**Supplementary Information**

Table S1: Study area characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ecoregions** | **Total Area**  **(km2)** | **Forest Area (km2)** | **Total Burned Area (km2)** | **Mean Annual Precipitation (mm)** | **Mean Monthly Temperature (℃)** |
| Eastern Cascades | 56187.34 | 27846.81 | 1703.32 | 575 | 7.6 |
| Coastal Sage | 101081.91 | 5411.55 | 5891.52 | 507 | 16 |
| Baja CA | 17919.06 | 3006.51 | 3084.86 | 454 | 14.2 |
| Klamath Mountians | 48541.20 | 29947.89 | 3736.13 | 1397 | 11.6 |
| Sierra Nevada | 52706.85 | 29632.99 | 3033.34 | 1016 | 8.6 |
| Canadian Rockies | 18880.52 | 8788.56 | 1455.60 | 1125 | 3.1 |
| Middle Rockies | 156471.79 | 48140.21 | 4977.51 | 609 | 3.3 |
| Southern Rockies | 145700.65 | 57834.20 | 1698.16 | 575 | 4.6 |
| North Cascades | 30391.80 | 15061.96 | 1252.96 | 1817 | 5.7 |
| Idaho-Batholith | 60280.66 | 29981.59 | 5883.15 | 828 | 4.3 |
| Columbia Mountains | 81957.75 | 41911.46 | 1580.32 | 798 | 6.4 |
| Blue Mountains | 70906.05 | 24066.24 | 3917.74 | 520 | 7.5 |
| Great Plains | 201807.49 | 3092.37 | 3126.93 | 391 | 7.3 |
| Temperate Sierras | 108628.45 | 56339.32 | 7753.26 | 431 | 11.7 |
| AZ-NM Plateau | 150081.62 | 18455.92 | 914.66 | 245 | 11.3 |
| Central Basin | 309971.20 | 33496.20 | 13084.30 | 258 | 9.6 |
| Colorado Plateau | 134929.93 | 25656.65 | 933.34 | 291 | 10.2 |
| Mojave Basin | 129602.96 | 2505.71 | 2444.75 | 148 | 17.8 |
| NA highland | 42926.15 | 4686.64 | 2147.02 | 345 | 16.6 |
| Wasatch Mountains | 45686.02 | 15710.65 | 680.04 | 585 | 5.4 |
| Cascades | 46429.60 | 35354.93 | 806.69 | 1803 | 7.9 |

Table S2: Pre-fire and post-fire summer LAI (post-fire/pre-fire) across ecoregions of each forest type.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Forest Types/Ecoregions** | **Pre-fire** | **1-Yr Post-fire** | **10-Yr Post-fire** | **20-Yr Post-fire** | **25-Yr Post-fire** |
| **Douglas-fir** |  |  |  |  |  |
| Cascades | 3.61 | 1.10(30) | 2.35(65) | 3.23(89) | 3.55(98) |
| Columbia Mountains | 2.72 | 0.85(31) | 1.84(68) | 2.70(99) | 3.37(124) |
| Idaho Batholith | 1.70 | 0.66(39) | 1.08(63) | 1.11(65) | 1.22(72) |
| Klamath Mountains | 2.84 | 0.94(33) | 2.02(71) | 3.11(110) | 3.08(108) |
| Middle Rockies | 1.84 | 0.72(39) | 1.21(66) | 1.48(81) | 1.63(89) |
| North Cascades | 2.20 | 0.59(27) | 1.31(59) | 1.84(84) | 1.93(88) |
| Southern Rockies | 1.69 | 0.47(28) | 0.69(41) | 1.71(101) |  |
| Temperate Sierra | 1.73 | 0.61(35) | 1.13(65) | 1.43(82) | 1.31(76) |
| **Lodgepole Pine** |  |  |  |  |  |
| Canadian Rockies | 1.94 | 0.66(34) | 1.64(85) | 1.34(69) | 1.52(78) |
| Columbia Mountains | 2.39 | 0.62(26) | 1.58(66) | 2.22(93) | 2.84(119) |
| Idaho Batholith | 1.66 | 0.66(40) | 1.03(62) | 1.19(72) | 1.31(79) |
| Middle Rockies | 1.68 | 0.59(35) | 1.05(62) | 1.08(64) | 1.22(73) |
| Northern Cascades | 1.69 | 0.54(32) | 1.14(67) | 1.14(67) | 1.27(75) |
| Southern Rockies | 1.54 | 0.80(52) | 1.10(72) | 1.38(89) | 1.35(87) |
| **Mixed Conifer** |  |  |  |  |  |
| Baja California | 1.53 | 0.59(38) | 1.16(76) | 1.58(103) | 1.24(81) |
| Coastal Sage | 2.88 | 0.84(29) | 2.15(75) | 2.72(94) |  |
| Eastern Cascades | 2.13 | 0.789(37) | 1.51(71) | 3.06(144) | 3.31(155) |
| Klamath Mountains | 3.05 | 1.02(33) | 2.27(74) | 2.63(86) | 2.72(89) |
| Sierra Nevada | 2.68 | 0.78(29) | 1.76(66) | 2.47(92) | 2.61(97) |
| **Pinyon-Juniper** |  |  |  |  |  |
| AZ-NM Plateau | 0.75 | 0.48(65) | 0.84(113) | 0.86(115) | 0.79(105) |
| Central Basin | 0.72 | 0.40(56) | 0.54(75) | 0.47(66) | 0.47(65) |
| Colorado Plateau | 0.90 | 0.52(58) | 0.80(89) | 0.70(78) | 0.71(78) |
| Mojave Basin | 0.63 | 0.34(53) | 0.48(76) | 0.75(120) | 0.43(68) |
| Temperate Sierras | 0.92 | 0.48(52) | 0.82(90) | 0.85(93) | 0.89(97) |
| **Ponderosa Pine** |  |  |  |  |  |
| Blue Mountains | 1.41 | 0.64(45) | 1.04(74) | 0.99(70) | 0.83(59) |
| Eastern Cascades | 1.61 | 0.66(41) | 1.45(91) | 1.28(80) | 1.51(94) |
| Great Plains | 1.37 | 0.83(60) | 0.71(51) | 1.42(104) | 1.46(106) |
| Sierra Nevada | 1.94 | 0.46(24) | 1.03(53) | 1.18(61) | 1.28(66) |
| Temperate Sierras | 1.48 | 0.54(37) | 0.90(60) | 1.30(87) | 1.23(83) |
| Southern Rockies | 1.45 | 0.58(40) | 0.84(58) | 1.37(95) |  |
| **Oak** |  |  |  |  |  |
| Baja CA | 1.88 | 0.72(38) | 1.51(80) | 1.44(77) | 1.34(71) |
| Coastal Sage | 2.40 | 0.69(29) | 1.55(64) | 2.20(92) | 1.89(79) |
| North America Highland | 1.31 | 0.68(52) | 0.86(66) | 0.88(67) | 0.85(65) |
| Temperate Sierras | 1.22 | 0.66(54) | 1.09(90) | 1.42(117) | 1.07(88) |
| **Spruce/Fir/Hemlock** |  |  |  |  |  |
| Blue Mountains | 1.98 | 0.71(36) | 1.35(68) | 1.47(75) | 1.61(81) |
| Columbia Mountains | 2.20 | 0.68(31) | 1.40(64) | 2.23(101) | 2.62(119) |
| Idaho Batholith | 1.59 | 0.58(36) | 0.89(56) | 1.01(64) | 1.15(72) |
| Canadian Rockies | 1.96 | 0.66(34) | 1.38(70) | 1.01(52) | 1.20(61) |
| Middle Rockies | 1.44 | 0.49(34) | 0.91(63) | 0.78(54) | 0.91(63) |
| Northern Cascades | 1.80 | 0.49(27) | 1.12(62) | 1.17(65) | 1.13(63) |
| Southern Rockies | 1.52 | 0.77(51) | 1.12(74) | 1.36(90) |  |
| Wasatch/Unita Mountains | 1.57 | 0.69(44) | 1.05(67) | 2.44(156) |  |

Table S3: Pre-fire and post-fire summer albedo (post-fire/pre-fire) across ecoregions of each forest type.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Forest Types/Ecoregions** | **Pre-fire** | **1-Yr Post-fire** | **10-Yr Post-fire** | **20-Yr Post-fire** | **25-Yr Post-fire** |
| **Douglas-fir** |  |  |  |  |  |
| Cascades | 0.10 | 0.08(84) | 0.11(115) | 0.11(118) | 0.11(117) |
| Columbia Mountains | 0.10 | 0.09(90) | 0.12(126) | 0.12(129) | 0.12(124) |
| Idaho Batholith | 0.09 | 0.09(95) | 0.12(126) | 0.13(137) | 0.13(140) |
| Klamath Mountains | 0.11 | 0.09(80) | 0.11(104) | 0.12(115) | 0.12(110) |
| Middle Rockies | 0.10 | 0.09(98) | 0.12(128) | 0.12(126) | 0.12(124) |
| North Cascades | 0.09 | 0.08(95) | 0.11(131) | 0.13(154) | 0.13(149) |
| Southern Rockies | 0.10 | 0.10(99) | 0.13(139) | 0.14(143) |  |
| Temperate Sierra | 0.10 | 0.09(91) | 0.12(123) | 0.13(130) | 0.13(130) |
| **Lodgepole Pine** |  |  |  |  |  |
| Canadian Rockies | 0.09 | 0.09(95) | 0.12(129) | 0.11(127) | 0.12(129) |
| Columbia Mountains | 0.08 | 0.08(89) | 0.11(131) | 0.12(137) | 0.11(134) |
| Idaho Batholith | 0.08 | 0.08(95) | 0.11(130) | 0.11(138) | 0.11(140) |
| Middle Rockies | 0.08 | 0.08(93) | 0.11(130) | 0.11(141) | 0.11(139) |
| Northern Cascades | 0.08 | 0.07(98) | 0.10(134) | 0.11(140) | 0.11(143) |
| Southern Rockies | 0.10 | 0.10(100) | 0.13(132) | 0.11(113) | 0.10(108) |
| **Mixed Conifer** |  |  |  |  |  |
| Baja California | 0.11 | 0.11(101) | 0.15(133) | 0.13(122) | 0.13(115) |
| Coastal Sage | 0.11 | 0.09(87) | 0.13(119) | 0.12(112) |  |
| Eastern Cascades | 0.10 | 0.10(99) | 0.14(137) | 0.13(128) | 0.13(123) |
| Klamath Mountains | 0.10 | 0.09(85) | 0.11(109) | 0.12(117) | 0.12(118) |
| Sierra Nevada | 0.10 | 0.09(89) | 0.14(133) | 0.13(123) | 0.12(118) |
| **Pinyon-Juniper** |  |  |  |  |  |
| AZ-NM Plateau | 0.12 | 0.14(117) | 0.14(121) | 0.13(114) | 0.12(106) |
| Central Basin | 0.12 | 0.13(112) | 0.15(127) | 0.15(125) | 0.14(120) |
| Colorado Plateau | 0.11 | 0.13(111) | 0.15(130) | 0.15(128) | 0.14(125) |
| Mojave Basin | 0.14 | 0.16(117) | 0.16(117) | 0.14(105) | 0.15(109) |
| Temperate Sierras | 0.12 | 0.13(103) | 0.14(112) | 0.13(106) | 0.13(107) |
| **Ponderosa Pine** |  |  |  |  |  |
| Blue Mountains | 0.11 | 0.11(92) | 0.14(123) | 0.14(122) | 0.13(114) |
| Eastern Cascades | 0.11 | 0.10(93) | 0.13(124) | 0.12(114) | 0.12(112) |
| Great Plains | 0.13 | 0.13(104) | 0.17(132) | 0.16(123) | 0.16(125) |
| Sierra Nevada | 0.12 | 0.12(99) | 0.15(124) | 0.14(118) | 0.14(116) |
| Temperate Sierras | 0.10 | 0.10(99) | 0.13(138) | 0.12(127) | 0.12(120) |
| Southern Rockies | 0.11 | 0.10(95) | 0.13(123) | 0.13(119) |  |
| **Oak** |  |  |  |  |  |
| Baja CA | 0.12 | 0.13(108) | 0.13(111) | 0.13(108) | 0.12(101) |
| Coastal Sage | 0.12 | 0.12(95) | 0.13(108) | 0.13(104) | 0.11(90) |
| North America Highland | 0.12 | 0.14(111) | 0.14(117) | 0.14(112) | 0.14(116) |
| Temperate Sierras | 0.12 | 0.13(105) | 0.14(111) | 0.13(104) | 0.13(105) |
| **Spruce/Fir/Hemlock** |  |  |  |  |  |
| Blue Mountains | 0.09 | 0.08(93) | 0.12(132) | 0.12(132) | 0.11(128) |
| Columbia Mountains | 0.08 | 0.07(91) | 0.11(131) | 0.12(152) | 0.12(146) |
| Idaho Batholith | 0.08 | 0.08(97) | 0.11(133) | 0.13(148) | 0.13(152) |
| Canadian Rockies | 0.09 | 0.09(96) | 0.12(133) | 0.12(140) | 0.13(142) |
| Middle Rockies | 0.09 | 0.08(94) | 0.11(129) | 0.12(145) | 0.12(145) |
| Northern Cascades | 0.07 | 0.07(95) | 0.10(133) | 0.11(150) | 0.11(150) |
| Southern Rockies | 0.09 | 0.09(97) | 0.12(132) |  |  |
| Wasatch/Unita Mountains | 0.11 | 0.10(97) | 0.13(124) | 0.13(123) |  |

Table S4: Pre-fire and post-fire winter albedo (post-fire/post-fire) across ecoregions of each forest type.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Forest Types/Ecoregions** | **Pre-fire** | **1-Yr Post-fire** | **10-Yr Post-fire** | **20-Yr Post-fire** | **25-Yr Post-fire** |
| **Regions** |  |  |  |  |  |
| Idaho Batholith | 0.39 | 0.37(95) | 0.44(112) | 0.51(131) | 0.51(130) |
| Middle Rockies | 0.43 | 0.46(108) | 0.49(115) | 0.50(117) |  |
| Northern Cascades | 0.15 | 0.37(240) | 0.45(292) | 0.40(258) | 0.36(231) |
| **Lodgepole Pine** |  |  |  |  |  |
| Idaho Batholith | 0.39 | 0.39(100) | 0.46(117) | 0.53(136) | 0.45(115) |
| Middle Rockies | 0.25 | 0.38(153) | 0.50(204) | 0.56(227) | 0.50(202) |
| Southern Rockies | 0.42 | 0.47(113) | 0.43(104) |  |  |
| **Mixed Conifer** |  |  |  |  |  |
| Eastern Cascades | 0.26 | 0.40(152) | 0.55(209) | 0.44(167) | 0.70(266) |
| Klamath Mountains | 0.16 | 0.10(65) | 0.17(105) | 0.24(151) | 0.15(97) |
| Sierra Nevada | 0.17 | 0.25(149) | 0.44(264) | 0.26(157) | 0.25(151) |
| **Pinyon-Juniper** |  |  |  |  |  |
| Central Basin | 0.36 | 0.45(125) | 0.52(144) | 0.54(150) | 0.52(145) |
| Colorado Plateau | 0.36 | 0.53(146) | 0.56(153) | 0.58(159) | 0.48(131) |
| **Ponderosa Pine** |  |  |  |  |  |
| Eastern Cascades | 0.31 | 0.38(120) | 0.50(161) | 0.43(138) | 0.49(157) |
| Sierra Nevada | 0.24 | 0.31(130) | 0.49(205) | 0.33(136) | 0.34(143) |
| Temperate Sierra | 0.29 | 0.38(129) | 0.46(157) | 0.40(138) |  |
| Southern Rockies | 0.45 | 0.42(94) | 0.48(106) | 0.37(82) |  |
| **Spruce-Fir\_Hemlock** |  |  |  |  |  |
| Idaho Batholith | 0.37 | 0.41(111) | 0.44(119) | 0.48(130) | 0.49(132) |
| Canadian Rockies | 0.27 | 0.33(123) | 0.43(163) | 0.47(177) | 0.44(166) |
| Middle Rockies | 0.51 | 0.48(95) | 0.56(110) | 0.60(117) |  |
| Northern Cascades | 0.31 | 0.35(112) | 0.38(122) | 0.42(136) | 0.38(123) |

Table S5: Model performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Forest Types** | **OOBE (r2)** | | **OOBE (r2)** | |
| 10-Yr LAI | 20-Yr LAI | 10-Yr Albedo | 20-Yr Albedo |
| Mixed Conifer | 0.0306 (0.73) | 0.0385 (0.66) | 0.0044 (0.79) | 0.0034 (0.76) |
| Lodgepole pine | 0.0323 (0.65) | 0.0258 (0.69) | 0.0129 (0.65) | 0.0091 (0.52) |
| Douglas-fir | 0.042 (0.78) | 0.058 (0.65) | 0.0079 (0.68) | 0.009 (0.7) |
| Ponderosa pine | 0.039 (0.7) | 0.049 (0.72) | 0.0054 (0.83) | 0.0052 (0.82) |
| Pinyon-Juniper | 0.05 (0.66) | 0.052 (0.67) | 0.0081 (0.77) | 0.0079 (0.77) |
| Oak | 0.079 (0.77) | 0.092 (0.78) | 0.004 (0.72) | 0.0041 (0.72) |
| Spruce/Fir/Hemlock | 0.046 (0.69) | 0.035 (0.71) | 0.0139 (0.55) | 0.016 (0.52) |

Chart, line chart

Description automatically generated

Figure S1: Mean snow-free summer and winter post-fire albedo as a function of time since fire in mixed conifer and ponderosa pine forests of Sierra Nevada.

Diagram

Description automatically generated with medium confidence

Figure S2: Relative variable importance scores for simulating degree of post-fire summer LAI recovery. (Predictors: Elev = elevation; AvgT = mean summer temperature; AnnualP = annual total precipitation; FS – fire severity).

Diagram

Description automatically generated

Figure S3: Relative variable importance scores for simulating degree of post-fire summer albedo recovery.

Diagram

Description automatically generated

Figure S4: Mean winter post-fire LAI (± SE) as a function of time since fire in seven different forest types of the western US.