# Supporting Information for “Characteristics of debris flow prone watersheds and triggering rainstorms following the Tadpole Fire, New Mexico, USA”

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This supporting information file contains 3 tables and 3 figures.

| Sample Type | Latitude | Longitude | Sand (%) | Silt (%) | Clay (%) |
|---|---|---|---|---|---|
| Hillslope (0-5cm) | 32.95856 | -108.23450 | 46.3 | 43.1 | 10.6 |
| Hillslope (0-5cm) | 32.95583 | -108.23230 | 39.6 | 46.1 | 14.3 |
| Debris Flow | 32.95552 | -108.23255 | 76.0 | 18.4 | 5.6 |
| Debris Flow | 32.95809 | -108.24071 | 80.7 | 11.7 | 7.6 |
| Debris Flow | 32.95784 | -108.23170 | 63.7 | 22.6 | 13.7 |
| Debris Flow | 32.95838 | -108.23131 | 82.2 | 10.6 | 7.2 |
| Debris Flow | 32.95809 | -108.24071 | 61.2 | 25.4 | 13.4 |
| Debris Flow | 32.96103 | -108.23588 | 58.5 | 26.8 | 14.7 |

Table S1: Percentages of sand, silt, and clay were determined using the hydrometer method for hillslope samples, taken at a depth of 0-5 cm, and samples of debris flow deposits.

| Watershed ID | Date | Flow Timing (UTC) | Storm Start (UTC) | Storm End (UTC) | $I_{15}^{*}$ (mm/h) | $I_{15}^{p}$ (mm/h) | $I_{30}^{*}$ (mm/h) | $I_{30}^{p}$ (mm/h) | $R_{tot}^{*}$ (mm) | $R_{tot}$ (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| B | 18 July 20200 | 22:38 | 22:12 | 22:56 | 53 | 53 | 33 | 36 | 16 | 20 |
| C | 18 July 2020 | 22:38 | 22:12 | 22:56 | 53 | 53 | 33 | 36 | 16 | 20 |
| D | 18 July 2020 | 22:33 | 22:12 | 22:56 | 51 | 53 | 28 | 36 | 14 | 20 |
| E | 21 July 2020 | 20:59 | 20:38 | 21:23 | 52 | 52 | 31 | 31 | 15 | 16 |
| E | 21 July 2020 | 21:04 | 20:38 | 21:23 | 52 | 52 | 31 | 31 | 15 | 16 |
| A | 24 July 2020 | 10:42 | 10:34 | 10:51 | 33 | 34 | 16 | 18 | 8 | 9 |
| C | 9 Sept. 2020 | 5:17 | 4:57 | 5:55 | 55 | 93 | 31 | 72 | 15 | 45 |
| D | 9 Sept. 2020 | 5:16 | 4:57 | 5:55 | 50 | 93 | 28 | 72 | 14 | 45 |
| A | 9 Sept. 2020 | 5:21 | 4:55 | 6:13 | 76 | 86 | 47 | 66 | 23 | 44 |

Table S2: Summary of debris flow timing information and triggering rainfall characteristics, including triggering 15 ($I_{15}^{*}$) and 30-minute rainfall intensities ($I_{30}^{*}$), peak 15 ($I_{15}^{p}$) and 30-minute rainfall intensities ($I_{30}^{p}$), cumulative rainfall prior to debris flow initiation ($R_{tot}^{*}$), and storm cumulative rainfall ($R_{tot}$).

| Watershed ID | dNBR | MH23 | KF |
|---|---|---|---|
| 1 | 549 | 0.78 | 0.2 |
| 2 | 464 | 0.92 | 0.2 |
| 3 | 401 | 0.26 | 0.2 |
| 4 | 579 | 0.78 | 0.2 |
| 5 | 716 | 0.85 | 0.2 |
| 6 | 648 | 0.64 | 0.2 |
| A | 715 | 0.74 | 0.2 |
| B | 611 | 0.62 | 0.2 |
| C | 637 | 0.64 | 0.2 |
| D | 723 | 0.68 | 0.2 |
| 7 | 364 | 0.12 | 0.2 |
| E | 395 | 0.45 | 0.2 |
| 8 | 211 | 0.15 | 0.2 |
| 9 | 198 | 0 | 0.2 |
| 10 | 176 | 0.07 | 0.2 |
| 11 | 164 | 0 | 0.2 |
| 12 | 145 | 0.06 | 0.2 |

Table S3: Burn severity, terrain, and soil attributes needed for input to the M1 debris flow likelihood model, specifically watershed average differenced normalized burn ratio (dNBR), the fraction of watershed area greater than 23 degrees that burned at moderate or high severity (MH23), and the watershed average soil KF factor.

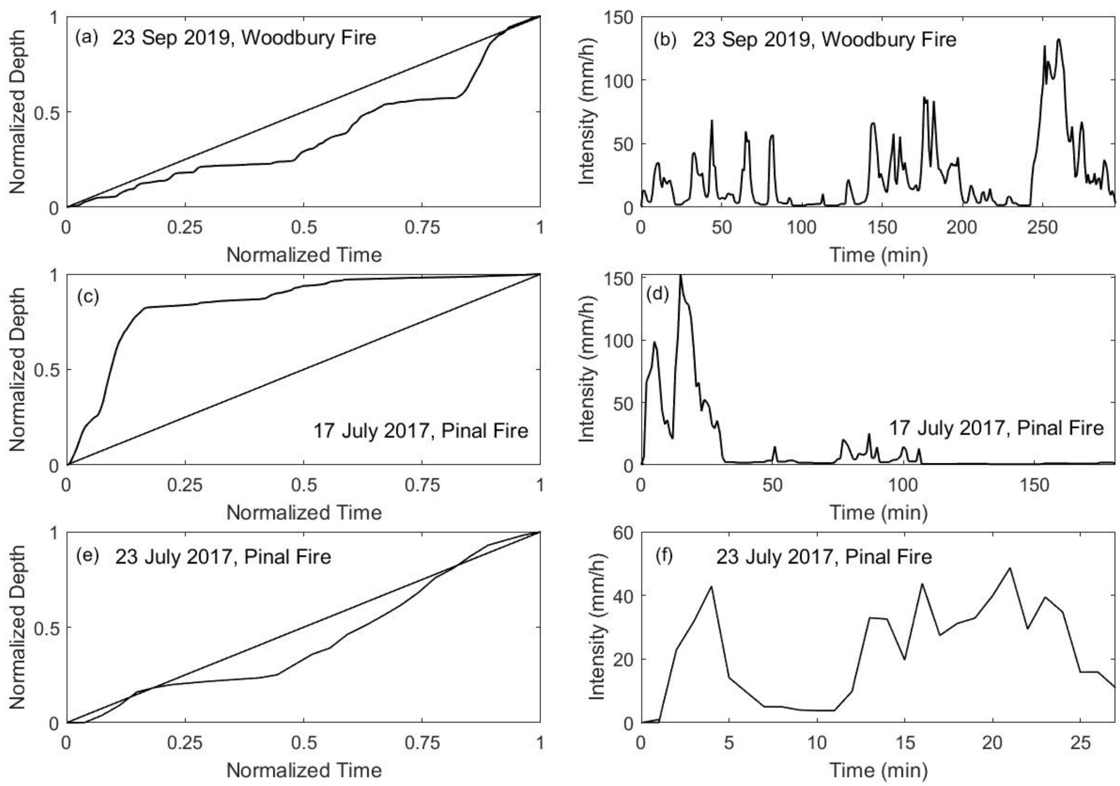


Figure S1: Standardized rainfall profiles (SRPs) provide a way to visually assess the temporal variability of rainfall within storms. (a) SRP for a rainstorm that produced debris flows following the 2019 Woodbury Fire (McGuire et al., 2021). Rainfall data are from the B2 rain gage in McGuire et al. (2021). We classify rainstorms based on the quartile of storm duration that contains the highest cumulative rainfall total. That is, if the majority of rainfall occurs during the first quartile of the storm it is classified as a Q1 storm, storms with a majority of rainfall during the 2$^{nd}$, 3$^{rd}$, or 4$^{th}$ quartile of the storm duration are classified as Q2, Q3, and Q4 storms, respectively (Huff, 1967). In this Q4 rainstorm, more rainfall occurred during the fourth quartile of the storm duration compared with any other quartile. (b) SRP of a Q1 rainstorm that produced a debris flow following the 2017 Pinal Fire (Raymond et al., 2020). Rainfall data are from the 651 South rain gauge in Raymond et al. (2020). (c) SRP of a Q3 rainstorm that produced a flood flow following the 2017 Pinal Fire (Raymond et al., 2020). Rainfall data are from the 651 South rain gauge in Raymond et al. (2020).

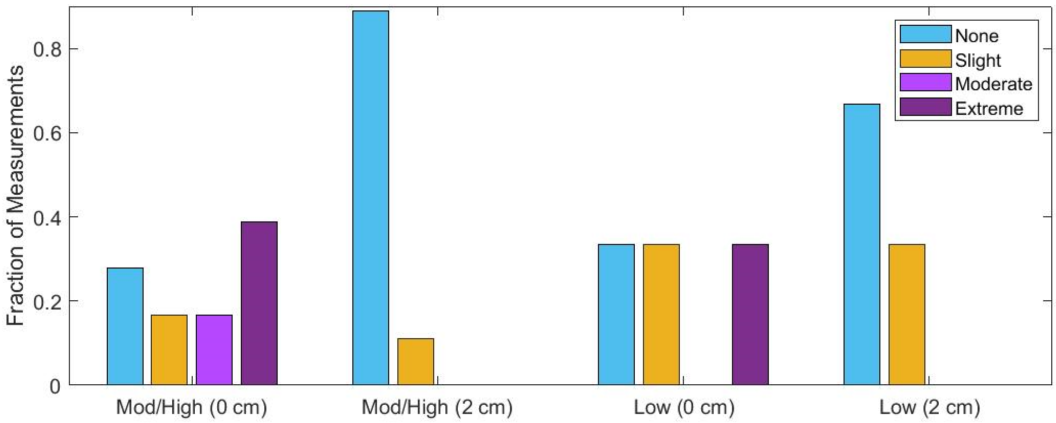


Figure S2: Soil water repellency measurements made in July 2020 using the water drop penetration time test demonstrate greater water repellency at the soil surface (0 cm) compared that found at 2 cm depth. Classification of soil water repellency is determined by the time to absorption with 0-5 s, 5-60 s, 60-180 s, and 180+ seconds indicating no, slight, moderate, and extreme water repellency.

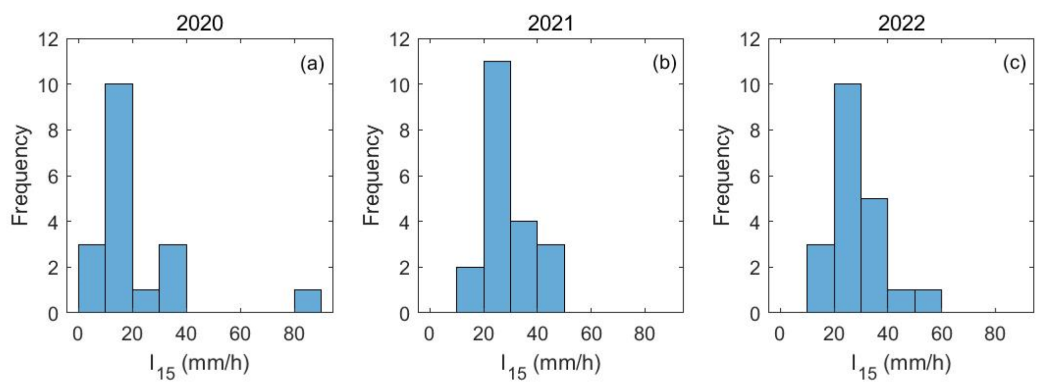


Figure S3: Histograms showing the frequency of peak $I_{15}$ for the 20 most intense rainstorms during each year of monitoring.

**References**

Huff, F. A.: Time distribution of rainfall in heavy storms, Water Resour Res, 3, 1007–1019, https://doi.org/10.1029/WR003i004p01007, 1967.

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