Paragraph 1 – Plant strategies and roots

* How plant strategies change along environmental and disturbance gradients has been extensively studied in aboveground functional traits, but belowground functional traits have historically received less attention.
* Functional traits are defined as the physiological properties of a plant that influences the species’ growth, survival and reproduction.
* Combinations of these functional traits are referred to as trait economic spectrums.
* Plant economic spectrums are made up of root and leaf economic spectrums, which show a gradient of conservative to acquisitive strategies (Tilman)
* Historically, root economic spectrums were thought to be concurrent with the better studied leaf economic, but we now know this not to be the case

Paragraph 2 – Mycorrhizal symbiosis and fire

* A large reason for this is the presence of a second economic gradient in root systems involving collaboration with mutualistic microbial symbionts
* Arbuscular mycorrhizal fungi are an ancient nutrient symbiosis between most land plants and a monophyletic fungal clade called the Glomeromycota.
* This symbiotic relationship can act as a limiting factor in plant growth when light intensity is high (Tilman)
* Climate change is predicted to result in increasing frequency and severity of extreme events, including fire.
* Fire is an ecologically important disturbance and contributes to the maintenance of healthy ecosystems.
* Some studies have suggested that fire reduces mycorrhizal colonisation and soil fungal diversity, though others have shown no effect

Paragraph 3 - Introduction to study

* Methodology
  + Mycorrhizal data came from root samples collected at Cedar Creek Ecosystem Science Reserve, Mninnesota
  + In each of the 12 burn units, a root sample was taken at random from the species with the highest coverage in that burn unit from each functional group (grass, legume, non-legume forb, sedge)
  + Of 48 samples, 33 were possible to stain for mycorrhizal symbiosis using the methods and equipment at our disposal
  + Of these 33 samples, 17 were successfully stained for mycorrhizal colonisation (clearing using KOH ambient for 48 hours, trypan blue 8 mins at 96C)
* Theory
* In this study, we looked at how root traits and species strategies may explain their response to disturbance by fire.
* The interplay between fire, soil nitrogen and phosphorous, root system architecture, light availability, and arbuscular mycorrhizal colonisation will be investigated.
* To quantify mycorrhizal colonisation, a modified clearing and staining method was used, with a modified light microscopy being performed intersection method was used.
* Due to mycorrhizal staining being relatively uncommon in ecological studies (in favor of RNA-seq using 18S rRNA), considerable troubleshooting was required for consistent successful measurements of mycorrhizal colonisation in root samples of different species.
* 33 slides were mounted, with a total of 3,300 observations of the presence of arbuscular mycorrhizal fungi. Another 22 slides were mounted, totalling 110 rot sections and 550 observations during the method pilot stage
* High mycorrhizal colonisation informs us that a plant is seeking to maximise its nutrient uptake, and when we looked at this measure, we found that in higher fire frequency, some species had higher mycorrhizal colonisation, however there was no overall trend for all our species
* Due to the statistical limitations of a small sample size as a result of methodological challenges, we also looked at morphological root traits of species in a broader test, which also gives insight into plant nutrient strategies
* As we can’t look at both together because of experimental limitations, we looked at them individually, and qualitatively assessed the conservation / collaboration gradient