CASE STUDY

California North Bay Wildfires of 2017
An Actuarial Analysis

2017 was a catastrophic year for wildfires across the United States. Over 10 million acres burned, and many lives, homes, and businesses were lost. When the rubble and ashes settled, the risk management community found lessons in the destruction and answers to the question of how well the science included in the Wildfire Risk Score model had performed.

Defining Risk in Relation to Events

These were some of the most extreme wildfires in recent history. In the world of risk management, the term “extreme” is reserved for those natural hazard events where the intensity, damage, or both are significantly greater than normal. When an event’s intensity increases, its impact can spread far beyond locations labeled as high risk. This is true whether the event is a wildfire, flood, hurricane, severe convective storm, or earthquake.

Hurricane Harvey, for example, brought extreme and prolonged rainfall across a wide area, which caused flood waters to rise quickly and significantly. The higher flood waters spread the damages beyond the Federal Emergency Management Agency’s (FEMA) high-risk Special Flood Hazard Areas (SFHA) into areas of lower risk and higher elevation.

A similar phenomenon occurs with wildfires. Most wildfires start within locations of high- or very-high-risk vegetation. As the intensity increases, often fueled by high winds and fed by dry vegetation, the fires spread into lower risk areas, primarily via large embers carried by the wind. However, ground studies of the 2017 Northern California fires determined that a large number of the lower risk locations suffered damage as a result of urban conflagration; that is, homes caught fire from flames that spread from neighboring homes rather than from direct contact with the wildland fuels. Similar to dominos falling, very high winds caused embers from wildland fuels to spread the fires into neighborhoods.

To understand how this occurred, it’s helpful to look at the conditions, causes, and movements of the North Bay fires (the combined name for the Atlas, Nuns and Tubbs fires). CAL FIRE investigators have determined that the Atlas fire and five of six fires that merged to create the Nuns fire ignited when trees or tree branches fell against power lines.
The three fires were among more than 170 wildfires that started between the late-night hours of October 8 and early hours of October 9, 2017. The fires ignited at the tail end of the region’s hotter-than-normal dry season and during an uncommon wind pattern known as Diablo winds. Northern California’s version of the Santa Ana winds, the Diablo winds blew hot, dry air from the east into the cooler, moister air near the Pacific Ocean. Funneled by the peaks and valleys of the Northern Coast Range, the dry air rushed at windspeeds estimated as high as 90 miles per hour over parched grasses, shrubs, and trees. Calling the wildfire conditions “rare,” a group of scientists studying the North Bay fires determined that nearby meteorological stations experienced their most acute fire conditions in more than two decades of observation. In other words, the stage was ideally set for extreme fires. Following the late-night ignitions, the North Bay fires traveled with devastating speed. The Tubbs fire ignited at about 9:45 p.m. and raced to its far southwestern perimeter, some 12 miles away, to arrive before 3:00 a.m.

Calling the wildfire conditions “rare,” a group of scientists studying the North Bay fires determined that nearby meteorological stations experienced their most acute fire conditions in more than two decades of observation.

It’s also important to add that while “low risk” mainly refers to locations farther away from wildland fuels, construction materials, amount of defensible space around a home, proximity of combustible materials, and other loss-mitigation factors also affect risk. In Northern California’s Tubbs fire, hurricane-level wind gusts sent embers from wildlands, through neighborhoods, across a major freeway, and into the suburban Coffey Park neighborhood where few, if any, homeowners had performed any wildfire loss mitigation. As a result, this amplified the amount of loss.

CoreLogic Wildfire Risk Score Tested

Given the unusual conditions and extreme nature of the Tubbs, Atlas, and Nuns fires, which each destroyed homes in areas categorized as low risk, it’s reasonable to ask if the CoreLogic® wildfire risk scores work. The answer is yes.

Combined Impact of the Fires

In this analysis, we look at the Tubbs, Atlas, and Nun fires individually and collectively to assess how well the CoreLogic Wildfire Risk Score performed. The Atlas fire affected 446 single-family residences (SFRs), the Nuns fire affected 690 SFRs, and the Tubbs fire affected 4,817 SFRs. To show the model’s performance, we compared the distribution of affected structures to the distribution of the total population of SFRs in the ZIP codes affected. The combined analysis provides a good snapshot of how well the scientific risk assessments performed.

In the tables below, we see that 88.8 percent of the 79,607 SFRs in the affected ZIP codes were classified as low risk. Of the 5,953 homes damaged in the fires, 3,473 SFRs (58.3 percent) were in the low-risk category. This means that only 4.4 percent of low-risk SFRs in the affected ZIP codes were damaged in the fires. By comparison, of the 10,009 SFRs categorized as moderate, high, and very high risk, almost a quarter of them (24.8 percent) were damaged in the fires. Stated another way, SFRs in moderate and
higher risk locations were 5.68 times more likely to be damaged by these fires than were homes in the low-risk areas.

### Table 1: Damage Relativity of SFRs in All Three Fires by Risk Level

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Number of SFRs</th>
<th>% of SFRs in ZIPs</th>
<th># of Damaged SFRs</th>
<th>% of Damaged SFRs</th>
<th>% Damaged</th>
<th>Damage Relativity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1-50)</td>
<td>79,607</td>
<td>88.8%</td>
<td>3,473</td>
<td>58.3%</td>
<td>4.4%</td>
<td>0.66</td>
</tr>
<tr>
<td>Moderate (51-60)</td>
<td>1,437</td>
<td>1.6%</td>
<td>381</td>
<td>6.4%</td>
<td>26.5%</td>
<td>3.99</td>
</tr>
<tr>
<td>High (61-80)</td>
<td>4,552</td>
<td>5.1%</td>
<td>1,275</td>
<td>21.4%</td>
<td>28.0%</td>
<td>4.22</td>
</tr>
<tr>
<td>Very High (81-100)</td>
<td>4,020</td>
<td>4.5%</td>
<td>824</td>
<td>13.8%</td>
<td>20.5%</td>
<td>3.09</td>
</tr>
<tr>
<td></td>
<td><strong>89,616</strong></td>
<td><strong>100%</strong></td>
<td><strong>5,953</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>6.6%</strong></td>
<td><strong>1.00</strong></td>
</tr>
</tbody>
</table>

| Moderate or Greater (51-100) | 10,009 | 11.2% | 2,480 | 41.7% | 24.8% | 3.73 |

Given the extreme nature of these fires and the high percentage of low-risk locations in the affected ZIP codes, having moderate-, high-, and very-high-risk locations with damage ratios nearly six times higher than low-risk locations proves that the science works.

Comparing the final statistics from the three 2017 fires (Atlas, Nun, and Tubbs) to other California fires in recent years, including the 2018 Carr fire in far northern Trinity and Shasta counties, we can see how different those events were in the underlying distributions of risk, but how similarly and well the model performed.

First, when we look at the risk distribution for all California SFRs and in a few sets of events, we can see that the distribution of risk in the three Northern California fires of 2017 looks totally different than the risk distribution in the Carr and earlier fires. Surprisingly, the risk distribution of the 2017 fires is quite similar to the total population of California SFRs, especially in the percentage of low-risk SFRs:

### Graph 1: Distribution of all SFRs in Affected Areas
Also, when we compare the risk distribution of SFRs damaged in the fires, we can see how different the distribution of damage was for the 2017 fires compared to other California wildfires.

**Graph 2: Distribution of Damaged SFRs**

![Graph 2: Distribution of Damaged SFRs]

However, given how different the distributions were, the normalized damage ratios (percent of available SFRs that were damaged in the risk group compared to the total percentage for the event), the 2017 event results were similar to other events, in that the ratio of available low-risk SFRs that were damaged was significantly less than the ratio of moderate-, high- and very-high-risk SFRs that were damaged:

**Graph 3: Normalized Damage Relativities**

![Graph 3: Normalized Damage Relativities]

The following analyses will explore the individual results from the Atlas, Nuns, and Tubbs fires. As stated earlier, the Atlas fire affected 446 SFRs, the Nuns fire affected 690 SFRs, and the Tubbs Fire affected 4,817 SFRs. To show how the models worked, we will compare the distribution of affected structures to the distribution of the total population of SFRs in the ZIP codes affected.
The Atlas Fire

The Atlas fire, which began in two locations on October 8, burned approximately 51,000 acres over several days. CoreLogic gathered information that showed 880 structures incurred some level of damage, including 446 SFRs. The majority of structures damaged were in ZIP code 94558, with a much smaller amount within ZIP code 94534. Both ZIP codes are included in the analysis below. Table 1 below shows the distribution of damaged SFRs by Wildfire Risk Score range:

**Table 2: Distribution of SFRs Damaged by Atlas Fire by Risk Level**

<table>
<thead>
<tr>
<th>Score Range</th>
<th>ZIP: 94534</th>
<th>ZIP: 94558</th>
<th>Grand Total</th>
<th>% in Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1-50)</td>
<td>1</td>
<td>360</td>
<td>361</td>
<td>80.9%</td>
</tr>
<tr>
<td>Moderate (51-60)</td>
<td>-</td>
<td>30</td>
<td>30</td>
<td>6.7%</td>
</tr>
<tr>
<td>High (61-80)</td>
<td>-</td>
<td>30</td>
<td>30</td>
<td>6.7%</td>
</tr>
<tr>
<td>Very High (81-100)</td>
<td>3</td>
<td>22</td>
<td>25</td>
<td>5.6%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4</strong></td>
<td><strong>442</strong></td>
<td><strong>446</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Of the 446 damaged, this table shows that 361 (80.9 percent) homes were classified as low risk according to the CoreLogic Wildfire Risk Score model. Also, of the 446, 383 (85.9 percent) were destroyed, and only 48 (10.8 percent) had superficial damage. The chart below shows the distribution by damage level.

**Table 3: Distribution of SFRs from Atlas Fire by Damage Level**

<table>
<thead>
<tr>
<th>Damage Type</th>
<th># of SFRs</th>
<th>% of SFRs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial (1-9% damage)</td>
<td>48</td>
<td>10.8%</td>
</tr>
<tr>
<td>Minor (10-25% damage)</td>
<td>11</td>
<td>2.5%</td>
</tr>
<tr>
<td>Moderate (26-50% damage)</td>
<td>2</td>
<td>0.4%</td>
</tr>
<tr>
<td>Major (51-75% damage)</td>
<td>2</td>
<td>0.4%</td>
</tr>
<tr>
<td>Destroyed (&gt;75% damage)</td>
<td>383</td>
<td>85.9%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>442</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Next, we compare the damaged SFRs to the total population of SFRs in the affected ZIP codes. Looking at the damage ratios, defined as the total number of structures damaged divided by the number of structures in the affected ZIP codes, we glean insight on how the model worked. We expect to see a higher percentage of structures damaged as risk level increases. Tables 3, 4, and 5 give a summary of the Atlas fire:
While nearly 81 percent of damaged SFRs were in low-risk locations (as seen in Table 1), 95 percent of all SFRs in those ZIP codes were classified as low risk. Only 1.17 percent of low-risk SFRs were damaged during the Atlas fire, compared to 5.67 percent (4.85 times greater) of SFRs at moderate risk and above.

"To have such a large number of structures damaged or destroyed this far from high-risk fuels is extremely improbable under normal wildfire conditions."

The following table shows the distance, in feet, from the damaged SFRs to the nearest high- or very-high-risk vegetation (vegetation that can burn hot enough to ignite structures). As the table shows, low-risk structures were on average 3,328 feet from the closest possible high-risk vegetation.

CoreLogic Chief Wildfire Scientist Thomas Jeffery, Ph.D. noted, “While there is evidence that embers can travel more than a half mile and ignite a structure, it is much less common than ember ignitions on homes less than a half mile from high-risk fuels. To have such a large number of structures damaged or destroyed this far from high-risk fuels is extremely improbable under normal wildfire conditions.”
The Nuns Fire

During the night of October 8, 2017, what became known as the Nuns fire began as five separate fires (Nuns, Adobe, Norrbom, Pressley, and Partrick) that gradually merged into one. A sixth fire started on October 14, later called the Pythian or Oakmont fire, when utility crews reactivated a downed power line. As the fires burned, they joined to become the Nuns fire.

The combined fires burned approximately 56,600 acres over the next few days. Information gathered by CoreLogic shows the fires caused some level of damage to 1,515 structures, including 690 SFRs. The Nuns fire affected eight separate ZIP Codes, with 75 percent of the damaged SFRs in ZIP codes 95404, 95442 and 95452. The table below highlights the distribution of the 690 damaged SFRs from this event:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Number of SFRs</th>
<th>Average Distance</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1-50)</td>
<td>361</td>
<td>3,328</td>
<td>770</td>
<td>9,066</td>
</tr>
<tr>
<td>Moderate (51-60)</td>
<td>30</td>
<td>1,132</td>
<td>767</td>
<td>1,500</td>
</tr>
<tr>
<td>High (61-80)</td>
<td>30</td>
<td>603</td>
<td>273</td>
<td>888</td>
</tr>
<tr>
<td>Very High (81-100)</td>
<td>25</td>
<td>40</td>
<td>-</td>
<td>219</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>446</strong></td>
<td><strong>Average: 2,813</strong></td>
<td><strong>Minimum:</strong></td>
<td><strong>Maximum:</strong></td>
</tr>
</tbody>
</table>

Table 7: Distance from SFRs to High Risk Vegetation by Risk Level

Table 8: Distribution of SFRs Damaged by Nuns Fire by Risk Level
Of the 690 that were damaged, this table shows that 621 (90 percent) homes were classified as low risk according to the CoreLogic Wildfire Risk Score model. Also, of the 690 SFRs, 600 (87 percent) were destroyed, and only 66 (9.6 percent) had superficial damage. The chart below shows the distribution by damage level.

**Table 9: Distribution of SFRs from Nuns Fire by Damage Level**

<table>
<thead>
<tr>
<th>Damage Type</th>
<th># of SFRs</th>
<th>% of SFRs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial (1-9% damage)</td>
<td>66</td>
<td>9.6%</td>
</tr>
<tr>
<td>Minor (10-25% damage)</td>
<td>17</td>
<td>2.5%</td>
</tr>
<tr>
<td>Moderate (26-50% damage)</td>
<td>4</td>
<td>0.6%</td>
</tr>
<tr>
<td>Major (51-75% damage)</td>
<td>3</td>
<td>0.4%</td>
</tr>
<tr>
<td>Destroyed (&gt; 75% damage)</td>
<td>600</td>
<td>87.0%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>690</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Next, we compare the damaged SFRs to the total number of SFRs in the affected areas. Looking at the damage ratios, defined as the total number of structures damaged divided by the number of structures in the affected ZIP codes, we can see how well the model worked. Generally, we expect the percentage of structures damaged to rise as risk increases. Table 9 gives a summary of the Nuns fire:

**Table 10: Damage Ratio in All ZIP Codes by Risk Level**

<table>
<thead>
<tr>
<th>All ZIPS: Total SFRs &amp; Damage</th>
<th>Low Risk (1-50)</th>
<th>Moderate Risk (51-60)</th>
<th>High Risk (61-80)</th>
<th>Very High Risk (81-100)</th>
<th>All Risks (1-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total SFRs</td>
<td>56,934</td>
<td>1,012</td>
<td>3,324</td>
<td>3,158</td>
<td>64,428</td>
</tr>
<tr>
<td>Damaged SFRs in ZIP</td>
<td>621</td>
<td>31</td>
<td>24</td>
<td>14</td>
<td>690</td>
</tr>
<tr>
<td>% Damaged</td>
<td>1.09%</td>
<td>3.06%</td>
<td>0.72%</td>
<td>0.44%</td>
<td>1.07%</td>
</tr>
</tbody>
</table>

Perhaps because the Nuns fire began as several separate fires, the Nuns fire analysis follows a different pattern, with the percentage of SFRs damaged in low-risk locations being approximately the same as for higher-risk locations (with 90% of damaged SFRs located in low-risk areas). The important thing to look at here is that even though 90 percent of the damaged locations were low risk as seen in Table 7, 88 percent of the SFRs in those ZIP codes were classified as low risk. Fire damaged 1.09 percent of low-risk SFRs in the combined Nuns fire complex, compared to 0.92 percent of SFRs designated at moderate risk or above. This unusual result may be affected by the Nuns fire being a complex of six fires that started in different locations before growing into a single merged fire.

The following table shows the distance, in feet, from the damaged SFRs to the nearest high- or very-high-risk vegetation. By digging further into this table, we see that the average distance for low-risk structures was 4,698 feet from the closest possible high-risk vegetation—and three SFRs were more than 10,000 feet from the nearest high- or very-high-risk vegetation. While having embers fly more than a half mile to ignite structures has happened, it is infrequent. In contrast, having such a large number of structures damaged or destroyed at an average distance of almost a mile from high-risk vegetation is extremely improbable under normal wildfire conditions.
The Tubbs Fire

The Tubbs started just before 10 p.m. on October 8. Within a few hours, the fire had consumed more than 20,000 acres and traveled about 12 miles from its wildland origin north of Calistoga into densely populated neighborhoods in the town of Santa Rosa. Witnesses reported fire tornadoes that flipped vehicles, ripped trees from the ground, and flung garage doors into the street. The deadliest and most destructive of the North Bay fires, the Tubbs fire claimed 22 lives, burned approximately 37,000 acres, and damaged or destroyed almost 6,000 structures, including 4,817 SFRs. The fire affected four ZIP codes, with 95 percent of the damage in ZIP codes 95403 and 95404. The table below highlights the distribution of the 4,817 SFRs damaged during this event:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Number of SFRs</th>
<th>Average Distance</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1-50)</td>
<td>621</td>
<td>4,698</td>
<td>880</td>
<td>10,827</td>
</tr>
<tr>
<td>Moderate (51-60)</td>
<td>31</td>
<td>1,184</td>
<td>523</td>
<td>1,500</td>
</tr>
<tr>
<td>High (61-80)</td>
<td>24</td>
<td>567</td>
<td>254</td>
<td>978</td>
</tr>
<tr>
<td>Very High (81-100)</td>
<td>14</td>
<td>85</td>
<td>-</td>
<td>243</td>
</tr>
</tbody>
</table>

Total: 690  Average: 4,303  Minimum: -  Maximum: 10,827

<table>
<thead>
<tr>
<th>Score Range</th>
<th>ZIP: 94515</th>
<th>ZIP: 95403</th>
<th>ZIP: 95404</th>
<th>ZIP: 95409</th>
<th>Grand Total</th>
<th>% In Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1-50)</td>
<td>76</td>
<td>2,175</td>
<td>221</td>
<td>19</td>
<td>2,491</td>
<td>51.7%</td>
</tr>
<tr>
<td>Moderate (51-60)</td>
<td>23</td>
<td>122</td>
<td>170</td>
<td>5</td>
<td>320</td>
<td>6.6%</td>
</tr>
<tr>
<td>High (61-80)</td>
<td>39</td>
<td>375</td>
<td>802</td>
<td>5</td>
<td>1,221</td>
<td>25.3%</td>
</tr>
<tr>
<td>Very High (81-100)</td>
<td>42</td>
<td>102</td>
<td>639</td>
<td>2</td>
<td>785</td>
<td>16.3%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>2,774</td>
<td>1,832</td>
<td>31</td>
<td>4,817</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Of the 4,817 SFRs damaged, this table shows that 2,491 (51.7 percent) homes were classified as low risk according to the CoreLogic Wildfire Risk Score model. By comparison, the model shows that 79 percent of the total SFRs in affected ZIP codes were classified as low risk. Also, of the 4,817 SFRs affected, 4,609 (95.7 percent) were destroyed, and only 142 (2.9 percent) had superficial damage. The chart below shows the distribution by damage level.

Table 13: Distribution of SFRs from Tubbs Fire by Damage Level

<table>
<thead>
<tr>
<th>Damage Type</th>
<th># of SFRs</th>
<th>% of SFRs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial (1-9% damage)</td>
<td>142</td>
<td>2.9%</td>
</tr>
<tr>
<td>Minor (10-25% damage)</td>
<td>43</td>
<td>0.9%</td>
</tr>
<tr>
<td>Moderate (26-50% damage)</td>
<td>13</td>
<td>0.3%</td>
</tr>
<tr>
<td>Major (51-75% damage)</td>
<td>10</td>
<td>0.2%</td>
</tr>
<tr>
<td>Destroyed (&gt; 75% damage)</td>
<td>4609</td>
<td>95.7%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4817</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Next, we compare the damaged SFRs and the total number of SFRs in the affected areas. Looking at the damage ratios, defined as the total number of structures damaged divided by the number of structures in the affected ZIP codes, we can see how well the model worked. As the risk level increases, we expect to find a higher percentage of structures damaged. Table 13 gives a summary of the Tubbs fire:

Table 14: Damage Ratio in All ZIP Codes by Risk Level

<table>
<thead>
<tr>
<th>All Zips: Total SFRs &amp; Damage</th>
<th>Low Risk (1-50)</th>
<th>Moderate Risk (51-60)</th>
<th>High Risk (61-80)</th>
<th>Very High Risk (81-100)</th>
<th>All Risks (1-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ZIP SFRs</td>
<td>27,531</td>
<td>959</td>
<td>3,607</td>
<td>2,780</td>
<td>34,877</td>
</tr>
<tr>
<td>Damaged SFRs in ZIP</td>
<td>2,491</td>
<td>320</td>
<td>1,221</td>
<td>785</td>
<td>4,817</td>
</tr>
<tr>
<td>% Damaged</td>
<td>9.05%</td>
<td>33.37%</td>
<td>33.85%</td>
<td>28.24%</td>
<td>13.81%</td>
</tr>
</tbody>
</table>

The damage rates for this fire was much higher than the others, and while 9.05 percent of low-risk SFRs incurred fire damage, nearly 32 percent of moderate-, high- and very-high-risk homes (3.5 times greater) were damaged in this fire. In other words, SFRs in locations categorized as moderate risk or higher were 3.5 percent more likely to be damaged or destroyed.

The following table shows the distance, in feet, from damaged SFRs to the nearest high- or very-high-risk vegetation. As you can see, the average distance between low-risk structures and the closest high-risk vegetation was 4,016 feet. As stated earlier, it’s possible but uncommon for embers to fly more than a half mile to ignite structures. Under normal wildfire conditions, it is extremely improbable to find such a large number of burned structures located an average of almost three-quarters of a mile from high-risk vegetation.
Summary

Highly unusual wind and vegetation conditions caused several extreme wildfires to ignite within a short time of each other, a rare situation we can only hope will not repeat. Still, California’s North Bay wildfires left important lessons in the ashes. The fires woke up the public to the reality that such wildfires can occur and that it is imperative to have a clear picture of the risk homes face. With proper coverage and an accurate understanding of what’s at stake, families and businesses can better prepare for the financial catastrophes that often follow natural disasters.

1 CAL FIRE Investigators Determine Causes of 12 Wildfires in Mendocino, Humboldt, Butte, Sonoma, Lake, and Napa Counties; California Department of Forestry and Fire Protection; June 8, 2018

2 Simulation shows winds near origins of Oct. 8 fires in Northern California may have been 75-90 mph, Wildfire Today, October 30, 2017

3 The 2017 North Bay and Southern California Fires: A Case Study, Fire: Human-Related Ignitions Increase the Number of Large Wildfires across U.S. Ecoregions, June 2018

Table 15: Distance from SFRs to High Risk Vegetation by Risk Level

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Number of SFRs</th>
<th>Average Distance</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1-50)</td>
<td>2,491</td>
<td>4,016</td>
<td>753</td>
<td>8,440</td>
</tr>
<tr>
<td>Moderate (51-60)</td>
<td>320</td>
<td>696</td>
<td>.503</td>
<td>1,454</td>
</tr>
<tr>
<td>High (61-80)</td>
<td>1,221</td>
<td>181</td>
<td>-</td>
<td>941</td>
</tr>
<tr>
<td>Very High (81-100)</td>
<td>785</td>
<td>4</td>
<td>-</td>
<td>225</td>
</tr>
<tr>
<td><strong>Total: 4,817</strong></td>
<td><strong>Average: 2,170</strong></td>
<td><strong>Minimum: -</strong></td>
<td><strong>Maximum: 8,440</strong></td>
<td></td>
</tr>
</tbody>
</table>