**METHODS**  
*Sampling Design*

We evaluated trees at four sites at Mt. Desert Island in Maine, USA (Figure 1) in a factorially crossed fire history (Miller et al 2014) by elevation design: (1) Wonderland trail between 12 and 18 m elevation (low elevation, outside the footprint of the 1947 fire), (2) Cadillac cliffs between 28 and 40 m (low elevation, within the footprint of the 1947 fire), (3) St. Sauveur trail between 134 and 195 m (high elevation, outside the footprint of the 1947 fire) and (4) South Cadillac trail between 190 and 270 m (high elevation, within the footprint of the 1947 fire).

Figure 1. Insets which depict location of Mt. Desert island off the Maine coast; western and eastern hemispheres of the island and location of trees in burned and unburned locales.

A US Department of the Interior (National Park Service) permit provided access to obtaining edaphic and needle data. In the case of soil sample extraction, all sites were excavated similarly by hand trowel. Samples comprised uniformly similar shallow, homogeneous, low fertility characteristics (varying between .7-2.5 cm) and are usually overlain with rapidly drying needle duff (Day *et al* 2005) overlaying porous and acidic hornblende granite or Ellsworth schist. Using a soil probe (Accuproducts, Saline, MI, USA) and sharp-toothed hand trowel, aliquots were extracted from Oa-Ab horizon soil pockets of organic and mineral deposits within 60 cm of the tree base.

Leaf tissue was obtained from excision of basal fascicle bundles at dbh. Individual specimen collection served as a proxy for multiple trees located Height, spread (canopy) and diameter of target and proximate trees were also measured.

*Remote Sensing Technology*

Mapping was achieved through geospatial, remote sensing technology (Tierney *et al* 2012) used in the past to compare physiography and recalcitrant chemical biogeography, particularly in fire prone contexts (Szpakowski and Jensen 2019). Individual trees were randomly selected but a distance-between-subjects was observed, requiring 5m as a setback between specimens. We employed multiple satellite-configured GPS data (USGS 2m LIDAR 2010) to determine coordinates for individual trees (Lubinski Hop and Gawler 2003; Kim 2010). A Kodak Trimble Juno 3B unit was used to obtain an horizontal resolution of combined elevation, slope and aspect data plotted using between five and seven satellite telecommunication vehicles to maintain a maximum PDOP (Position Dilution of Precision). These data were differentially corrected and have estimated accuracies in the horizontal and vertical direction of 2 meters, while SA (selective availability) is set to zero. Trimble Pathfinder Office software accuracy is not represented. Instead, precision is an estimation of the positional error (closeness to truth) available as feature attributes. To estimate precision the software uses receiver type (for noise), baseline length, dilution, covariance and reference variance components. It is a repeatability measure not an accuracy measure. Horizontal precision for line and area features looks at all the individual points that make up the line/area feature and a mean value is computed by the software. These data points are used to establish not only elevation but to compute fire event sink-source metrics. For analysis purposes we constructed two bifurcated categories, assigning soil and tree aliquots to either a proximate (0-465 m) relation-to-fire-path or no historical exposure.

*Biomorphological measurements*

Using ArcGIS (version 10), specific slope, aspect and rose compass direction attributes were derived for forty sampling locations. The aggregated data were reduced to mean values for each measurement category yielding a table of four data arrays representative of the larger sample.

*Allometric measurements*

Several factors were considered. Height was estimated using nested, 2 m calibrated, lightweight aluminum rods (Garelick, St. Paul, MN, USA). Bole width was measured at 1.06 m dbh using a ProSkit electronic digital caliper (Amelia, VA, USA). Canopy spread was measured using the span between the same calibrated aluminum rods fixed with two landscape flags as a ground truth reference.

*Soil sampling*

Ten soil samples were excavated similarly by hand trowel corresponding to ten tree locations per site. Samples comprised uniformly similar shallow, homogeneous, low fertility characteristics (varying between .7-2.5 cm) and are usually overlain with rapidly drying needle duff (Day *et al* 2005) overlaying porous and acidic hornblende granite or Ellsworth schist. Using a soil probe (Accuproducts, Saline, MI, USA) and sharp-toothed hand trowel, aliquots were extracted from Oa-Ab horizon soil pockets of organic and mineral deposits within 60 cm of the tree base.

*Leaf tissue sampling*

Fifteen leaf tissue samples were obtained from excision of basal fascicle bundles beginning at 1 meter above the soil surface in each of four stands; we acknowledge photosynthetic and nutrient measurements differ according to light environments impacted by the size (height and canopy) of tree subjects.

*Foliar organic and mineral composition*

50 mL samples of needles were separated, cut and dried for two days at 60 ◦C. Then they were ground in a SPEX ball mill (Metuchen, NJ, USA). sieved to <10 mm and 15 mL were submitted for elemental analysis using Leco CN-2000 Carbon-Nitrogen Analyzer (Leco Corp., St. Joseph, MI) to determine C and N concentrations. The remainder of the same samples, 35 mL, were submitted for standard plant tissue nutrient analysis using a TJA Model 975 AtomComp ICP-AES (Thermo Jarrell-Ash Corp., Franklin, MA). The method comprised submersion in a 5 mL trace-metal-grade HNO3 treatment, then refluxed on hotblock at 80 ◦C for 2 hours and diluted to 25 mL with 0.4 micron PTFE syringe filters. Analysis was focused on macro and micro inorganic extractable fractions (Ca, P, K, Mg, Al and Zn).

*Stable isotope and elemental analysis*

C isotopic data of the needles (δ13C) of fully expanded leaf (needle cluster) of each species and accompanying soil samples was obtained. Sample fascicles were separated and dried for two days at 60 ◦C then ground in a SPEX ball mill (Metuchen, NJ, USA). Ground material was placed in Costech (Valencia, CA, USA) 5 x 9 mm tin capsules, weighed to +/- 2 mg for leaf tissue and +/- 5 mg for soil using a Cole-Palmer (Vernon Hills, IL, USA) micro analytic balance. In some cases, where calibration of C was problematic, sample mass was increased to as much as 50 mg. After mass was recorded, they were fed to a Perkins Elmer Elemental Analyzer ECS 4100 (Waltham, MA, USA) coupled with a Thermo Delta (Waltham, MA, USA) V+ IR-MS continuous flow isotope ratio mass spectrometer with a universal triple collector. Combustion gasses were separated on a gas chromatograph column, passed through a diluter and reference gas box, and introduced into the spectrometer. C abundance or depletion according to δ13C was used to determine iWUE. As a product of carboxylation and diffusion (Lambers Chapin Pons 2006) iWUEisotope represents δ13C unit/mL-1 percentage of photosynthesis, a sensitive long-term indicator of physiological change, i.e., growth versus stress inoculation. Foliar C and N were calculated using elemental analysis.

*Soil moisture retention*

70 mL samples were extracted from soils at fifteen tree locations at four sites, comprising <7.5 cm (Oa-Ab) horizon above bedrock to assess net moisture retention as a subset of soil moisture evaporation (*ψ*g), rather than depending on, say, matric potential (*ψ*m) to determine net evaporative loss or adsorption to surfaces. 50 g H2O were added to each aliquot. Soil moisture retention analysis was conducted according to the Fields method described previously (Licht *et al* 2017; Licht and Smith 2020). Retention effects of gravitational and evaporation forces was made on a wet basis where Wm=g H2O **●** g-1 moist soil; this method is described previously (Jingfang and Wenwei 2018).

*Soil organic and mineral composition*

250 mL soil samples were extracted and measured in 2019. Drying was performed in an oven at 100°C for two d. Analysis was performed using a modified Mehlich method using inductively coupled plasma spectroscopy, pH measurement via proton activity of a 1:1 slurry and effective soil cation exchange capacity (CEC) via formic acid extraction. These methods are described in detail previously (Licht *et al* 2017; Licht and Smith 2020). Bedrock C and N were also calculated using elemental analysis.

*Data Analysis*

All data were analyzed using a similar linear model structure with elevation (high or low) and presence of the 1947 fire (yes or no) as categorical fixed factors. The interaction between elevation and presence of the 1947 fire was also included in each model. In total, XX models were fit with following dependent variables: XXX, XXX, XXX. XXXX, XXX were log transformed to meet model assumptions of normality and heterogeneity of variances. All models were fit using the ‘lm’ function in R. Significance tests for each fixed factor was performed using the ‘anova’ function in R. Post-hoc Tukey’s tests were done to examine significant interactions between elevation and the presence of the 1947 fire using the ‘emmeans’ package (Lenth 2018) in R. All analyses were performed with R version 3.5.1 (R Core Team 2019).