Adapting to Climate Challenges: Surviving at Fire and Post-Fire Debris/Mudflow Prone Zones in Colorado Front Range in Light of *Feng-shui*

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Incorrect site selections can lead to disasters. Three pre-conditions for post-fire debris/ mudflows occurring in prone zones are: landforms trigger debris/mudflows; a wildfire strike has been experienced, accelerating and amplifying the debris/mudflow process; and constantly heavy rainfall is received. The high impact zones are where a sudden decline in slope appears in lower elevations, which causes the debris to release with the greatest impact; nearby rivers and lakes, that debris flows into and causes major flooding; and on hillsides with gullies pointing to or nearby the site. This interdisciplinary research would benefit site selection processes, warning criteria, and mitigation strategies.

INTRODUCTION

Extreme climate patterns in recent decades have led to frequent wildfires, massive rainstorms and subsequent debris/mudflows in the western United States. Climate change increases the global temperature, resulting in drier Colorado weather. Wildfires are a major threat to Rocky Mountain communities. Since 1970, the number of large fires per year has doubled and could increase another six-fold in the next two decades (Climate Central, 2013). In as soon as 50 years, the burn area could increase two to five times, engulfing almost all of the Rocky Mountain region (Baker, 2009).

Following wildfires, there is often another hazard: the post-fire debris flow sequence. The debris flow, often referred to by the media as a "mudslide," can be a deadly disaster. A debris/mudflow is one of the most dangerous natural hazards (Clark, 1987). It is different from a "spring runoff" flood, which usually involves water rising from spring snowmelt that runs over the bank and floods the land. A debris/mudflow comes from a higher elevation with great power. It can climb several feet high and eliminate houses.

There are major and minor debris flows. The major debris flow begins with a dense mud and stone flow, then it increases its solid concentration and size when proceeding downstream, and finally it develops into a full debris flow. The minor debris flow could occur in a gully that has unstable debris. Both can cause deadly disasters (Takahashi, 1991). Debris/mudflow events often occur suddenly. Recently, post-fire debris/mudflows in the West of the USA appear lacking an efficient warning system. Therefore, mountain residents are not prepared to deal with the impact and are caught off guard. In order to develop warning criteria for residential evacuation, this research uses *feng-shui* as a clue to identify the landscape patterns of the post-fire debris/mudflow prone zones, particularly using the case study with field investigations in the Colorado Front Range.

Located immediately east of the Rocky Mountains, the Front Range is the economic and cultural center of Colorado. It spans the cities of Denver, Boulder, Fort Collins, Colorado Springs, and Pueblo (Figure 1). This region accounts for 82% of the state's population and creates 86% of its economic output (Summit Economics, 2009). As of July 1, 2015, the Front Range Urban Corridor supported 4,757,713 people, an increase of 9.78% since the 2010 United States Census. As the population of the Front Range grows, more people are moving into the wildland-urban interface zones, which increases human-caused fires.

The current extreme weather patterns that impact density development in the wildland-urban interface are new for most of us, therefore we lack the necessary experience and preparation. In order to adapt to climate challenges, we must first identify what the problems and impacts are, how the hazards progress, where the problems initiate, and where the high impact areas are. Vernacular methods may help identify these factors.

The Chinese have inhabited mountainous regions for thousands of years. Thirty percent of the Chinese population lives in mountainous areas, and two-fifths of the cultivated land is located in mountain regions of the country (Li, 2004). China's experience for thousands of years in adapting to natural challenges are primarily summarized in *feng-shui* practice. *Feng-shui* is an ancient Chinese practice that harmonizes people with their environment. *Feng-shui*, directly translated to wind and water, is practiced at multi-scales, from mountain ranges and cities down to a site of a house or a graveyard. *Feng-shui* has many schools; particularly prominent is the form school, which discusses landforms such as mountain/dragon, hill, water, and site. *Feng-shui* is used to select proper timing, a suitable location, and supportive people to sustain lives and communities by pursuing positive energy for good luck and disaster avoidance. Humans struggle to survive in the challenging environment, by learning the natural rules. In Ian McHarg's book, "Design with Nature," he states that adaptations to natural laws enhance life by promoting harmony between humans and nature (McHarg, 1969). Using the wisdom of *feng-shui* and geomorphic study, people would further understand mountain disasters and identify the high impact zones in order to prevent tragedy within the mountain community.

ROCKY MOUNTAIN LANDFORMS TRIGGER FIRE

The jagged peaks of the Rocky Mountains reach above 14,000 feet against the fair blue sky. The snow melts off the mountains into glacial lakes in which cold water fish abound. Small streams flow through canyons and verdant valleys. Forests with high tree lines above 10,000 feet brighten up in autumn. This beauty contributes to the popularity of the region but coincides with frequent natural hazards of lightning, high winds, fires and debris flows.

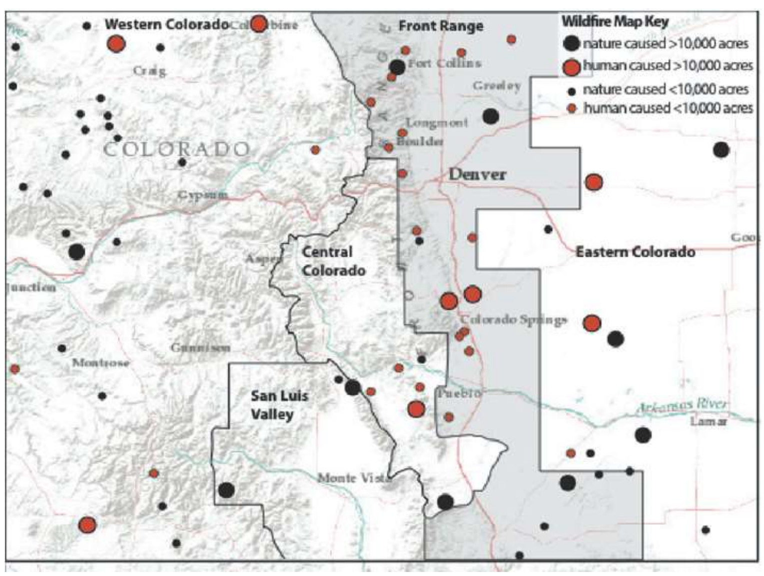
The high peaks of the Rocky Mountain Range attract lightning strikes. Lightning, an electric discharge, causes fires by striking an earth-bound object. The smoke and mist expelled by a massive forest fire can cause even more electric charges, igniting new fires many miles downwind (Dul'zon, 1996). Between 2011 and 2016, three of the four largest fires were caused by lightning strikes. Although lightning can occur at any elevation, areas with steep slopes and high altitudes, often above 8,000 feet, attract the highest number of lightning strikes. According to *feng-shui,* jagged mountain peaks with sharp slopes are called the fire mountains, because they experience frequent lightning strikes that spark the most fires (Jiang, 1997).

The Rocky Mountain range also triggers wind storms that spread fires over thousands of acres. Steep and rigid landforms of the Rocky Mountains at high elevations, particularly mountain crests, create these powerful wind gusts. The highest wind speeds tend to correlate with wildfires. Downslope wind storms are common in late autumn into spring along the Front Range. Downslope winds characterized by unseasonably warm temperatures are called Chinook winds, while Bora winds involve an influx of cold air and are accompanied by falling temperatures (Doesken & Roger, 2003). Canyons can form wind tunnels, increasing fire risk and spreading fire more rapidly. Colorado is the third most at-risk state for wildfires, due to the factors above (Insurance Information Institute [III], 2016). A primary criterion for site selection according to *feng-shui* is to avoid high winds. It recommends that people do not build on the crest of hills because positive energy cannot accumulate, and strong winds will blow the good luck away.

In recent decades, the weather patterns are becoming more extreme. Colorado Front Range has experienced dramatic weather change during each season, particularly with the warmer climate. Thermometers can read 80° and 30° Fahrenheit within the same day. In November 2014, Denver experienced a 77-degree temperature drop within three days (CBS, 2014). The forecasted increase of 3° Celsius includes alteration of latent heat flux, earlier snowmelt, intensification of the hydrological cycle, and many of the major snowstorms becoming rain storms (Bales, 2006). The increased global temperature as a result of climate change causes drier Colorado weather. The U.S. West's snowpack below 8,200 feet is expected to decline considerably by the mid-21st century. Smaller declines of 10-20% are also expected of the high-elevation snowpack, particularly in Colorado (Lukas, 2014). In addition, the population of the Front Range grows and more people are moving into the wildland-urban interface zones, which increases human-caused fires. The results of the heat flux, drier, hotter weather, and growing population in fire-prone areas have caused more frequent and intense fires.

According to the Intergovernmental Panel on Climate Change, warmer temperatures have also contributed to a longer and more destructive fire season. In the past 17 years in the West of the United States, the fire season has extended by 78 days; the number of fires has increased fourfold; the amount of time needed to extinguish the average fire is five times longer; and the total burn area has expanded 5.7 times (Saunders et al., 2008). Between 2011 and 2016, Colorado wildfires over 100 acres were a total of 108 fires and 681,447 acres burned (Xu, 2017); within the Front Range area 64% of wildfires were human-caused (Figure 1).

FIGURE 1
MAP OF COLORADO WILDFIRES 2011-2016



(Source: Ping Xu and Mackenzie Taylor)

Fire Ecology and Post-fire Landscape

Fire strikes have been severe threats to Rocky Mountain communities. The residents have worried about the fire strikes for all seasons. The hot temperature and lighting storms can initiate fires in the summer. Drought and high-speed winds tend to correlate with wildfires in the fall and the spring. Snowstorms may knock down the tall trees, which can damage power lines and cause fires in the winter. The author who lives in the foothills of Boulder has been evacuated three times during a decade.

The increasingly frequent fires in Colorado have led many residents to doubt the following academic theory: fire is an ecological system that plays a key role in shaping the natural landscape, and that this system should not be limited (Wuerthner, 2006). Colorado residents may align themselves more with Baker's different theory: fires should be investigated on a large regional scale, with hundreds of years of temporal understanding, including the increasing human impacts on and from the system. He argues that policies should be shaped to protect the landscape and the people. In the past, fires have been seen as manageable ecological processes in a resilient ecosystem. In the Rocky Mountains, however, this idea is no longer tenable (Baker, 2009).

According to Baker, weather warming and expanding populations in mountain areas disrupt the natural cycle and substantially increase fire frequency and size. The Colorado Rockies have never experienced fire exclusion, as the Rocky Mountain landscape triggers fire events naturally. Colorado forests, in particular, take a long time to recover from fires. In the Rockies, there are few plants with seed banks to aid tree regeneration. The dry weather also impacts the recovery time; many forests are still recovering from the large fires of the 19th century (Baker, 2009).

Burned trees release large amounts of carbon dioxide and can no longer filter pollutants or produce oxygen. Inhalation of smoke and ash from large wildfires creates serious health threats for the elderly, ill, and those with heart or respiratory conditions (Climate Central, 2013). Fires damage wildlife habitat, water quality, and mature forests and create carbon dioxide pollution. Also, the extended periods of recovery on burned slope sides leave them vulnerable to debris/mudflow disasters.

After a fire, the post-fire debris/mudflow frequently occurs, becoming a common phenomenon in mountain areas. The 2013 historical flood killed ten people and caused nearly $4 billion in damage across 24 counties. There were 18,147 evacuees, 1,852 homes destroyed, and 28,363 homes damaged. Many of the mountainous areas experienced fire strikes before the flood, worsening flash flooding and debris/mudflows. If heavy rainfall follows these wildfires, flash flooding can occur, weakening the soil further and creating optimal conditions for debris/mudflows. Many members of the community, especially mountain residents, face frustration as they continue to deal with the flood's aftermath years later (Aguilar, 2016).

Considering the potential impacts to ecological balance and human life and health, fires in the wildland-urban interface should be immediately extinguished.

ROCKY MOUNTAIN LANDFORMS TRIGGER POST-FIRE DEBRIS/MUDFLOWS

Rainstorms

Intense and heavy rainfall is a pre-condition for debris/mudflows. Heavy summer storms often occur along the Colorado Front Range. Gulf/Subtropical Atlantic moisture merges with western winds crossing the state to generate extreme weather patterns before reaching the high mountains (Dust, 2016). Orographic lift, when the air is forced from a low elevation to a high elevation over steep terrain, also creates high precipitation storms in the mountains and canyons of the Front Range (Whiteman, 2000). Severe thunderstorms can spawn supercells, which can generate tornadoes or hail. The frequency of hail damage to crops in northeastern Colorado is quite high. With an average number of six or more hail days per year, some counties in eastern Colorado are among the most hail-prone areas in the country (Saunders et al., 2008). Another hazard related to heavy rainfall is flash flooding, including debris/mudflows. The greatest threat of flooding in Colorado is not from snowmelt; rather, it is flash flooding from localized intense thunderstorms (Crespin, 2016). The intense rainfall triggered by the mountain landforms are instrumental to debris/mudflow disasters. Therefore weather forecasting is a significant factor in predicting post-fire debris/mudflows.

Debris/Mudflows

Residents often think living in the mountains is a way to avoid floods, but there is another water hazard -- debris/mudflows, one of the most dangerous natural hazards in mountain communities (Reneau & Dietrich, 1987). In *feng-shui* terms, it is called the "water showering head" (Jiang, 1997) and is identified as one of the evilest and deadliest factors. Based on the geomorphic study (Onda, 2004; Clark, 1987; and Reneau & Dietrich, 1987) and the author's field investigations of 2013 Colorado debris/mudflow zones, the discussion of landform patterns emphasizes three areas. The first area is the debris catchment, including the basin, surrounding mountains, and canyons where debris and runoff accumulate and debris flows are initiated. *Feng-shui* refers to this area as the "dragon." In particular, *feng-shui* recommends avoiding the mountain basins with debris, called the "sick dragon," and canyons with steep slopes and a narrow channel, called the "violent dragon." On the left of Figure 2 is a diagram from an ancient *feng-shui* textbook by Xu, Shike, representing the Violent Dragon. The black areas with zigzag patterns represent the mountain profiles, the fine lines represent the foothills, and the small circle represents the house site (Xu, 1580). The Big Thompson Canyon, CO would be identified by *feng-shui* as a violent dragon. Several houses along this canyon were destroyed during the 2013 flood (Figure 2).

FIGURE 2
DEBRIS/MUDFLOWS DEVELOP THROUGH STEEP AND NARROW CANYONS

(Source: Xu, Shike 1580, Chapter 5)

(Source: Ping Xu, 2014)

The second area is a debris flow track, which is often a water channel and the surrounding hillsides, where debris events develop, generate power, and accelerate downhill. Houses on hillsides should not be built on more than a 45% slope. According to *feng-shui*, a straight stream or river is evil, and a meandering stream or river is favorable. The area outside the meandering curve should be avoided. A dry wash with a narrow and straight channel that points directly at or nearby the site, known as a "hidden arrow," should be avoided as well (Xu, 2016b). Hills with constant steep slopes, called "hills without veins," are subject to frequent flooding (Liu, 1986). The final area is the debris flow fan, a receiving or impact area, where the slope has dropped, and debris is released. Figure 3 shows nearby Chapel on the Rock, the high impact area of the 2013 debris flow, that ran five miles from Mountain Meeker. *Feng-shui* recommends that the site selection process should encompass field investigations of surrounding landforms including mountains, canyons, hills, water, and the site conditions.

FIGURE 3
THE IMPACT AREA OF 2013 DEBRIS FLOW RUNNING FIVE MILES FROM MT. MEEKER


(Source: Ping Xu, 2014)

Post-fire Debris/Mudflow Sequence

The post-fire debris/mudflow sequence is a hazard that often occurs after a wildfire. According to the author's field investigations of the 2013 flood impact zones in the canyons of the Colorado Front Range, every high-impact zone experienced a fire before the debris/mudflow, most within the three years prior. Fire changes the structure of soil, coating it in burned organic molecules and making it virtually waterproof. Two primary erosion processes cause debris flows in burned watersheds (Wells, 1987). The first process is dry ravel. The downhill movement of debris without the flow of water dams dry washes and worsens future flows. The second is the formation of rill networks--small debris flows that branch extensively with little rain. These erosions accelerate and intensify debris/mudflow disasters (Wells, 1987). After a wildfire, it is crucial to anticipate debris/mudflows. When fire burns vegetation from the mountainsides, it kills the ground cover and loosens debris. During heavy rains, the dead trees fall more readily, levering up the soil and producing more debris. The dead timber washes into a debris flow, further generating power. Geomorphic research indicates that in a debris/mudflow, a significant amount of heavy timber causes landslides and the destruction of property (Reneau & Dietrich, 1987).

The author's field investigations indicate that the high-risk areas of the 2013 floods present similar landform patterns (Figure 4). These landform conditions led to the heaviest impacts in Jamestown and Drake during the 2013 Colorado mountain floods. The landform factors that create these patterns can be described as following: the site, with a slope of roughly 10%, is located at a confluence area of the lower portion of a canyon, which forms a receiving zone for a debris/mudflow; a small creek, originating several miles away, flows to the site through a "violent" or "ominous" canyon, which creates a zigzag shape; the hillsides of the canyon have a 25-35% slope; the narrow channel of the creek, which combines water, mud, sand, rocks, and dead trees, into a powerful debris/mudflow; a river that points at the site and turns, called "water shooting heart" by *feng-shui,* which can have the power to destroy homes during the flood (Figure 4); a steep hill north of the site, that experienced fires within a few years before the flood, leaving unstable soil and dead trees in its wake. These deposits developed into a debris/mudflow that hit the site and fed into the river during intense and heavy rain.

FIGURE 4
LANDFORM PATTERNS OF THE HIGHEST IMPACT AREAS

(Source: Ping Xu, 2016a) (Source: Ping Xu, 2014)

The Big Elk Meadow, Lyons, was a high impact area of the 2013 post-fire debris/mudflows. Three lakes filled with mud, and many houses built on the lower hillsides or close to the lake faced flooding and debris/mudflow disasters. Additionally, a house on a hillside affected by fire ten years ago was destroyed completely by a debris/mudflow. In the summer of 2017, the author revisited the site. Surprisingly, a new house has already been constructed within 10 feet of the 2013 debris track (Figure 5). This is because many existing insurance policies require damaged structures to be rebuilt at the same site, resulting in recurring damages due to landform patterns and the consistent hazards they present. Incorrect site selection can lead to disasters. Ignoring the disasters that occur does nothing to address the issue. In the next debris/mudflow disaster, it is highly likely the new house may face the same destruction as the last.

FIGURE 5
A NEW HOUSE BUILT 10 FEET FROM THE 2013 DEBRIS TRACK

(Source: Ping Xu, 2017)

WILDLAND-URBAN INTERFACE IMPACTS

Tourism, outdoor recreation and an increasing residential population in remote areas have made housing prices skyrocket as the area sees increasing human demand. People and their infrastructure have been intruding further into the wildland-urban interface, severely impacting the sensitive Rocky Mountain landscape. Eventually, the continuous development in the wilderness will destroy the appealing qualities people initially pursued. Furthermore, dreams of mountain living can turn into nightmares without thorough preparation and adaptation to natural hazards.

Fire, wind, rainstorms, and debris/mudflows are natural processes. Once humans move into areas prone to these natural hazards, disasters can destroy human life and property. Colorado wildfires have impacted hundreds of thousands of acres of land, thousands of homes, and taken several lives. In this system, humans fall victim to disasters but are also a direct contributor to the dangers. Between 2011 and 2016, of the 108 wildfires surveyed, 60% were caused by humans. As the population of the Front Range increases, particularly in the wildland-urban interface zones, so will the development of homes and infrastructure, including roads and power lines. Large trees with shallow roots can be toppled by severe winds, damaging power lines and potentially lighting a fire that will spread rapidly by the winds. There is also an increase in mountain tourism with the growing population. Campfires can quickly spread out of control, which is often the cause of Colorado fires. Due to the high rate of human-caused fires, fire prediction analyses should include the risk factor of human-caused ignition.

Once the vegetation is stripped through fire or erosion, there is an opportunity for alien seeds to grow. These invasive species compete for ground cover against native plants, monopolizing topsoil and sunlight, which can easily change the mountain landscape and the ecosystem. Since these plants are aggressive and often overgrown, they are very easy to ignite, which can lead to large wildfires. Many mountain residents choose to inhabit the hazard zones to be near wildlife and to see wildlife, but in reality they are competing against these animals for territory. Bears commonly break into cars and houses for food and mountain lions threaten human lives. Human development and infrastructure in the wild eventually drive endangered species to extinction.

Mountain residents desire privacy and their individual freedom. To have their own territory, some are willing to pay a high price and build a long driveway. Construction projects in the mountains alter the original terrain and drainage systems and often cause erosion. During heavy rainstorms, debris/mudflows can occur. Evacuating people and their pets from remote areas during fires and debris/mudflows is often very expensive, sometimes requiring helicopter assistance, and can also risk the lives of firefighters. The development of the wildland-urban interface negatively impacts the Rocky Mountain ecosystem and leads to more losses during natural disasters.

CONCLUSIONS

Faced with natural disasters, humans respond with three main attitudes. The first attitude is over-optimistic; the belief that humans can have power over nature. When nature causes trouble, these people want to "beat mother nature back." However, increasingly frequent natural disasters around the world have forced people to accept that nature is more powerful than humans. The second attitude is over-pessimistic; the feeling that natural disasters are out of people's control, creating resistance to acknowledging the issue. The people with this mentality simply hope that natural disasters will not happen during their lifetime. The third attitude is that we must adapt to climate challenges to sustain our society. As Darwin posited, "*It is not the strongest of the species that survives, nor the most intelligent, but rather the one most adaptable to change*" (Darwin, 1909).

Natural systems move in periodic cycles, with good years and bad years. We have to learn to survive with natural hazards. Climate, along with racial inheritance and cultural development, ranks as one of the most crucial factors in determining the conditions of civilization (Olgyay, 1963). Once people settle in hazard-prone zones, they are in danger. In many cases, the disastrous tragedies stem from design errors, particularly poor site selections. Throughout history, architecture and environmental design have developed with survival strategies impacted by the forces of climatic disasters. The current fire and post-fire debris/mudflows would teach us how to survive with these hazard challenges. In order to survive in hazard-prone zones, we must understand where the primary impact zones are, and when disasters will occur.

According to the author's field investigations of the 2013 flood impact zones in the Colorado Front Range canyons, every high-impact zone experienced a fire before the debris/mudflow. The geomorphic research by Wells states that fire changes the structure of soil, coating it in burned organic molecules and making it virtually waterproof. The primary post-fire erosion processes include the dry ravel -- the downhill movement of debris, which dams dry washes and worsens future flows; and the rill networks-- small debris flows that branch extensively with little rain. These erosions accelerate and intensify debris/mudflow disasters during intense and heavy rainfall (Wells, 1987). After a fire, it is crucial to anticipate debris/mudflows.

The three pre-conditions of the post-fire debris/mudflow are as follows: 1) the landforms trigger debris/mudflows. A debris/mudflow often initiates from steep uphill landforms and basin areas in higher elevations abound with debris. The debris/flow accelerates and generates power through a narrow channel/canyon, continuing to erode the surrounding land and accumulate debris; 2) the area experiences a wildfire strike, particularly at a higher elevation, which accelerates and amplifies the debris/mudflow process; and 3) the area receives heavy and constant rainfall.

The high impact areas include four major zones downstream: 1) the first occurs where the slope suddenly declines by about 25%, causing debris to release; 2) the area in the lower elevation with a slope of <15%, where debris is released with the greatest impact; 3) areas where debris flows into rivers and lakes, especially at a confluence, which can block channels and cause flooding; and 4) the zone on a hillside with a gulley/dry wash directed to the site, called the "hidden arrow" in *feng-shui,* or the area nearby a gulley/dry wash.

By following the criteria of landscape patterns, the potentially dangerous zones of debris/mudflows can be determined, and a warning method can be developed. These areas can be mapped manually or by digital GIS mapping, providing a basis for identifying hazard zones. After a wildfire, all areas are well mapped by government institutions. The burn areas, particularly those on the uphill areas of the debris catchments would potentially initiate the debris/mudflow passing the narrow canyon or dry wash. The debris/mudflow ultimately releases the debris/mud at its downhill areas with gentle slopes, which are the high impact areas.

Finally, the reliable weathercast system can warn residents of anticipated heavy and constant rainfall. Therefore, after a wildfire, the local government should warn people living in the debris/ mudflow prone zones to be prepared for a post-fire debris/mudflow strike. It is common for flooding to occur after a wildfire, as debris flows into creeks and rivers, raising the water level. But the debris/mudflow on the hillside can also be a deadly disaster, leveling houses, toppling trees, and in worst case scenarios even taking lives. When weather forecasting predicts heavy and constant rainfall, people living in the impact zones should be asked to evacuate immediately before the storm, as the post-fire debris/mudflow can be too fast to escape.

Humans have inhabited mountains throughout history. Over generations, they learned how to survive in challenging environments. A wise site selection would help people to avoid danger. Combining scientific study and *feng-shui's* practice, the following criteria would help people to select a site for their mountain home, and provide specific factors to identify the potential hazard zones of post-fire debris/mudflows.

- *Mountain range and canyon (Dragon):* First, people should look and evaluate the mountain range and canyon, including the ridge dividing watersheds. *Feng-shui* refers to this area as the "dragon." In particular, *feng-shui* recommends avoiding the mountain basin with debris, the "sick dragon," or the mountain ridge area abound with loose debris, and the canyon with steep slopes and a narrow channel, the "violent dragon."
- *Hills:* Housing in hilly regions should be constructed with caution. Areas above 8,000 feet in elevation, particularly on mountain crests and hill peaks, are susceptible to lightning, high winds, and wildfires. Furthermore, steep slopes over 25% grade and downhill areas should be avoided because they can trigger debris/mudflows. People should evacuate from houses built on the lower end or nearby a straight gulley, with a dry wash behind or directed towards the site, referred to in *feng-shui* as "the hidden arrow."

• *Water: river, creek, and dry wash: Feng-shui* advises people to avoid construction on sites near water because of its vulnerability to debris/mudflows and floods. Houses should not be constructed near the confluence of two rivers. Sites outside the curve of a river with a channel pointing directly at the house, called "water shoot the heart" in *feng-shui*, are particularly dangerous and residents should prepare for evacuation in the case of a debris flow.

• *Site: Feng-shui* also advises people to have a comprehensive analysis of the surrounding landforms. Flat areas that have a 10% slope on the downhill side of a creek or dry wash can be a receiving or impact area of debris/mudflows. Low points in the landscape are susceptible to flooding. Dense forests have a high risk of wildfires. Additionally, the highest impact areas often have the combination of landform patterns: a zigzag canyon with a hillside over 25% grade, a river that flows toward the site, the confluence of two rivers, and a local steep hill that was recently affected by a fire. People located in such areas should immediately evacuate after preconditions are observed.

Natural hazards are dangerous for humans, but they are part of the ecological process and only become disasters when they affect human life and property. With increasingly extreme weather conditions and growing populations, Colorado wildfires and post-fire debris/mudflows will continue to occur frequently. Nature is hard to control, but human behavior can be modified. Human development and populations are harmed by the hazards, but also contribute to the cause of disasters. The wildland-urban interface expansion negatively alters the Rocky Mountain ecosystem and results in more damages from the hazards. Pushing populations and infrastructure away from the hazard-impact areas would be an effective strategy for adapting to climate challenges and sustaining the Rocky Mountain communities.

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