Potential Undergraduate Projects in the ADFER Lab

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Fire Ecology

*Fuel moisture dynamics and flammability of prairie forbs

Many old-field sites in Ohio have been targeted for the creation of prairie habitat. Restoring disturbance by fire to prairies is critically important to manage their composition and diversity. Recently created prairies and abandoned old fields often become dominated by weedy native forbs such as goldenrod (*Solidago* spp.). Whilst an important component of prairie flora, where these species become over-dominant they can cause management issues as they suppress the growth of other species and their limited flammability can constrain the potential to manage site by burning. This project will investigate seasonal and diurnal variation in the moisture content of and flammability goldenrod in the hope of helping managers to identify suitable windows for burning.

How is mesophication altering the flammability of Ohio's forests?

Much of Ohio was once covered in Oak-Hickory forests that were maintained through a mixture of traditional managed burning by native peoples and wildfire. The frequent fire regime favoured oak and hickory over less fire-resistant species such as beech and maple and created an open forest structure that supported a range of important wildlife. Fire suppression over the last 100 years has allowed oak forests to become increasingly dominated by beech and maple which establish better in the denser-shadier conditions that subsequently developed. Significant efforts are underway to restore fire to oak forests but efforts remain hampered by a lack of understanding of fundamental controls on fire intensity and severity. This project could help solve this knowledge gap by modelling variation in forest floor fuel moisture and assessing inherent differences in fuel flammability between different forest compositions.

Soil and plant community restoration

*Could autumn olive be used as an ecosystem engineer during mineland reclamation?

Autumn olive is a problematic invasive species across large areas of Ohio. This is particularly the case in some regions in the south-east where it was extensively-planted as part of mineland reclamation efforts. In areas where it was introduced it has often spread to form large-monospecific stands and is a problematic invasive in restored and remnant native habitat. Despite it's bad press autumn olive does have some benefits as it establishes well and is productive in degraded, compacted mineland soils in which establishment by other woody species is poor. Previous research has shown that "less-

desirable" species can act as a stepping stone to restoration in degraded ecosystems. As a woody, deep-rooted, nitrogen-fixing plant that produces abundant plant litter might it actually provide benefits for soil reclamation? Might establishment success of native species in areas formerly dominant by autumn olive actually be better than in the wider landscape? Might cover of autumn olive provide native tree seedling with protection from browsing by deer? The project could investigate some of impacts and legacy effects of autumn olive on the soil environment, how autumn olive interacts with native woody vegetation and potential methods for its effective control.

Using parasitic plants to control cool-season pasture grasses
Non-native, cool-season (C3) pasture grasses create significant challenges for prairie restoration as they form dense that layers that prevent seed germination, compete with native plants for resources, and remain green well into the fall and spring constraining opportunities for their control via managed burning. There are a number of hemiparasitic plants that have been used in other regions to reduce the vigour and abundance of cool season grasses. This project will investigate whether introducing such plants into restored grasslands can help reduce the abundance of problematic non-native grasses and increase the establishment success of reseeded natives.

Green hay transfer as a restoration tool
In European grassland restoration project managers will frequently use green hay transfer to re-establish desirable species at new sites. This method "cuts out the middleman" as vegetation is harvested from a donor site and directly-applied to the restoration area. Using this method thereby reduces reliance on expensive commercial seed and ensures seed applied during restoration is from local sources. The green hay transfer method has not been previously tested in the context of prairie restoration and this project will evaluate its success

Evaluating direct tree seeding as a tool to restore bottomland forests
Bottomland forests that have been invaded by species like honeysuckle often have a dearth of regeneration of native trees and shrubs. Whilst replanting with nursery stock can help restore sites it is expensive and time consuming. In contrast to a huge amount of work investigating controls on the survival of out-planted seedlings there has been little investigation of the success of direct seeding approaches to restoration. In this scenario seed is harvested from trees and planted at the site rather than first being grown on in a nursery. Current practice is limited by a lack of knowledge of success rates for different species and how seed should be collected, processed, stored and applied.