

Feng-shui as a Clue: Identifying the Landform Patterns of Impact Zones from the 2013 Historic Mountain Floods in Boulder and Nearby Areas, Colorado, USA

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Abstract—The 2013 historical flood along the Colorado Front Range exposed problems of the existing ways in which the mountain residence has been established. Scientific knowledge is only superficially considered in site planning efforts. Particularly, the mountain floods including debris flows, mudflows, landslides, and post-fire factors, have not been researched sufficiently. Moreover, the increasing population and frequent fires in the mountains have changed the vulnerable system of the mountainous surface and caused debris source and erosion. With recent extreme weather patterns, the hazards in mountain areas appear frequently. Therefore, research on mountain floods is urgent. The 2013 flooding areas demonstrated strong evidence of high impact zones, which are the basis of this research. Feng-shui, Chinese geomancy, particularly the form school, provides landform criteria of the good luck sites and the risky areas. Using feng-shui as a clue, this research identifies 1) landforms providing abundant debris source, 2) landforms generating the speed and power of the debris flow proceeding downstream; and 3) landforms of the receiving areas of the debris flow; and also, using the geomorphic concepts, examines feng-shui criteria, in order to establish guidelines, which would benefit site selection processes and evacuation planning efforts during similar natural hazards.

Keywords—feng-shui; impact zones; mountain flood; debris/mudflow; landform patterns

I. INTRODUCTION

Boulder, Colorado is one of the most attractive and desirable small towns in the U.S. because of its beautiful mountain landscape and healthy living conditions. From September 9th-15th of 2013, a historic flood struck the peace of Boulder and its surrounding communities. The violent power of the flood destroyed houses, roads and bridges, wiped out small towns, re-routed creeks and streams, and took lives. This flood in the foothills of the Rockies was caused by a week of heavy rain over complex mountain terrain with steep landforms. Such mountain floods include multi-faceted events of debris flows, mudslides, landslides, and post-fire factors.

The 2013 historical flood exposed the problems of existing ways how residences have been developed in which scientific knowledge of mountain hazards is only superficially considered. Moreover, the popularity of living in the

mountains and the impact of recurring patterns of extreme weather have caused terrible disasters during the last decades.

The mountain population has been increasing, due to the air pollution in the metropolis areas, building technique able to stretch roads to remote areas and any elevation, reliable 4 wheel vehicles making all season driving available; and most important, people having a fantasy of living in a mountain house with beautiful views and surroundings. In addition, the digital revolution allows people to operate a business in a mountain house with their family. The image of mountain living has been transferred from being the poor to being the wealthy.

When dreaming of mountain living, people do not want to know of the mountain hazards, such as fire, Chinook winds with the high gusts, mud flows, landslides, and debris flows. Mountain floods have been less researched, since the floods occur in remote areas with rugged terrains and roads can be destroyed during risky weather (Takahashi, 1991.) Education of site analysis doesn't provide enough knowledge of mountain floods. With recent extreme weather patterns, the mountain hazards will appear more and more. Therefore research of mountain floods is important and urgent.

In contrast to contemporary site analysis practices that lack knowledge of mountain floods, some vernacular setting methods can provide wisdom. China has 30% of the population living in mountain areas (Li, 2004) and thousands of years of written record on their survival experiences, which are mainly summarized in the *feng-shui* practice. *Feng-shui* is an ancient geomancy used to harmonize people with their environment, particularly the form school, which provides criteria of the landforms for attracting good luck and avoiding troubles.

As a professor and *feng-shui* consultant, the author researches on landscape settings and has lived in the Boulder mountain region for over 20 years. This research method includes text studies of geomorphology and *feng-shui*, and field investigations in the canyons of the Colorado Front Range. The author will present her research on the landform patterns of the flood's impact zones in order to establish

guidelines to avoid building at those places. Such outcomes would benefit site selection processes and evacuation planning efforts during similar natural hazards.

II. FENG-SHUI CRITERIA OF NEGATIVE SITE CONDITIONS

Chinese have inhabited mountain areas for over thousands of years. Even today about 1.3 billion people and two-fifths of the cultivated land are distributed in the mountain areas of the country (Li, 2004). China has a long tradition of recording the debris/ mud flows that killed people from a couple hundreds to a couple thousands. Tianchi Li in his article titled “Mountain Hazards in China” states that in 186 BC in the Gansu Province, Wudu Area, the rock and debris avalanche caused 760 deaths; in 1680 in Shaanxi Province, Tonghe area, there was a debris flow and 2,385 deaths; in 1888 in Beijing, Fangshan area, the debris flow caused over 1,000 deaths; in 1891 in Sichuan Province, Xichang area, the debris flow caused over 1,000 deaths; in 1926 in Sichuan Province, Ganlu area, the debris flow caused 230 deaths; in 1943 in the Henan Province, Lushan area, the debris flow caused over 100 deaths and it happened again in 1956 and caused 290 deaths; in 1981, Sichuan Province, Ganlu area, the debris flow caused 360 deaths and in 1984, in the same area, the debris flow caused over 300 deaths; and in 1994 in Henan Province, Xiyu, Lingbao area, the debris flow caused over 2,000 deaths (Li, 2004).

Chinese experiences dealing with mountain floods have been summarized into *feng-shui*, the Chinese geomancy. *Feng-shui* is used to select good timing, a suitable place, and supportive partners in order to sustain people’s life and their society by pursuing positive energy for good luck and avoiding disaster. *Feng-shui* method is practiced with multi-scales, from a large scale to a small scale, from mountain range, to city, to house and even to furniture.

Feng-shui has many schools, particularly the form school deals with landforms of mountains - 龙, Hills - 砂, water - 水 and site - 穴; and orientations - 向, to select the favorable sites and avoid the unlucky factors. According to ancient *feng-shui* textbooks, the landform criteria of flood risk areas are interpreted as follows:

A. Dragons: mountains and canyons - 龙

According to *feng-shui* (Fig.1), people must avoid building in the following canyons; and also should avoid building on the lower valley of such canyons (Xu, 1580):

- The “sick dragon” -- the mountain surface has some areas broken, such as a basin area. Ancient Chinese believed that the *qi* (vital energy) of such mountain has exhausted.
- The “violent dragon” -- the canyon has steep slopes, a narrow channel and many big rolling rocks, it makes people feel threatened.
- The “ominous dragon” -- according to the author’s interpretation, the plan view of a canyon is zigzag, called the “crab legs”.

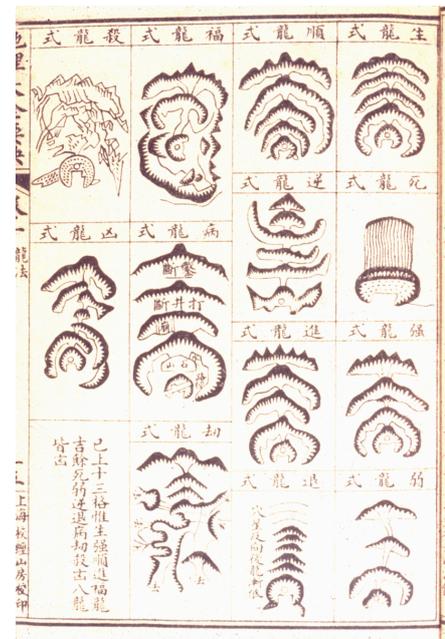


Fig. 1. The *feng-shui* diagrams present the unfavorable mountains. (source: Xu, Shike. (1580) *Di Li Tian Ji Hui Yuan*.)

B. Hills - 砂。

According to *feng-shui*, people must avoid building on or nearby the following hills (Xu, 1580 and Jiang, 1997):

- The crab leg hills – the plan view of the hills is zigzag.
- The broken flag hills – the hills full of debris and broken rocks.
- The evil hidden arrow -- a dry wash above and behind a house or site points directly at it. It can cause the debris flow and destroy the house. *Feng-shui* classifies the hidden arrow as the most dangerous one, since the evil factor follows a straight line.
- The dead eel hills -- the hills have a straight range and even contours without veins. Their plan view looks like a parallel vein leave.
- The hill without veins -- according to *feng-shui*, a hill without veins will cause floods (Liu, 1986).
- The pressuring hills -- the high hill is in front of the site or house.

C. Water - 水

According to *feng-shui*, a straight stream or river with fast water is evil, and the meandering one is favorable. The area located inside of the curve of a river is favorable; while the area outside the curve of a river is unfavorable. The area in the lower part of a confluence is unfavorable, but the site above the water meeting point is favorable (Ye, 1688). Particularly, the following types of water should be avoided (Fig. 2).

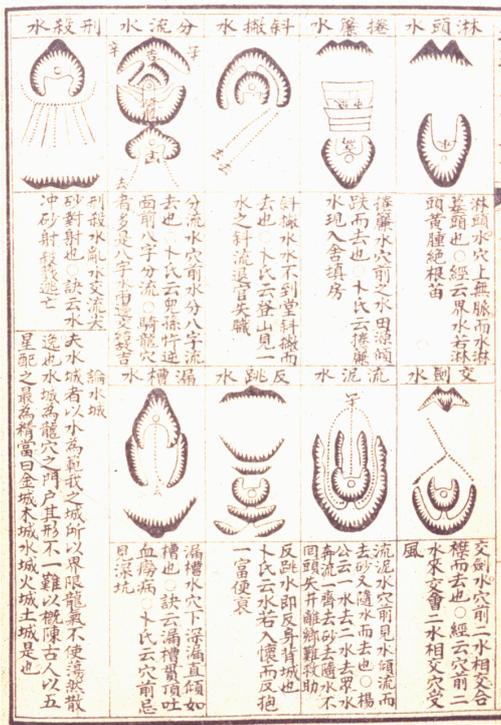


Fig. 2. The *feng-shui* diagram demonstrates the unfavorable types of water. (source: Ye, Jiusheng. (1688) *Di Li Da Cheng*. Chapter 4.)

- The “water showering head” -- 淋头水。In the ancient times the coffin was set behind the gravestone and the dead were placed with the head faraway and feet nearby the gravestone. In the mountain areas the head of the dead was placed at a relatively higher point. The gravesite must be selected in the area that will not be flooded by the water from the higher elevation, called the “water showering head” (Jiang, 1997). The “water showering head” is identified as one of the most evil factors. The water from above, such as the debris/mudflows can be a deadly flood.

- The “water cutting feet” -- 割脚水。The water nearby the site cuts off pieces of the land during floods.
- The “water shooting heart”-- 冲心水。The stream directly points to the site and turns. Such water is classified by *feng-shui* as one of the most evil factors.
- The “mud water”-- 泥流水。 *Feng-shui* states that the water with mud washes luck away, which can make residents lose their home and become vagrants.

D. Site - 穴

According to *feng-shui*, in a favorable site the *qi* (vital energy) accumulates, having a U-shaped containment enfolded by hills, facing the south where there are mountain peaks in the distance, high hills in the north, and a meandering river passing through (Fig. 3). However, the multi criteria of an unfavorable site are rarely found in *feng-shui* text. It was a hypothesis of this research that there are combined landform criteria of the highest impact areas during the 2013 flood.

E. Orientation- 向

Orientation is very important in site selections. Good luck sites should face south, east and southeast. Also, the canyons which open toward the south, east and southeast are favorable, but the ones which open toward the north are unfavorable.

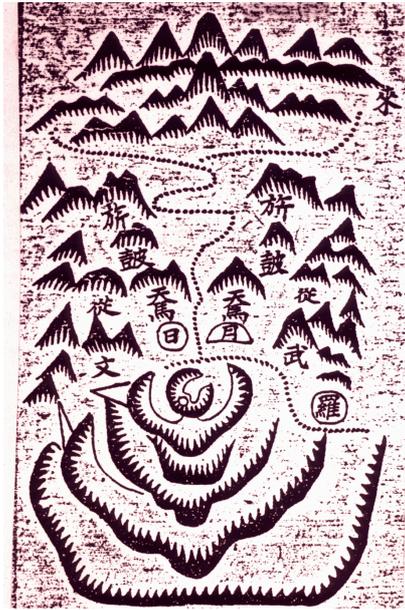


Fig. 3. The ideal model of a favorable *feng-shui* site. (Source: Ye, Jiusheng. (1688) *Di Li Da Cheng*. Chapter 3.)

III. FIELD INVESTIGATIONS, USING *FENG-SHUI* AS A CLUE

The author’s early research on *feng-shui* is her doctoral dissertation titled “*Feng-shui: A Model for Landscape Analysis*,” at Harvard University in 1990, using an early version of GIS (Geographic System Information). By comparing *feng-shui* with a conventional Western method of land planning, she demonstrated *feng-shui* as a valid alternative method for landscape analysis. Moreover, *feng-shui* practices with multiple scales, from large to small; and emphasizes the horizontal and spatial analysis (Xu, 1990). In this research, using *feng-shui* as a clue, her field investigations took place about 4 months in the canyons along the Colorado Front Range, from larger scales of mountain ranges to single sites of the impact areas of the historic 2013 floods.

The historic 2013 flood caused heavy impacts for the mountain neighborhoods and also provided a unique opportunity to research the mountain flood, demonstrating the facts and evidence of the flood impact areas. It is a crucial time after one year of the flood to investigate the impact zones, since the sites destroyed by the flood still can be identified, even after repairing. Damaged sites are accessible to the public, although some areas are still restricted. Also, it is an important time to conduct research recommendations on site selections for buildings, since many houses and bridges are in the re-construction phase. Rebuilding houses in the same pre-flood locations would lead to those houses being destroyed again during future floods.

The author's investigated areas include the Poudre Canyon, west of Fort Collins, the high impact town is Poudre Park (5); the Big Thompson Canyon, the high impact town is Drake (3); the N. St. Vrain Canyon, the high impact area is near Chapel on the Rock (1); the Big Elk Drive, the high impact zone is the three lake area (6); the James Canyon, the high impact area is Jamestown; and at Boulder there are several high impact areas including the sites at the west end of Arapahoe Ave (4), at Olde Stage Rd (7) and at N. Cedar Brook Rd (8). The field investigations indicate that the high impact zones always are involved with debris/mudflows. According to Tamotsu Takahashi there are two different types of debris flows, one is in a large scale and the other is in a minor scale (Takahashi, 1991). In this section, the investigations are discussed with these two types of the debris flows.

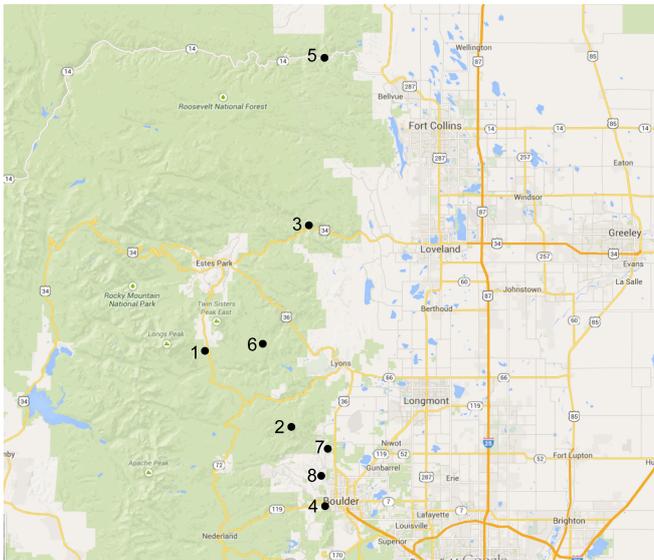


Fig. 4. The author's investigated areas in the canyons of the Front Range, Colorado, USA. (By Ping Xu, 2015)

A. Major Debris

According to Tamotsu Takahashi the debris flow "is born as a dense mud and stone flow which more or less resembles ordinary tractive flow, then it increases its solid concentration and size as it proceeds downstream, and at last it changes into a fully developed debris flow having a swelled forefront." (Takahashi, 1991). Therefore, this research, using *feng-shui* as a clue, identifies 1) landforms providing the abundant debris source, 2) landforms generating the speed and power of the debris flow proceeding downstream; and 3) landforms of the receiving areas of the debris flow, and also examines the *feng-shui* criteria with the geomorphic concepts.

1) Chapel on the Rock, Allenspark, N. St. Vrain Canyon

This site is the one with the heaviest debris flow impact. During the 2013 flood the heavy debris flow buried roads, bringing over 6 feet of mud and a couple of feet deep of tree chips. This debris flow came from five miles away--Mt. Meeker. At the upper portion of the canyon there are a lot of fallen trees, huge rocks and rolling stones; their diameter can

be over 5 ft. The chapel built (1936) on the top of the huge rocks had no damage. Mt. Meeker's peak is high above the tree line and provides an abundant amount of broken rocks and sands. It's large basin, without veins, collected debris and runoff that caused debris flows, therefore this high impact zone could have frequent debris flows (Fig. 5).

Feng-shui evaluation is as follows:

Dragon-- canyon: Mt. Meeker has a big basin area. According to the *feng-shui* definition, such a mountain would be called "a sick dragon."

Hills: The steep slope without veins and the straight channel of the creek points to the site. In *feng-shui* such a straight line is called "the hidden arrow."

Water: The little creek from a high elevation passes a straight channel on steep slopes, which causes debris flows. In *feng-shui* the debris flow is called the "water showering head", one of the most dangerous waters.

Site: A plain located beneath the mountain peak having a huge basin area without veins and a narrow stream. Such site has a flooding risk.



Fig. 5. The 2013 debris flow came from Mt. Meeker, 5 miles away. (Photo by Ping Xu, 2014)

2) Jamestown, James Canyon

Jamestown belongs to one of the heavy impact areas with a death. During the 2013 flood the entire town was evacuated. The most dangerous area is in the center of town, a big house had 1/3rd knocked down, and some other houses were destroyed (Fig.6). Many houses were flooded. The Little James Creek passes the steep canyon; it can carry huge amounts of debris. The mud on the creek bank is proof that the debris climbed over several feet. Also, on north of the town there is a high hill. The soil on the southern slopes of this hill is dry and thin, with small rocks and a few vegetation, which provides the source of debris. After the 2011 fire on this hill, the situation became worse. During the heavy rain, the debris was washed down directly to the center of Jamestown.

Feng-shui evaluation is as follows:

Dragon: The canyon that the Little James Creek passes is narrow and steep. The plan view of this canyon takes the shape of zigzags, called the “crab legs”. *Feng-shui* evaluates such canyon as the “ominous dragon”.

Hills: North of town there is a hill with steep slopes, which *feng-shui* calls the fire hill, where was a big fire during 2011.

Water: The Little James Creek and the James Creek meet at the center of this town. James Creek flows fast and directly points at the house that was knocked down. *Feng-shui* calls such river as the “water shooting heart”, one of the most dangerous waters. Passing through the “ominous dragon,” the Little James Creek caused terrible debris flow, called the water showering head.

Site: This town was located in a deep and narrow canyon with a confluence, a river -- the “water shooting heart” that comes from the southwest; and the Little James Creek that comes down from the northwest through the canyon called the “ominous dragon”. In the north the steep hill had a fire two years ago.



Fig. 6. James Creek flows fast and directly points at the house that was knocked down. (Photo by Ping Xu, 2014)

3) Drake, the Big Thompson Canyon

This site was located at the area immediately up to the confluence. All of the 8 houses were flooded by the 2013 debris flow that spread mud over 4 feet high. The family at the west end had the most damages. All the people on the site were evacuated by helicopter. The North Fork Big Thompson River passing the steep canyon carried a huge amount of debris. Also, the southern slope of the hill in north of the town with an abundance of dry soil and small rocks provided the source of debris. In 2011 on this hill there was a fire.

Feng-shui evaluation is as follows:

Dragon: The North Fork Big Thompson canyon is one of the most violent canyons along the Colorado Front Range. The dark and narrow canyon is filled with the remaining debris flow, mudflows, landslides -- huge pieces of rock with a diameter of over 10 ft that fell from the mountain -- broken hills, fallen trees, shredded pieces of vehicle and destroyed

houses. *Feng-shui* would evaluate such a canyon as the “violent dragon”.

Hills: North of town there is a high hill with steep slopes, which *feng-shui* calls as the fire hill, there was a big fire two years ago.

Water: The Big Thompson River with fast moving water directly points to the house site. *Feng-shui* calls such river as the “water shooting heart”. The North Fork Big Thompson River brought the water violently down and the debris flooded the houses.

Site: This town was located in a canyon with a confluence -- a “water shooting heart” from southwest points to the site, and the small creek coming down from the “violent dragon”. In the south the steep hill had a fire two years ago.

4) The west end of Arapahoe Ave, Boulder

This site is located on the lower plain of the Flatiron Summit, Boulder. During the 2013 floods the debris/mud flow split a building into two parts and over 10 feet of mud filled the first floor. People were shocked at how they were flooded by the water and mud from “heaven”. They did not realize that this beautiful site is beneath the mountain peak having a huge basin and a straight dry wash that points directly to the site. The steep surface of the hill is full of small pieces of rock, sand, and fallen trees. The rich deposit of debris, when enough rain is received, can develop the debris flow.

Feng-shui evaluation is as follows:

Dragon: The Flatiron Summit has a huge basin, without veins, which *feng-shui* calls the “sick dragon”.

Hills: On the steep slope there is a straight channel of a dry wash that points to the site, collecting the runoff with debris and then it flows to the basin area. The straight channel *feng-shui* calls the “hidden arrow.”

Water: A little dry wash from a high elevation passes a straight channel on steep slopes. This water is called “water showering head,” and it can cause debris flow when it rains heavily.

Site: This site is located on the lower plain of the Flatiron Summit, Boulder. The mountain has a huge basin area without veins and the channel of a dry wash points to the site.

B. Minor Debris

“Another minor occurrence type in this gully is assumed to be that the very unstable deposit on the bed can be mobilized and become a debris flow by appearance of surface water flow due to either instantaneous release of dammed up water behind deposit or piping of seepage water through the deposit” (Takahashi, 1991) According to the author’s field investigations such debris flow occurs from a local hill, and they can cause killing disasters.

5) Proud Park, Larimer County

This town located on the confluence area recently had frequent floods after the mountain fires. Homes on the Fall Gulch particularly took the hardest hit by the 2013 flood. The upper portion of the Fall Gulch has a straight channel that

passes the canyon with parallel contours, taking the shape of a single veined leaf. During the 2013 floods utilities were out, roads were washed-out, and homes were inaccessible even by 4-wheel drive vehicles. The whole valley was evacuated. The steep surface of the hill was full of small pieces of rocks, sands, and fallen trees. The rich deposit of debris, during the heavy rain, developed the debris flow.

Feng-shui evaluation is as follows:

Dragon: The mountain range of the Fall Gulch is a straight line; *feng-shui* calls such mountain the “dead eel”.

Hills: The hillsides have steep slopes with parallel contours, taking the shape of a single veined leaf. According to *feng-shui*, steep slopes without veins will cause floods.

Water: The little dry wash from a high elevation on the Fall Gulch passes a straight channel with a steep slope. This water *feng-shui* calls the “water showering head”; it can cause debris flow when it rains heavily.

Site: The house sites were built on the slopes of Fall Gulch. The hillsides have steep slopes with parallel contours, taking the shape of a single veined leaf. A dry wash passes through the site.

6) *Three Lakes, the Big Elk Meadow Drive, Lyons*

This site is reserved for people’s summer second homes with secure surroundings for their kids to play and fish. During the 2013 floods, the lakes were filled with mud and many houses were flooded. A house on the steep slope was destroyed, and the only thing left was the garage buried in mud. On the top hill there was a fire two years ago, and there is a dry wash directly pointing to the house site. The upper portion of the canyon, taking the shape of the single veined leaf, caused erosion and mudslides that developed the debris flow.

Feng-shui evaluation is as follows:

Dragon: The Deer Creek canyon takes the shape of the single veined leaf. The mountain range is a straight line, *feng-shui* calls such mountain the “dead eel”.

Hills: The destroyed house was on steep slopes, where there were abundant dead trees burnt by the fire two years ago and a straight dry wash -- “a hidden arrow” directly pointed to the house.

Water: The dry wash passing a straight channel with a steep slope caused the debris flow --the “water showering head” destroyed the house.

Site: The lakes fed by the creeks passing through narrow canyons. The hill has steep slopes where fire burnt off vegetation.

7) *Sites on Olde Stage Road, Boulder*

North of Boulder, there are hills running south to north. The side facing the city of Boulder has kept undeveloped areas, as a part of the Green Belt Zone, while the other side has been developed as a relatively dense and wealthy residential area along Olde Stage Road and North Cedar Brook Road. During the 2013 floods, the homes along

both roads were hit heavily, while there was no flood reported on the hillside of the Green Belt. The Olde Stage Road was washed out and several houses on the lower portion of the valley were flooded with debris and mud.

Feng-shui evaluation is as follows:

Dragon: The mountain range along the Olde Stage Road is straight. In *feng-shui*, such mountain is called the “dead eel”, which is not favorable to inhabit.

Hills: The hill taking the shape of a single veined leaf with parallel and even contours can cause floods. There were frequent fires during recent years.

Water: The little dry wash passing through a straight channel on a steep slope caused the debris flow. In *feng-shui*, such water is called “the water showering head”.

Site: The site was located on the lower portion of the valley, enfolded by the hills with steep slopes and parallel contours without veins. The hills called “dead eel” caused debris flows.

8) *Sites on North Cedar Brook Road, Boulder*

On the North Cedar Brook Road, a house was demolished by the debris flow that came down from a dry wash behind the house (Fig. 7). The upper floor had partially fallen into the basement. This area has been developed as a relatively dense neighborhood with big houses. Some of them are built up on the top of the hill with steep slopes. Such development causes local landslides and erosion of mud and debris.

Feng-shui evaluation is as follows:

Dragon: The mountain range along the North Cedar Brook Road is straight. In *feng-shui*, such mountain is called the “dead eel”, which is not favorable to inhabit.

Hills: The hills have a dry wash- taking a straight-line shape -- “a hidden arrow” directly pointing to the destroyed house.

Water: The straight gully with a steep slope caused the debris flow. Such water, in *feng-shui*, is called “the water showering head.” It destroyed the house.

Site: The dense development caused the local landslides and erosion. The straight dry wash caused the debris flow when it rained heavily.



Fig. 7. The house was demolished by the debris flow. (Source: <http://www.pinebrookhills.org>)

IV. CONCLUSION

Mountain issues have gained more attention over the last few decades, due to the popularity of mountain living and extreme weather patterns. The 2013 historical floods in the Colorado Front Range distressed mountain communities and exposed problems within the isolated specializations of our existing academic system. It has become clear that the issues of mountain floods are missing from the education of site analysis. The 2013 flooding areas, demonstrating strong factual evidence of high impact areas, function as the basis of this research. Combining scientific knowledge with the vernacular practice of *feng-shui*, this research provides the landform criteria of the flood impact zones in mountainous areas.

Feng-shui, Chinese geomancy, particularly the form school, provides landform criteria of good-luck sites and trouble areas. Such criteria can be used to predict potential risk areas. Using *feng-shui* as a clue, this research identifies 1) landforms providing abundant debris source, 2) landforms generating the speed and power of debris flows; and 3) landforms of the receiving areas of the debris flow and also, using the geomorphic concepts, examines the *feng-shui* criteria. The landform patterns of the high impact areas are identified as follows:

A. Mountains and Canyons, in *feng-shui*, are called “dragon.” The unfavorable dragons include the “sick dragon”-- the mountain surface is broken; the “violent dragon”-- a narrow and dark canyon that has steep slopes, and many broken rocks and rolling stones; and the “ominous dragon”-- the canyon plan takes the shape of zigzags. According to the author’s field observations, all such canyons provide abundant debris source, a crucial condition to cause the debris/mud flows, particularly, the large-scale debris/mud flows.

The debris source could come from miles away, thus, in this issue, the *feng-shui* method presents a better understanding than the Western conventional site analysis practice which works on a master plan of a piece of land purchased or proposed. By working on a small scale, the impacts from the large scale areas could be missed. It would explain why the 2013 debris flow shocked the planners as well as the general public.

B. Hills, in *feng-shui*, means the hills that the house site is located on or nearby and discussed in a local scale. *Feng-shui* warns people to not build on the hill like a dead eel – the hill range is straight and its contours are parallel, like a single-veined leaf. According to the author’s field observations, such landforms could cause soil erosion, particularly after a mountain fire. When it rains heavily, there could be local debris/mud flows. Such debris flow is born from a local hill, but they can cause killing disasters.

C. Water: *feng-shui* practice pays special attention to the forms of water bodies. Such concepts enhance our understanding of mountain floods. With field investigations, the author interprets the most dangerous types of waters as follows:

- The “water showering head” -- a muddy flood comes from higher elevation above a site. *Feng-shui* states such flows are one of the most evil disasters. The debris/mudflows in a large scale or a local scale are born from a higher elevation and generate speed and power when proceeding downhill, causing one of the most violent floods.

- The “water shooting heart” -- a stream running toward the site and then running away. According to the author’s field investigations, the area that a river directly points to can be a risky site during floods.

- The confluence -- *feng-shui* states that the area located below the joint of two rivers is unfavorable. According to the author's investigations, the confluence areas in the lower portion of a canyon could be the high impact areas of the floods.

- The “hidden arrow” -- the water comes from the back and directly points to the site, such as a straight dry wash or gully located on a hill. During heavy rains, a dry wash or gully with a narrow and straight channel can generate water with mud, sand, and rocks into a powerful debris flow. Moving fast and climbing banks, a debris/mudflow can knock down houses, take lives, and even bury an entire village. No wonder ancient Chinese were terrified of the straight line of “the hidden arrow,” they spread this trembling fear on all straight things, like roads and railways.

D. Site: for an ideal site, *feng-shui* emphasizes the horizontal and spatial analysis with multiple landform criteria of mountain, hills, water, and site, while negative site conditions are usually described with a single criterion. The combined criteria of a high impact site are rarely found in *feng-shui* textbooks. The author's field investigations indicate that the landforms of the high-risk areas of the 2013 floods present similar combined patterns, which can be identified as follows:

The sites located in a valley with the confluence of two rivers. A small creek, similar to a dry wash, flows down to the site through the “violent or ominous” canyon with abundant debris sources. The narrow channel of the creek generated water, mud, sand, rocks and dead trees into a powerful debris/mudflow. The river directly pointing at the site had the power to destroy houses. In addition, the steep sloped hill in north of the site had fires in 2 year ago, which provided unstable soil and dead trees. During the heavy rain these deposits developed into a local debris/mudflow that hit the site and fed into the river. The plain of the site forms a receiving zone of debris/mudflow. All these landform

conditions led the heaviest impacts on the site during the 2013 mountain floods.

The characteristics of the bedrocks and soil in the Rocky Mountains provide abundant debris source -- the bedrocks are often exposed; the soil is thin; and the tree roots grow shallow and fall down easily during floods; particularly, on the south exposure of the hills, there are tremendous amount of broken rocks and sand due to the extreme change of the temperature and lack of vegetation. Moreover, the increasing population, dense development, and frequency of fires in mountains have changed the vulnerable system of the steep surface and generated the debris source and erosion. The abundant debris sources can cause the large scale or the local scale debris flows when it rains heavily.

This research uses an interdisciplinary approach to site selections in mountainous areas, taking into account adaptation to climate challenges and geographic conditions. This work of landform patterns is anticipated to predict the impact zones of mountain floods for government, planners, architects, landscapers, developers, and for the general public. Wise site selections would contribute to a sustainable strategy of environmental planning in order to avoid risk areas and to evacuate during natural hazards in the Colorado mountain area and beyond.

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