**Supplemental Information**



Figure S1. Discharge-stage rating curves for each watershed, number of discharge measurements used to fit the rating curve (N), and the coefficient of determination (R2) for the fitted power function relating discharge (*D*) to measured stage (*h*).

Table S1. Minimum detection limits for water quality analyte concentrations.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Minimum detection limit (mg L-1) | | |
| Analyte | 2016 | 2017 | 2018 |
| Ca2+ | 0.016 | 0.016 | 0.006 |
| K+ | 0.002 | 0.003 | 0.001 |
| Mg2+ | 0.004 | 0.008 | 0.001 |
| Na+ | 0.009 | 0.014 | 0.001 |
| Cl- | 0.005 | 0.002 | 0.003 |
| SO42- | 0.004 | 0.004 | 0.003 |
| NH4+-N | 0.001 | 0.002 | 0.002 |
| NO3--N | 0.001 | 0.004 | 0.001 |
| PO43- | 0.002 | 0.004 | 0.002 |
| DOC | 0.019 | 0.030 | 0.041 |

Table S2. Mean (±se) depth of the Oi (litter) and Oe+Oa (fermentation + humus) forest floor layers, exposed mineral soil, and bole char height for plots in the burned and unburned watersheds. Also shown is the plot-based mean (±se) composite burn severity index and associated categorical burn severity class.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Oi | |  | Oe+Oa | |  | Exposed mineral soil (%) | Bole char height  (m) |  |  |
| **Burned** | Mean depth (cm) | Min ̶ Max  (cm) |  | Mean depth  (cm) | Min ̶ Max  (cm) |  | Mean Composite burn severity index | Categorical burn severity class |
| CA | 0 | n.a. |  | 1.04 (0.16) | 0.18 ̶ 2.78 |  | 16.7 (3.4) | 0.90 (0.13) | 3.05 (0.27) | M-H |
| CA-TO | 0 | n.a. |  | 0.98 (0.16) | 0.61 ̶ 1.58 |  | 11.0 (4.0) | 1.26 (0.42) | 3.48 (0.56) | M-H |
| IN | 0 | n.a. |  | 1.14 (0.17) | 0.34 ̶ 3.19 |  | 9.7 (2.7) | 1.61 (0.45) | 2.90 (0.24) | M-H |
| IR | 0 | n.a. |  | 1.28 (0.20) | 0.08 ̶ 3.09 |  | 14.5 (4.6) | 0.98 (0.19) | 2.74 (0.24) | M |
| All burned | 0 | n.a. |  | 1.15 (0.10) | 0.08–3.19 |  | 13.7 (2.1) | 1.15 (0.17) | 2.89 (0.14) | M-H |
|  |  |  |  |  |  |  |  |  |  |  |
| **Unburned** |  |  |  |  |  |  |  |  |  |  |
| AR | 4.68 (0.36) | 3.14 ̶ 7.65 |  | 1.81 (0.32) | 0.80 ̶ 4.72 |  | n.a | n.a | n.a | n.a |
| AR-UP | 3.83 (0.32) | 3.14 ̶ 4.69 |  | 1.47 (0.30) | 0.80 ̶ 2.30 |  | n.a. | n.a. | n.a. | n.a. |
| CH | 4.15 (0.48) | 2.16 ̶ 6.68 |  | 1.46 (0.38) | 0.39 ̶ 4.26 |  | n.a | n.a | n.a | n.a |
| TE | 4.58 (0.23) | 3.18 ̶ 5.70 |  | 2.03 (0.25) | 0.84 ̶ 3.58 |  | n.a | n.a | n.a | n.a |
| All unburned | 4.47 (0.21) | 2.16 ̶ 7.65 |  | 1.77 (0.19) | 0.39–4.72 |  | n.a. | n.a. | n.a. | n.a. |

Table S3. Mean (±se) tree mortality and density of live trees by size class (large stems ≥20 cm diameter, and small stems < 20 cm diameter) and fire tolerance classification (mesophytic, xerophytic) across the three burned and three unburned watersheds; end of growing seasons 2017 and 2018. Tree stem diameters were measured at 1.37 m height (i.e., diameter at breast height).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **2017** | Mortality (%) | | |  | Live tree density (stems ha-1) | | |
| **Burned** | Large | Small | All sizes |  | Large | Small | All sizes |
| Mesophytic | 9.6 (3.8) a | 43.4 (4.4) a | 35.7 (4.0) a |  | 140 (17) b | 211 (27) a | 351 (37) a |
| Xerophytic | 4.6 (1.7) a | 38.8 (5.2) a | 20.4 (3.1) b |  | 178 (15) a | 103 (14) b | 280 (22) b |
| All types | 5.9 (1.6) | 42.4 (3.8) | 31.2 (3.2) |  | 317 (18) | 278 (40) | 631 (37) |
|  |  |  |  |  |  |  |  |
| **Unburned** | Large | Small | All sizes |  | Large | Small | All sizes |
| Mesophytic | 1.2 (1.0) a | 11.2 (3.7) a | 8.4 (2.9) a |  | 132 (24) a | 370 (49) a | 502 (52) a |
| Xerophytic | 1.2 (0.9) a | 5.1 (2.8) a | 3.4 (1.6) a |  | 150 (20) a | 238 (61) b | 388 (63) b |
| All types | 1.7 (1.2) | 7.8 (2.5) | 6.3 (2.0) |  | 282 (23) | 608 (77) | 890 (67) |
|  |  |  |  |  |  |  |  |
| **2018** |  |  |  |  |  |  |  |
| **Burned** | Large | Small | All sizes |  | Large | Small | All sizes |
| Mesophytic | 18.8 (4.4) a | 61.3 (4.7) a | 48.9 (4.2) a |  | 128 (17) a | 147 (24) a | 275 (34) a |
| Xerophytic | 9.1 (3.3) b | 51.2 (5.5) a | 28.6 (3.8) b |  | 168 (15) a | 80 (12) b | 248 (21) b |
| All types | 12.6 (3.1) | 57.1 (4.2) | 40.6 (3.6) |  | 296 (19) | 228 (28) | 523 (37) |
|  |  |  |  |  |  |  |  |

†Different letters in columns denote significant (*P* < 0.10) differences.

Table S4. Mean (±se) basal area of live trees and basal area loss due to fire mortality by size class (large stems ≥20 cm diameter, and small stems < 20 cm diameter) and fire tolerance classification (mesophytic, xerophytic) across the three burned and three unburned watersheds.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Basal area (m2 ha-1) | | |  | Basal area loss m2 ha-1 [%] | | |
| **Burned 2017** | Large | Small | All sizes |  | Large | Small | All sizes |
| Mesophytic | 11.11  (1.63) | 2.75  (0.34) | 13.87  (1.74) |  | 0.28 (0.11)  [6.0%] | 1.03 (0.19)  [27.3%] | 1.32 (0.22)  [17.8%] |
| Xerophytic | 20.33  (1.98) | 1.57  (0.24) | 21.90  (1.96) |  | 0.80 (0.33)  [4.0%] | 0.76 (0.19)  [25.1%] | 1.56 (0.40)  [8.9%] |
| All types | 31.44  (2.08) | 4.31  (0.41) | 35.75  (2.09) |  | 1.08 (0.37)  [4.3%] | 1.80 (0.32)  [27.7%] | 2.88 (0.53)  [8.8%] |
|  |  |  |  |  |  |  |  |
| **Burned 2018** | Large | Small | All sizes |  | Large | Small | All sizes |
| Mesophytic | 10.52  (1.62) | 1.87  (0.28) | 12.40  (1.72) |  | 0.86 (0.22)  [12.0%] | 1.91 (0.32)  [49.9%] | 2.77 (0.43)  [29.2%] |
| Xerophytic | 19.54  (2.02) | 1.29  (0.21) | 20.82  (2.01) |  | 1.63 (0.58)  [8.8%] | 1.05 (0.24)  [35.4%] | 2.68 (0.64)  [14.6%] |
| All types | 30.06  (2.20) | 3.16  (0.35) | 33.22  (2.26) |  | 2.50 (0.71)  [10.1%] | 2.96 (0.47)  [43.2%] | 5.46 (0.91)  [16.9%] |
|  |  |  |  |  |  |  |  |
| **Reference 2017** | Large | Small | All sizes |  |  |  |  |
| Mesophytic | 14.26  (2.97) | 2.97  (0.45) | 17.22  (2.94) |  |  |  |  |
| Xerophytic | 18.25  (2.83) | 2.65  (0.67) | 20.90  (2.89) |  |  |  |  |
| All types | 32.51  (3.15) | 5.62  (0.81) | 38.13  (2.82) |  |  |  |  |
|  |  |  |  |  |  |  |  |



Fig. S2. Relation between soil inorganic N concentration and burn severity from soil samples collected from the 0–10 cm depth in burn plots.



Fig. S3. 2016-2018 monthly precipitation (bars) and mean monthly precipitation over the 1935-2018 period of record (line) for RG19 at the Coweeta Hydrologic Laboratory (A), and 2017-2018 monthly precipitation measured at the Camp Branch (red bars), Arrowwood (blue bars), and Tellico (green bars) rain gauges (B).



September–October Average Maximum Daily Temp (℃)

Fig. S4. Maximum consecutive dry days (CDD) and average maximum daily September-October air temperatures measured at the USDA Forest Service Coweeta Hydrologic Laboratory in Otto, NC, USA. September 19 to November 23, 2016 was the longest CDD (66 days), and September-October, 2016 was the highest mean air temperature on record.

A close up of a map

Description automatically generated

Fig. S5. TSS concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S6. pH in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples, comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S7. Ca concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S8. K concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S9. Mg concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S10. Na concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S11. Cl concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S12. SO4 concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A screenshot of a video game

Description automatically generated

Fig. S13. DOC concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S14. TVS concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S15. NH4-N concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A screenshot of a cell phone

Description automatically generated

Fig. S16. PO4 concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols) , comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.

A close up of a map

Description automatically generated

Fig. S17. NO3-N concentration in burned (red triangles) and unburned (green circles) watersheds from weekly grab samples (hollow symbols) and automated storm sampling (filled symbols), comparing burned watersheds CA, CA-TO, IN, and IR to unburned watersheds AR, AR-UP, CH, and TE, respectively. The daily *Q* for burned watersheds (grey) is also shown for reference.