# **Appendix A**

**Figures**

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**Figure A1.** The spectral recovery metric scheme (NDVIrec) used in this research is described in Equation 1.



**Figure A2.** For each forest subtype, the interaction plots illustrate the relationship between both factors, fire severity and drought levels (x-axis). The y-axis represents the response variable NDVIrec at year five. Parallel lines in the interaction plots suggest no interaction between factors, indicating similar recovery patterns across different levels of fire severity and drought. In this case, there is a significant interaction effect as the slopes are unequal. For (a) *Q.* *saponaria & L. caustica*. (b) *V. caven & M. boaria* and (c) *C. alba & P. boldus.*



**Figure A3**. Summary matrices by forest subtype that indicate the percentage of the means of the NDVIrec at year 5 by fire severity and drought level. The colors indicate the *p-value* of the post hoc (Tukey's multiple comparison test, p < 0.01).

**Tables**

**Table S1.** Wildfires selected in the study area and their characteristics.

| ID  | ID CONAF  | Fire Name | Fire year  | Administrative Region | Forest subtype | Wildfire area (ha) | Latitude | Longitude |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | ID189237 | Santa Maria - Los Molles | 2017 | Valparaíso | Qs & Lc, Vc & Mb, Ca & Pb | 1,190.30 | -32.24 | -71.49 |
| 2 | ID189192 | Madre del Agua | 2016 | Valparaíso | Qs & Lc | 417.2 | -32.65 | -71.32 |
| 3 | ID189119 | Lo Orozco | 2017 | Valparaíso | Qs & Lc, Vc & Mb | 169.9 | -33.24 | -71.42 |
| 4 | ID169148 | El Penon | 2014 | Metropolitana | Qs & Lc | 606,3 | -33.57 | -70.51 |
| 5 | ID189223 | El Toyo | 2017 | Metropolitana | Qs & Lc | 891,8 | -33.58 | -70.44 |
| 6 | ID169133 | El Manzano | 2013 | Metropolitana | Qs & Lc | 445.4 | -33.59 | -70.41 |
| 7 | ID169171 | El Carrizo | 2014 | Metropolitana | Vc & Mb, Ca & Pb | 14,173,5 | -33.64 | -71.37 |
| 8 | ID189257 | Rinconada de Pirque | 2017 | Metropolitana | Qs & Lc, Ca & Pb | 3,228.20 | -33.73 | -70.58 |
| 9 | ID189124 | San Rafael De Puro | 2017 | Metropolitana | Qs & Lc | 130 | -33.79 | -71.41 |
| 10 | ID39037 | Los Maitenes | 1992 | Metropolitana | Qs & Lc, Vc & Mb, Ca & Pb | 497.2 | -33.82 | -71.34 |
| 11 | ID112326 | Cruce Las Aranas | 2004 | Metropolitana | Qs & Lc, Vc & Mb, Ca & Pb | 1,911.40 | -33.87 | -71.33 |
| 12 | ID189195 | Quilamuta | 2016 | Metropolitana | Qs & Lc, Vc & Mb | 511.2 | -33.89 | -71.50 |
| 13 | ID118979 | La Manga | 2005 | Metropolitana | Qs & Lc, Vc & Mb | 2,057.20 | -33.89 | -71.61 |
| 14 | ID169040 | Corneche | 2014 | Metropolitana | Qs & Lc, Ca & Pb | 255.8 | -33.95 | -71.63 |
| 15 | ID189264 | Lo Chacon | 2017 | Metropolitana | Ca & Pb | 6,035.80 | -33.96 | -71.28 |
| 16 | ID118915 | Longovilo | 2005 | Metropolitana | Qs & Lc | 344.8 | -33.97 | -71.40 |
| 17 | ID151627 | Quelentaro | 2011 | O'Higgins | Qs & Lc | 94.2 | -33.99 | -71.56 |
| 18 | ID169139 | El Membrillo | 2014 | Metropolitana | Qs & Lc, Vc & Mb, Ca & Pb | 1252.52 | -34.00 | -71.28 |
| 19 | ID146674 | Cuesta Alhue | 2010 | Metropolitana | Qs & Lc | 1,020.00 | -34.02 | -71.20 |
| 20 | ID189263 | Talami | 2017 | Metropolitana | Qs & Lc, Va & Pb | 7,747.70 | -34.05 | -70.99 |
| 21 | ID169120 | Cruce Santa Ines | 2013 | O'Higgins | Qs & Lc | 217.1 | -34.08 | -71.37 |
| 22 | ID151674 | La Palmeria  | 2011 | O'Higgins | Qs & Lc, Va & Pb | 1,490.40 | -34.18 | -71.12 |
| 23 | ID177153 | La Palmeria 4 | 2015 | O'Higgins | Qs & Lc | 576,2 | -34.19 | -71.12 |
| 24 | ID136426 | Quebrada Quillyquen | 2008 | O'Higgins | Qs & Lc | 126.4 | -34.26 | -71.61 |
| 25 | ID157096 | Rinconada de Idahue | 2012 | O'Higgins | Qs & Lc | 71.1 | -34.29 | -71.15 |
| 26 | ID157061 | Pampa Idahue | 2012 | O'Higgins | Qs & Lc | 52 | -34.31 | -71.17 |
| 27 | ID177202 | Las Nieves 4 | 2015 | O'Higgins | Ca & Pb | 688,9 | -34.47 | -70.75 |
| 28 | ID189265 | Rincon de Yaquil 4 | 2017 | O'Higgins | Qs & Lc, Vc & Mb, Ca & Pb | 40,366.70 | -34.56 | -71.28 |
| 29 | ID68831 | El Calabozo | 1997 | O'Higgins | Qs & Lc | 1,636.10 | -34.57 | -71.04 |
| 30 | ID68630 | Las Cruces | 1997 | O'Higgins | Vc & Mb | 66.4 | -34.58 | -71.98 |
| 31 | ID136494 | San Jose De Apalta | 2008 | O'Higgins | Qs & Lc | 2,221.90 | -34.62 | -71.23 |
| 32 | ID146656 | Paredones | 2010 | O'Higgins | Vc & Mb | 150.6 | -34.64 | -71.90 |
| 33 | ID189226 | Alto Nilahue | 2016 | O'Higgins | Vc & Mb | 5,463.40 | -34.67 | -71.81 |
| 34 | ID176579 | Lo Orozco | 2015 | O'Higgins | Qs & Lc | 19.1 | -34.70 | -71.07 |
| 35 | ID189275 | Las Cardillas | 2017 | Maule | Qs & Lc, Ca & Pb | 52,908.60 | -34.90 | -71.99 |
| 36 | ID73968 | Los Maquis | 1998 | Maule | Ca & Pb | 32.6 | -34.98 | -70.89 |
| 37 | ID142593 | La Aguadilla | 2009 | Maule | Qs & Lc, Vc & Mb, Ca & Pb | 174.6 | -34.98 | -70.91 |
| 38 | ID151664 | Los Quenes | 2011 | Maule | Ca & Pb | 424.5 | -35.02 | -70.81 |
| 39 | ID189254 | Tabunco- El Aguila Convenio | 2017 | Maule | Qs & Lc | 3,215.10 | -35.18 | -71.99 |
| 40 | ID169169 | Quivolgo 1 | 2014 | Maule | Ca & Pb | 2,670,9 | -35.32 | -72.39 |
| 41 | ID118965 | Loncomilla | 2005 | Maule | Qs & Lc | 742.2 | -35.66 | -71.76 |
| 42 | ID189243 | Llepo | 2017 | Maule | Qs & Lc | 1,839.90 | -35.95 | -71.48 |

*Abreviation:* *Quillaja saponaria & Lithrea caustica (Qs & Lc), Vachellia caven & Maytenus boaria (Vc & Mb), Cryptocarya alba and Peumus boldus (Ca & Pb)*

**Table A2.** Sample for two-way ANOVA.

***Q. saponaria & L. caustica***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Drought Level | Fire Severity | count | mean | median | sd | cv |
| Hyper Drought | high | 386 | 0.31 | 0.36 | 0.49 | 1.58 |
| Hyper Drought | medium | 387 | 0.24 | 0.35 | 0.48 | 2.00 |
| Mega Drought | high | 386 | 0.80 | 0.80 | 0.61 | 0.76 |
| Mega Drought | medium | 386 | 0.69 | 0.79 | 0.62 | 0.90 |
| No Drought | high | 385 | 0.90 | 0.86 | 0.46 | 0.51 |
| No Drought | medium | 148 | 0.67 | 0.57 | 0.39 | 0.58 |
| Total  | 2078 |  |

***V. caven & M. boaria***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Drought Level | Fire Severity | count | mean | median | sd | cv |
| No Drought | high | 228 | 0.63 | 0.55 | 0.32 | 0.51 |
| No Drought | medium | 85 | 0.60 | 0.46 | 0.30 | 0.50 |
| Mega Drought | high | 109 | 0.66 | 0.64 | 0.36 | 0.55 |
| Mega Drought | medium | 7 | 0.60 | 0.71 | 0.33 | 0.55 |
| Hyper Drought | high | 386 | 0.28 | 0.27 | 0.30 | 1.07 |
| Hyper Drought | medium | 341 | 0.21 | 0.20 | 0.31 | 1.48 |
|  | 1156 |  |

***C. alba & P. boldus***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Drought Level | Fire Severity | count | mean | median | sd | cv |
| No Drought | high | 386 | 1.00 | 1.05 | 0.29 | 0.29 |
| No Drought | medium | 76 | 0.65 | 0.66 | 0.25 | 0.38 |
| Mega Drought | high | 174 | 0.56 | 0.59 | 0.41 | 0.73 |
| Mega Drought | medium | 104 | 0.45 | 0.48 | 0.48 | 1.07 |
| Hyper Drought | high | 360 | 0.39 | 0.42 | 0.24 | 0.62 |
| Hyper Drought | medium | 140 | 0.30 | 0.29 | 0.24 | 0.80 |
|  | 1240 |  |

**Table A3.** A confidence interval of ANOVA.

***Q. saponaria & L. caustica***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Fire Severity |  |  |  |  |  |
| Drought Level | **Mean** | **SE** | **df** | **Lower**  | **Upper** |
| No Drought | 0.898  | 0.0268  | 2072 | 0.845 | 0.950 |
| Mega Drought | 0.802  | 0.0268  | 2072 | 0.749 | 0.855 |
| Hyper Drought | 0.305  | 0.0268  | 2072 | 0.253  | 0.358 |
| High Fire Severity |  |  |  |  |  |
| No Drought | 0.668  | 0.0433  | 2072 | 0.583 | 0.753 |
| Mega Drought | 0.692  | 0.0268  | 2072 | 0.640  | 0.745 |
| Hyper Drought | 0.237  | 0.0268  | 2072 | 0.184  | 0.289 |

***V. caven & M. boaria***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Fire Severity |  |  |  |  |  |
| Drought Level | **Mean** | **SE** | **df** | **Lower**  | **Upper** |
| No Drought | 0.630 | 0.0207  | 1150 | 0.590 | 0.671 |
| Mega Drought | 0.656  | 0.0300  | 1150 | 0.597 | 0.715 |
| Hyper Drought | 0.279  | 0.0159  | 1150 | 0.248  | 0.310 |
| High Fire Severity |  |  |  |  |  |
| No Drought | 0.597  | 0.0339  | 1150 | 0.530 | 0.664 |
| Mega Drought | 0.600  | 0.1182  | 1150 | 0.368  | 0.832 |
| Hyper Drought | 0.211  | 0.0169  | 1150 | 0.178  | 0.245 |

***C. alba & P. boldus***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Fire Severity |  |  |  |  |  |
| Drought Level | **Mean** | **SE** | **df** | **Lower**  | **Upper** |
| No Drought | 0.998 | 0.0158 | 1234 | 0.583 | 1.29 |
| Mega Drought | 0.558  | 0.0235  | 1234 | 0.393 | 0.604 |
| Hyper Drought | 0.390  | 0.0163  | 1234 | 0.252  | 0.422 |
| High Fire Severity |  |  |  |  |  |
| No Drought | 0.653  | 0.0355  | 1234 | 0.583 | 0.723 |
| Mega Drought | 0.453  | 0.0304  | 1234 | 0.393  | 0.512 |
| Hyper Drought | 0.303  | 0.0262  | 1234 | 0.252  | 0.355 |

Confidence level used: 0.95

**Table A4.** Post-hoc, Tukey's multiple comparison tests, confidence level 0.95, p < 0.01 (contrast).

***Q. saponaria & L. caustica***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Fire Severity |  |  |  |  |  |
| Drought Level | **Estimate** | **SE** | **df** | **t ratio**  | **p value** |
| No Drought -Mega Drought | 0.096 | 0.0379  | 2072 | 2.525 | 0.031 |
| No Drought -Hyper Drought | 0.592 | 0.0379  | 2072 | 15.627 | <.0001 |
| Hega Drought - Hyper Drought | 0.497  | 0.0379  | 2072 | 13.111  | <.0001 |
| High Fire Severity |  |  |  |  |  |
| No Drought -Mega Drought | -0.024  | 0.0509  | 2072 | -0.471 | 0.885 |
| No Drought -Hyper Drought | 0.4318 | 0.0509  | 2072 | 8.487  | <.0001 |
| Hega Drought - Hyper Drought | 0.4557 | 0.0509  | 2072 | 12.036  | <.0001 |

***V. caven & M. boaria***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Fire Severity |  |  |  |  |  |
| Drought Level | **Difference** | **lower** | **upper** |  |  |
| Mega drought:high-No drought:high  | 0.02530 | -0.07868047  | 0.129287775 |  |  |
| Hyper drought:high-No drought:high  | -0.351355 | -0.42594118  | -0.276769678 |  |  |
| No drought:medium-No drought:high | -0.03346069 | -0.14694297 | 0.080021576 |  |  |
| Mega drought:medium-No drought:high  | -0.030555039  | -0.37320465  | 0.312094567 |  |  |
| Hyper drought:medium-No drought:high | -0.418985060  | -0.49537642  | -0.342593695 |  |  |
| Hyper drought:high-Mega drought:high  | -0.376659081  | -0.47351551  | -0.279802653 |  |  |
| No drought:medium-Mega drought:high  | -0.058764352  | -0.18797875  | 0.070450044 |  |  |
| Mega drought:medium-Mega drought:high  | -0.055858693  | -0.40403521  | 0.292317824 |  |  |
| Hyper drought:medium-Mega drought:high  | -0.444288713  | -0.54254233  | -0.346035091 |  |  |
| No drought:medium-Hyper drought:high  | 0.317894729 | 0.21090549  | 0.424883965 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Mega drought:medium-Hyper drought:high | 0.320800388  | -0.01975390  | 0.661354676 |  |  |
| Hyper drought:medium-Hyper drought:high  | -0.067629632  | -0.13399311  | -0.001266158 |  |  |
| Mega drought:medium-No drought:medium  | 0.002905659  | -0.34822454  | 0.354035857 |  |  |
| Hyper drought:medium-No drought:medium  | -0.385524361  | -0.49378009  | -0.277268630 |  |  |
| Hyper drought:medium-Mega drought:medium  | -0.388430021  | -0.72938431  | -0.047475728 |  |  |

***C. alba & P. boldus***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Fire Severity |  |  |  |  |  |
| Drought Level | **Estimate** | **SE** | **df** | **t ratio**  | **p value** |
| No Drought -Mega Drought | 0.440 | 0.0283 | 1234 | 15.558 | <.0001 |
| No Drought -Hyper Drought | 0.607  | 0.0227  | 1234 | 26.779 | <.0001 |
| Hega Drought - Hyper Drought | 0.168  | 0.0286  | 1234 | 5.864  | <.0001 |
| High Fire Severity |  |  |  |  |  |
| No Drought -Mega Drought | 0.200  | 0.0467  | 1234 | 4.290 | 0.0001 |
| No Drought -Hyper Drought | 0.350  | 0.0441  | 1234 | 7.929  | <.0001 |
| Hega Drought - Hyper Drought | 0.149  | 0.0441  | 1234 | 3.726  | 0.0006 |

**Table A5.** Post-hoc pairs tests, F.ratio: F statistic for drought level within each category of fire severity.

***Q. saponaria & L. caustica***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Drought Level | df1 | df2 | F ratio  | p value |
| No Drought  | 1 | 2072 | 20.297 | <.0001 |
| Mega Drought  | 1  | 2072  | 8.379 | 0.0038 |
| Hyper Drought | 1  | 2072  | 3.288 | 0.0699 |

***C. alba & P. boldus***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Drought Level | df1 | df2 | F ratio  | p value |
| No Drought  | 1 | 1234 | 78.806 | <.0001 |
| Mega Drought  | 1  | 1234  | 7.561 | 0.0061 |
| Hyper Drought | 1  | 1234  | 7.997 | 0.0048 |

**Table A6.** Report of post-fire recovery observed in previous studies using satellite indices (adapted from Bright 2019).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Location | Vegetation type | Authors | Year  | Spectral index | Mean recovery time (year) |
| Spain | Mediterranean forest | Viedma et al. | 1997 | NDVI | 1 to 18 |
| California, USA | Chaparral | Hope et al. | 2007 | NDVI | 10 |
| Israel | Mediterranean forest | Wittenberg et al. | 2007 | EVI | 3 |
| Spain | Semi-arid | Vicente-Serrano et al. | 2011 | NDVI | 24  |
| SE Australia | Sclerophyll forest | Hislop et al. | 2018 | NBR | 8 to 10 |
| Western, USA | Temperate forest  | Meng et al. | 2015 | NDVI |  |
| Western, USA | Temperate forest | Bright et al. | 2019 | NBR | 9 to 13 |
| Spain | Mediterranean forest | Rodríguez-Blanco et al. | 2023 | TCTB | > 5 |

Abbreviations: *NDVI* Normalize Difference Vegetation Index, *EVI* Enhanced Vegetation Index, *NBR* Normalized Burn Ratio, *TCTB* Tasseled Cap Transformation Brightness.