**METHODS**  
*Overview and data harvest*

Where the local history of fire occurrence is known (Miller et al 2014), we evaluate trees along a transect of elevation gradients: Wonderland trail between 12 and 18 m elevation, Cadillac cliffs between 28 and 40 m, St. Sauveur trail between 134 and 195 m and South Cadillac trail between 190 and 270 m (Fig. 2). These locales serve as proxies for other fire-involved and unburned pitch pine stations including Bear Brook, Champlain Mountain, base of Precipice trail, North Cadillac and Norumbega Mountain. Mapping of these sites was achieved through geospatial sensing technology (Tierney *et al* 2012) used in the past to compare physiography and recalcitrant chemical biogeography. A transect was established within each population of non-equidistant sampling points. 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 within 5 m. All trees had a median diametrical measurement of +/- 12.5 cm. Height, spread (canopy) and diameter of target and proximate trees were also measured.

*GIS*

Based on previous use (Lubinski Hop and Gawler 2003; Kim 2010), we employ multiple satellite-configured GPS data (USGS 2m LIDAR 2010) to determine coordinates for individual trees. 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.

*Allometric measurements*

Several factors were considered. Height was estimated using nested, demarcated, 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 aluminum rods fixed with two landscape flags as a ground truth reference.

*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 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. 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.

If we decide to report topographical data (e.g., elevation, aspect and slope), it is available in a table (see Tables in ***Results*** section).