wildfires are growing in scale and duration, increasing numbers of communities are affected, we need a better understanding of how wildfires affect economies and communities. Impacts of wildfires are often described in terms of lives threatened, structures and homes lost or damaged, overall suppression costs, and damage to the natural resource base on which many rural communities such as Taos, New Mexico rely on.

Taos County is found in the north-central region of New Mexico in the foothills of the Sangre de Cristo Mountains. The town of Taos (elevation 6,950 feet) is located next to Taos Pueblo the Native American village from which it takes its name (red willow in the Tiwa language). The town of Taos population is (estimate 2019) 5, 929, while Taos County inhabits approximately 32, 723 residents. The population density consists 17.4% persons under 18 years of age and 27.5% for persons 65 years and over. Persons without health insurance, under age 65 years is 12.3% and those with disabilities under age 65 years is 13.8 % (U.S. Census Bureau QuickFacts: Taos County, New Mexico 2019). Now that we have a basic understanding of the community statistically let us explore economic and health impacts of wildfire.

Negative economic effects for the community involving wildfires is the burning of timber, making recreation and tourism (Taos's economy thrives on tourism) unappealing, and also can affect agricultural production. Damage to the infrastructure, including roadways (guardrails, signage, culverts), communication facilities, power lines, and water delivery systems. Direct impacts to the community are contamination of municipal water supplies and soil erosion. Depending on the severity and location of a wildfire, post-recovery efforts can have a crippling effect on the community because of cost associated to replace or repair lost facilities

and associated infrastructure, watershed and water quality mitigation and sensitive species and habitat restoration. Wildfires can have both a positive and a negative effect on the community's economy. Positive effects come from economic activities generated in the community during fire suppression and post-fire rebuilding. These may include support work, such as building fire lines and performing other defenses, or providing firefighting teams with food, ice, and amenities such as temporary shelters and washing machines (Economic Impacts of Wildfire 2014).

So, we talked about economic impacts of wildfire, but how about health concerns. In the article Wildfires and Public Health: A View from the Front Lines 2016, mention that the composition of wildfire smoke is primarily made of carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons and other organic chemicals, nitrogen oxides, and many other trace elements. However, smoke composition can vary, depending on the fuel type, fire temperature, and wind conditions. Of these pollutants, particulate matter (which a mixture of gas and tiny bits of matter) is the most concerning, given their very small size and ability to be inhaled deeply into the lungs.

Exposure to particulate matter generated from wildfires has been associated with a wide range of human health effects, such as wheezing, coughing, sore eyes and throats, and shortness of breath, to more adverse health outcomes, ranging from increases in asthma-related hospitalizations, chronic and acute respiratory and cardiovascular health outcomes (heart attack, heart failure, and stroke), and premature death (Wildfires and Public Health: A View from the Front Lines 2016). As mentioned previously the population density of Taos county consists 17.4% persons under 18 years of age and 27.5% for persons 65 years and over. Nikki Cooley, Northern Arizona University's tribal climate change program manager, said she had heard of

even healthy people becoming sickened by the smoke. “The combination of the wildfire smoke, the increasing heat, combined with the man-made facilities spitting out coal ash, it’s really affecting people’s lungs,” she said. In, fact according to Health Highlight Report for Taos County 2019, asthma hospital discharges for children (2013-2017) in New Mexico was at 14.5 % and during the same time 8.6 % in Taos County as compared to the same date related for adults in New Mexico at 10.1% and Taos County 10.4%. Why is this important? asthma is one of the common chronic disease in New Mexico, with an estimated 156, 782 adults and 46, 503 children currently having the disease. People with asthma are more likely to miss school, work, and experience an overall reduced quality of life. Then the complication of asthma is exacerbated by wildfire air pollution.

III

As wildfires are increasing in volume and frequency preparation is a key component to survival. It is important to utilize technology that is available to keep informed. Such as the Federal Emergency Management Agency (FEMA) application so, that real-time alerts from the National Weather Service or for the Emergency Alert System IEAS and Wireless Emergency Alert (WEA) which neither require a sign up. Other things to do for preparation is making of an emergency plan in which everyone in your household knows and understand in the event that a quick evacuation is needed. Know your evacuation zones and where you may need to shelter. Due to the current pandemic ensure personal protective gear and hand sanitizer is taken to prevent exacerbation on Covid-19. As you prepare for wild fires ensure to review the CDC’s guidelines for “Going to a public Disaster Shelter During the Covid-19 Pandemic.”

Who is at greatest risk from wildfire smoke? People who have heart or lung diseases, like heart disease, lung disease, or asthma. Older adults are more likely to be affected by smoke due to their increase risk of heart and lung disease. Children are also likely to be affected by health threats of smoke because airways are still developing and they breathe more air per pound of boy weight than adults according to Centers for Disease Control and Prevention, 2020.

So how can we prepare to protect our health from wildfires and the byproduct of smoke. The most effective way to protect yourself during wildfire emergencies is to stay indoors or limit your time outdoors when there is smoke in the air. This is especially important if you have heart or lung disease and are at higher risk for adverse health effects. Reducing physical activities and using HEPA-filtered air cleaners indoors are other ways to reduce your smoke exposure. Consider temporary relocation out of the smoky are if possible. Other preparations can include emergency supplies such as respirators.

Proper preparation for wildfire adverse effects, will help mitigation of healthcare concerns from the wildfires. By using the HEPA filter indoors during a wildfire you have started to mitigate healthcare concerns, that effect the entire body. The use of respirators helps alleviate health concerns as well. Being the Nation currently is experiencing a pandemic and the use of masks and respirators are recommended to protect against the Covid-19 virus, the concurrent use of the mask will also work for air pollutants decrease negative outcomes.

Wildfires may create a variety of hazards not only for workers involved in the cleanup, but for citizens of the community as well. There are many factors that can exacerbate many chronic diseases such as sickle cell anemia where extreme temperature fluctuations can trigger a sickle cell crisis. There can be hazardous material spills which can create toxic gas plumes

carbon monoxide poisoning from the use of gasoline or diesel-powered pumps, generator and pressure washer utilized during clean-up and a variety of other injuries such as fatigue, slips, trips, and falls. As the community is mitigating a wildfire, there has to be a conscious effort made not only for the cleanup crews who are suspectable to the pollutants but to the public because the likelihood of contamination into water systems and disruption of electricity could impact patients who are on home oxygen or require electricity for healthcare concerns such as dialysis. The community needs to prepare for emergency management for planning and response by clinics, hospitals, law enforcement, volunteer healthcare providers, but also for other city, county, state, and national agencies and organizations.

IV

The nation's western states have experienced a record-breaking number of severe wildfires in 2020**.** Since August, drought conditions have been fueled by thunderstorms, strong winds, and in some cases, human error to ignite widespread fires. Homes, businesses, forests, parklands, and even entire towns have succumbed to the intense flames. Hundreds of thousands of people have had to flee their homes, often with little notice.

Climate scientists tell us that we can expect more severe wildfires due to higher temperatures and increased drought potential. Therefore, those of us who live in the West must learn to plan for what might have once seemed to be the unthinkable. To be prepared means you must be proactive instead of reactive. Of course, the safety of your family members and your pets should be your top priority. But the proactive decisions you make now may also help save your home and your belongings in a wildfire.

Reducing hazardous fuel accumulations have been efforts by the United States Forest Service (USFS) and the Bureau of Land Management (BLM) to reduce wildfire risks through the elimination of brush, small diameter trees, and other fuels and the reintroduction of fire to forest and rangeland ecosystems. Reduction of fuels can be accomplished by a variety of ways. Either by mechanical, chemical, biological, and manual methods. The careful use of fire, either alone or in combination with other methods can be one of the most effective ways of reducing such hazardous fuel. Early research has revealed that selective removal of undergrowth and non-native plant species can meaningfully decrease fire risks.

The General Accounting Office (GAO Report GAO/RCED-99-65) also has emphasized the need for fuels management, concluding that "the most extensive and serious problem related to the health of forests in the interior West is the over-accumulation of vegetation, which has caused an increasing number of large, intense, uncontrollable, and catastrophically destructive wildfires."

Wildland fire policy recognizes that effective fire management requires close coordination with local communities, particularly those communities that are in the wildland-urban interface. As the management of private lands has become a key factor in the fire-risk equation, the Departments have recognized the importance of providing outreach, education, and support for local communities who must play a primary role in reducing fire hazards in and near their communities (In Response of the Wildfires of 2000, 2000).

The changing demographics are expanding the wildland-urban interface and creating new challenges for fighting wildland fires. Increasingly, homes are being built on private land and around new communities are at risk because of the dense locations and the movement into rural

lands dense in natural resources. The National Fire Protection Association (NFPA) estimates that wildfires destroyed more than 9,000 homes between 1985 and 1995. Officials further believe that the number of homes damaged by wildfires in the 1990s is six times that of the previous decade. More than 1,000 homes have been destroyed during this summer alone.

Safe and effective protection in these areas requires close coordination between local, State, Federal and Tribal firefighting resources. Usually, the primary burden for wildland-urban interface fire protection falls to property owners and State and local governments. Rural and volunteer fire departments provide the front line of defense, or initial attack, on up to 90 percent of these high-risk and costly fires. While they have a good record in rapidly suppressing traditional wildland fires, these local resources often struggle to effectively address the complex demands of fighting fire in the wildland-urban interface.

The Federal Government also have taken additional measure to assist communities in developing their own firefighting abilities. The Forest Service's State and Volunteer Fire Assistance Programs, for example, provide technical and financial assistance to local firefighting resources to help endorse effective and coordinated unified fire management response. Through the Volunteer Fire Assistance Program, the Forest Service has been effective in providing firefighting equipment to rural fire departments and in training their firefighters to meet Federal interagency standards.

In Response of the Wildfires of 2000, a top priority for reducing risk is to reduce fuels in forests and rangelands adjacent to, and within communities. Particular emphasis should be placed on projects where fuel treatment can also be accomplished on adjoining State, private, or other nonfederal land so as to extend greater protection across the landscape. This provides

protection from catastrophic fires that develop on public lands. This can be accomplished by making available adequate incentives and technical assistance to communities and private landowners to encourage the reduction of hazardous fuels around homeowner properties. These individual actions will not only provide greater personal protection but will also increase the safety and effectiveness of firefighting personnel. When done on a large scale, fuel reduction around individual homes can result in greater overall protection for an entire landscape or watershed.

There has been an ongoing effort to implement a number of programs to educate communities and homeowners in recently burned areas and high-risk urban-wildland interface areas about fire hazards. The Forest Service's Firewise program, for example, is a very successful program designed to educate rural homeowners about precautions they can take to make their homes more fire resistant and more easily defendable by local fire departments. Firewise specifically helps communities and homeowners recognize fire hazards, design Firewise homes and landscapes, and make wise planning, zoning, and building material choices. These efforts play an important role in reducing the loss of lives and property, as well as tremendous government expense, in the wildland-urban interface.

Your family’s safety means everything to you, which is why being prepared for the unexpected should be a priority. If you live in an area that is prone to wildfires, the first step to peace of mind is creating a wildfire evacuation plan. Much like a fire escape plan, having a set list of steps and practiced routine creates a proactive approach to the threat of wildfires. So, what are the stages of evacuation notices? Navigating an evacuation can be a stressful event. That is why it is important to have things in place just in case there is little warning to evacuate. Be familiar with various stages of evacuation so that you are familiar with what needs to be done in

the event evacuation is called for in your neighborhood. The fire warning is issued through an Emergency Alert System in the US and specifically in Taos County the use of htttp://onelinkto/alertme is utilized. Technology is helping us stay safer and communicate better than ever before. Taos County uses a system called Regroup Mass Notification to send important day-to-day and emergency alerts by email, phone, text, and more. The Regroup also offers a mobile app free of cost to keep Taos County citizens informed even when cell phone towers are down or overloaded.

The free AlertMe App from Regroup, you can receive push notification about weather closures, safety notifications, emergency alerts, and important events sent to smartphones. The notification can be isolated to a specific part of the county or specific parts of the city limits. Evacuation warning, which can be through local alert systems as mention or through the Emergency Alert System in the US which typically informs the public of major and uncontrolled fires that threaten populated regions and may block major roadways and arteries.

So, what are the stages of wildfire evacuation, according to How to Plan for a Wildfire Evacuation, 2019 the stages consist of the following;

Stage 1 Wildfire Evacuation Notice indicates a wildfire are either in your area or that a wildfire is approaching quickly, and you should start getting ready for an evacuation if ordered. That requires monitoring of the situation closely through emergency services websites and local media. Get your supplies and emergency provisions into your vehicle. Gather all medications and essential supplies that you may need. Review mandated evacuation routes provided by emergency services.

Stage 2 Wildfire Evacuation Order is declared when a significant risk of fire to your area is possible. Residents are ordered to leave the area. It is best to leave voluntarily, upon issue of the notice. Relocating to a Stage 1 area or into an official designated region immediately is mandated. Map out your evacuation route now and have a hard copy in your car. Stay update with local media and radio on changing conditions. Contact family and friends, Evacuate to a safe area at earliest opportunity.

Stage 3 Wildfire Evacuation Order is the final and most severe statement of imminent fire in your area. A Stage 3 Evacuation simply means “GO!” Leave immediately, as emergency services and first responders may not be able to assist you. Exit your home immediately, grab your ‘go bag” and get out. Text or call family and friends informing them of your route and target destination. Drive safely according to designated evacuation routes that are provided by emergency personnel. Be aware that no further warning may be announced. Re-entry into Stage 3 zones may be limited until first responders have extinguished fires in the area. Tune into local radio and TV updates on nearby road closures and conditions. Time is of the essence when an emergency evacuation is announced. It is important to listen to local authorities if a wildfire is spotted.

Now that we have set an evacuation plan what occurs, do not return home until authorities say it is safe. Staying safe during a wildfire requires you to pay attention to local weather forecast, especially those that may affect fire conditions, and always follow instructions given by local emergency management officials. Especially, for those who have asthma, chronic obstructive pulmonary disease, or heart disease. Women who are pregnant and children also need to be careful from breathing in smoke. Take steps to reduce your exposure to smoke, because smoke can stay in the air for days after a wildfire ends. Stay inside with the doors and windows

closed. Whether you have a central air condition system or a room unit, use high efficiency filters to capture fine particles from the smoke. If smoke is still to prevalent seek shelter elsewhere in capable. Do not burn candles, woodburning stoves, limit the use of gas or propane, the use cigarettes and other similar substances add more pollutants into the polluted air.

According to the Emergency Support Function, 2020, is a group of governmental and certain private sector capabilities into an organizational structure to provide support, resources, program implementation, and services that are most like needed to save lives, protect property and the environment, restore essential services and critical infrastructure, and help victims and communities return to normal following a domestic incident such as wildfires. Some of the functions of the Emergency Support Function are help with transportation, communications, public works and engineering, firefighting, emergency management, massacre, housing and human services, resource support, public health and medical services, oil and hazardous materials response, agriculture and natural resources, energy, public safety and security, long-term community recovery and mitigation and external affairs. The resources help communities with the aftermath of wildfires.

In the aftermath of a wildfire, workers may be involved in a variety of response and recovery operations. Some operations, such as utility restoration, cleaning up spills of hazardous materials, and search and rescue, should only be conducted by workers who have the proper training, equipment and experience. Some of the potential problems associated with the severity of wildfires will extend well into the winter months. The burned area will lack vegetation on the hillsides, the likelihood that rain and snowfall will create flooding and mudslides increase. The water quality of streams and rivers are damaged, this in turn will kill native fish. The wildlife population can be impacted or disrupted due to the fires. Non-native invasive plants species,

usually thrive on both public and private lands in the wake of wildfires, causing problems. The opportunistic plants can overtake native plant environments. The proliferation provides fuel for wildfire, which has the potential for providing fuel for future wildfires. Cheatgrass as an example spreads throughout the West on degraded rangelands increasing in density of burned areas (Wildfires and Climate Change 2020).

Stabilization activities include short-term actions to remove hazards and stabilize slopes and soils. Some of the activities include re-seeding by helicopters, plane, or by hand. Constructing dams and various other structures to maintain the integrity of slopes to slow down erosion. Correcting infrastructures like road drainage, realigning poorly designed roads and culverts. Temporarily fencing livestock and humans out of burned areas. This priority for stabilization incudes activities that protect human life and property, protecting public health and safety, stabilizing watersheds, stabilizing steep slopes and unstable terrain, while protecting archaeological resources.

Restoration activities include a longer term of activities to repair or improve lands that are unlikely to recover naturally from severe fire damage. Such activities can include re-seeding or planting of native plants species, reforesting desired tree species, chemical or mechanical treatment to reduce competition and other efforts to eliminate invading plant species. By doing these activities the promotion of restoration of the ecosystem is underway. As restoration activities occur communities affected by wildfires need to continue in current wildfire fuel reduction activities such as prescribed burns. Which is a physical removal of undergrowth and other fuels. Because most of the hazardous fuels in forests are excessive levels of forest-based biomass, consisting of dead, diseased, and down trees. There can be some benefits associated with finding economical uses for this material, including offsetting some forest restoration cost;

protecting watersheds, helping restore forest resiliency and protecting the environment (Wildfires and Climate Change 2020).

The US Forest Service research teams are working on ways to develop new uses for small trees and new ways to process them. The US Forest Service propose partnerships with communities, universities, and businesses to conduct research on the stimulation of small diameter tress and various other vegetative products industries. For example, if technology can be utilized to use small diameter trees for housing materials such as trim, sliding, and sub-flooring. Recent technology now makes it possible for wood composites - fibers, flakes and strands - from lower quality species of trees such as juniper, pinon pine, and insect-killed white fir to be used successfully for particleboard and replacement filler for thermoplastic composites that make up a wide range of consumer products such as highway signs. Similar uses are being expanded for pulp chips. The woody residues that make up a forest's undergrowth has historically been burned or allowed to accumulate in huge piles on the forest floor. This material could potentially be economically used as compost and mulch material (In Response of the Wildfires of 2000, 2000). If this material was repurposed this could help in deforestation.

Wildfires know no jurisdictional boundaries. As withing fighting fires, Federal, State. and local governments will have to cooperate to restore damaged lands, invest in protecting affected communities, and reduce hazardous fuel lands. Such in the case on July 4, 2003 when lightening ignited a fire on Taos Pueblo land known as the Encebado Fire. The fire endangered watershed supplies for the Taos Pueblo residents. Fireline was being cut around the wildfire to prevent the spread into the Taos and Taos Pueblo communities. Nine-hundred thirty-two officials from various disciplines had arrived to help extinguish the blaze. They were using eleven helicopters, twenty-eight engines, nine bulldozers and eleven water tenders all with one goal of exterminating

the fire. I being one of the nine-hundred thirty-two individuals got to see first-hand as I was one of the bulldozer operators. I got to see how quickly the undergrowth ignited and fueled the growing fire, not realizing how quick the fire moves until we were moved into a helipad in the middle of the forest as helicopters started dumping gallons of water on us as slurry bombers dropped slurry several hundred yards away from us. Although, the event was stimulating it is an event I would not like to experience again.

My community has since taken a strong approach on cleaning undergrowth with prescribed burns to eliminate potential fuel sources. I have seen the effects of re-seeding in the burned areas of Taos Pueblo and how active Agency were to prevent the growth on invasive plant species. The Encebado Fire occurred seventeen years ago, but with the implementation of alert systems and active approaches with cleaning dense forest of undergrowth, many parts of my community have taken a proactive approach towards wildfire.

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