**RESULTS** (tables are included as references to the report)

Elements of forest pyrolysis, an absence of fire in non-contiguous forests, elevation gradients and soil and foliar chemistry play a role in an enigmatic response of pitch pine trees located in and outside a 1947 fire footprint on Mt. Desert island.

***Allometric Data***

Response, either as growth or stress resistance was discernable in trees from burned and unburned stands; they differed significantly in Tukey’s tests according to height growth (*P*=0.031), canopy width (*P*=0.035) and dbh (*P*=0.001). Individuals along Cadillac South ridge trail were substantially shorter, narrower in canopy and smaller in dbh than their three counterparts (Table 1). We assumed trees at lower unburned elevations would deport more substantial allometric gains based on a lack of environmental stressors which would be more likely to depress growth at higher elevations—this premise was confirmed. (Maybe these become three figure panels in Figure 2)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1. Results from analysis of variance (ANOVA) for plant height, canopy (span)** | | | | | | | | | | |
|  | **and diameter (at breast height)** | | | | |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  | Height (cm) |  | Canopy (cm) | | DBH (cm) | |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | df | F | P | F | P | F | P |  |  |  |
| Sites | 3 | 3.3319 | **0.03** | 3.1881 | **0.035** | 6.8211 | **<0.001** |  |  |  |
| Residuals | 36 |  |  |  |  |  |  |  |  |  |

***Foliar C, δ13C, N and δ53N Data***

Elevation gradients, growth and stress resistance were highlighted also according to foliar C availability and δ13C (iWUEisotope) response (Table 2).Strictly on a percentage basis foliar C was more substantial in burned as opposed to unburned communities resulting in marginally significant outcomes (*P*=0.055). The most robust iWUEisotope response was found among trees at higher elevation St. Sauveur trail (-27.0‰) and along South Cadillac trail (-27.4‰) consistent with depleted C and overall differences were significant (*P*=0.004). We anticipated a correlation between allometrics, foliar C and iWUEisotope and, for the most part, that result materialized. Based on evidence obtained by others elsewhere, we further conjectured differences in foliar N recalcitrancewould be minimal; in fact there was <5% difference in N availability among the populations and δ15N was not a factor. Foliar C/N ratios were not significantly different (*P*>.05).

***Foliar nutrient Data***

Foliar mineral availability was significantly different between burned and unburned trees—Ca (*P*<0.001), P (*P*=0.032), K (*P*<0.001) and Zn (*P*<0.008) (Table 3)—split between a group advantage for unburned and some individually higher minerals (P, K and Mg) at Cadillac cliffs where we interpret elevation played a much larger role than pyrolysis recalcitrance. Mg and Al contributions were not statistically different (*P*>0.05). Despite finding substantially greater P

availability at Cadillac cliffs, it along with N, did not factor into growth in comparison with trees at another low elevation (Wonderland).

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 3. Results of Analysis of Variance (ANOVA) for foliar mineral nutrient** | | |  |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | | |  |  |  |  |  |  |  |  |  |  |  | |  |  | Ca |  | P |  | K |  | Mg |  | Al |  | Zn |  | |  | df | F | P | F | P | F | P | F | P | F | P | F | P | | Sites | 3 | 6.623 | **0.001** | 3.198 | **0.032** | 6.825 | **0.001** | 2.0252 | >.05 | 0.102 | >.05 | 4.456 | **0.008** | | Residuals | 37 |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |

***Soil organic Data***

Soil C concentration was approximately two times greater at Wonderland and St. Sauveur (*m*=24.5%) trails compared to those at South Cadillac trail and Cadillac Cliffs (*m*=13.2%) with Wonderland three times higher than South Cadillac trail (Table 4). These data correspond to significant differences between burned and unburned precincts (*P*=0.023). Except for a lower soil N at South Cadillac trail (.28%) compared to the others (.51%), there was no significant difference (*P*>.05) in soil N between groups. However, in the case of soil C/N, differences were statistically significant (*P*=.039), owing to a greater disparity in C contributions amongst tree groups.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 4. Results from analysis of variance (ANOVA) for soil C and N nutrient** | | | | | | | | | | | | | | | | | | | | | | |
|  | |  | |  | | |  | | |  | | | |  | |  | | |  | | |  |
|  | | |  | | |  | | |  | | |  | | |  | |
|  | C | | | |  | | | N | | |  | | C/N | | | | |  | |  |
|  | | df | | F | | | P | | | F | | | | P | | F | | | P | | |  |
| Sites | | 3 | | 3.726 | | | **0.023** | | | 0.7197 | | | | >.05 | | 3.2896 | | | **0.039** | | |  |

***Soil mineral Data***

Elevation gradients discriminated presence or absence of soil minerals; we found St. Sauveur and Wonderland, unburned populations, collectively held greater Ca, P and Mg amounts but only K (*P*=0.019) and Al (*P*=0.027) were statistically more significant (Table 5). Noticeably higher P at Wonderland was consistent with higher growth output compared to the other sites.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 5. Results from analysis of variance (ANOVA) for soil mineral nutrient** | | | | | | | | |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | | |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Ca |  | P |  | K |  | Mg |  | Al |  | Zn |  |
|  | df | F | P | F | P | F | P | F | P | F | P | F | P |
| Sites | 3 | 2.691 | >.05 | 1.753 | >.05 | 3.908 | **0.019** | 1.234 | >.05 | 3.564 | **0.027** | 1.536 | >.05 |
| Residuals | 37 |  |  |  |  |  |  |  |  |  |  |  |  |

***Soil moisture retention Data* (maybe this becomes Figure 3 panel depending on how stark it looks)**

In the stressed environment on Mt. Desert, soil moisture retention, especially during peak PAR (photosynthetic active radiation) months, is crucial to survival in competition with other, larger evergreens indirectly sharing the same moisture resources. In a previous paper, investigators (Licht and Smith 2020) examined moisture retention in a controlled study of pitch pine exposed to natural and prescribed fire treatments with the result that charcoal PyC effects were found to add considerably to water retention outcomes. At Mt. Desert, though soils are glaciated as opposed to sandy or gravelly, and though no surface and very little subsurface charcoal was identified (compared to reports by Laird in 1993), we used the earlier methods to confirm recalcitrant effects of wildfire charcoal derived from the mid-twentieth century conflagration. At Cadillac cliffs, although not at South Cadillac trail, moisture retention was accompanied by a significant level of soil C (*P*<0.0001), which was 45% greater than its nearest unburned cohort, St. Sauveur. We subscribe to a theory that higher C at Cadillac cliffs and Wonderland is likely due to greater organic detritus and decomposition.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 6. Results from analysis of variance (ANOVA) soil water retention** | | | | | | | | |
|  |  |  |  |  |  |  |  |  |
| Water retention | | df | F | P |  |  |  |  |
| Sites |  | 3 | 9.671 | **<0.001** |  |  |  |  |
| Residuals |  | 36 |  |  |  |  |  |  |

***Biomorphological data***

**TABLE 7. Biomorphological data**

Compass regimentation, nutrient availability and photosynthetic output were aligned at south-facing Wonderland and to a lesser extent at southeast-facing Cadillac South trail and Cadillac cliffs. A combination of bimorphological factors favored Cadillac cliffs pitch pine vertical growth (greatest vertical, *µ*=6.2 m)—contrasted with south-facing and nearly level Wonderland trees achieving the widest canopy and southeast oriented South Cadillac trail trees deporting by far the least dbh.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Stand | x | y | Elevation | Slope | Aspect | Compass |
| CADST | -68.22126 | 44.3288 | 239.3 | 10.5 | 127.1 | SE |
| CADCLIFFS | -68.18527 | 44.3278 | 33 | 17 | 142 | SE |
| STSAUV | -68.32666 | 44.31071 | 172 | 15 | 252 | W |
| WONDER | -68.31443 | 44.2313 | 16 | 3 | 188 | S |