Wildlife Preservation Fund Grant # 08-009W
Macrofungi Associated with Tree Windfall in Old Growth Prairie Groves

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Project Objectives

Questions to be addressed by this study include:

i) Does macrofungi species composition differ on two different decay classes of Northern red oak and sugar maple?
ii) Does macrofungi species composition and species richness change within and between years?
iii) Do tree windfalls influence macrofungi species composition and richness patterns?
iv) Does fungal species diversity decline as Northern red oaks are replace by sugar maples?
v) Do environmental and abiotic variables influence macrofungi species composition and species richness?

This study will help address a trend observed in mixed forests in the Midwest where Northern red oaks are rapidly being replaced by sugar maples. It may allow us to predict if macrofungal species diversity declines in mixed forest stands as Northern red oaks are replaced by sugar maples and will add significantly to knowledge of the ecological role of macrofungi in forest ecosystems.

Completed Project Description:

This study investigated macrofungi (Ascomycota and Basidiomycota) associated with tree windfall in Brownfield (26.1 ha) and Trelease Woods (24.5 ha), Champaign Co., Illinois. These woods are remnants of a larger, pre-settlement prairie grove now encircled by houses, fragmented forests, prairie and agricultural land. Although initially a virgin, deciduous, upland forest dominated by oak, ash and maple with a high, closed canopy and fairly open (Brownfield Woods) to moderately dense (Trelease Woods) understory, sugar maple is rapidly becoming the dominant tree species. Beginning with a windstorm in November 1994 that damaged canopy trees in Trelease Woods, fallen trees in both woods have been tagged with an ID number, date of windfall, dbh and location relative to a network of marked grids by Steve Buck, Resources Technologist, Committee on Natural Areas Site Manager, University of Illinois.

This study represents a unique opportunity to study: i) differences in macrofungi species composition relative to woody substrates of different species, dbh, decay class and bark condition; ii) variation in macrofungi production between years; iii) changes in macrofungi species composition and species richness change within and between years; and iv) perturbation of macrofungi species composition and richness patterns by tree windfalls. A preliminary survey completed in Fall 2005 facilitated selection of tree windfalls to be sampled, established transects to survey terrestrial macrofungi, and yielded a baseline of nearly 100 taxa of macrofungi from Brownfield and Trelease Woods.

Summary of Project Accomplishments:

Introduction: This study investigated macrofungi (Ascomycota and Basidiomycota) associated with tree windfall in Brownfield (26.1 ha) and Trelease Woods (24.5 ha), Champaign Co., Illinois. These woods are remnants of a larger, pre-settlement prairie grove now encircled by houses, fragmented forests, prairie and agricultural land. Although initially a virgin, deciduous, upland forest dominated by oak, ash and maple with a high, closed canopy and fairly open (Brownfield Woods) to moderately dense (Trelease Woods) understory, sugar maple is rapidly becoming the dominant tree species. Beginning with a windstorm in November 1994 that damaged canopy trees in Trelease Woods, fallen trees in both woods have been tagged with an ID number, date of windfall, dbh and location relative to a network of marked grids by Steve Buck, Resources Technologist, Committee on Natural Areas Site Manager, University of Illinois.

A preliminary survey initiated in Fall 2005 to survey macrofungi on tree windfalls as well as terrestrial macrofungi was extended through a second field season (2006) and into a third (2007). To date, nearly 100 species of macrofungi have been recorded from Brownfield and Trelease Woods (See separate file for a list of species).

This study will help address a trend observed in mixed forests in the Midwest where Northern red oaks are rapidly being replaced by sugar maples. It will allow us to predict if macrofungal species diversity declines in mixed forest stands as Northern red oaks are replaced by sugar maple and will add significantly to knowledge of the ecological role of macrofungi in forest ecosystems.

Materials and Methods: Brownfield and Trelease Woods were visited July 5, July 19, August 2, August 16, August 30, September 13, September 27, October 11, October 25, November 8, November 29, 2007 as well as March 20, April 3, April 17, May 1, May 15, May 29, June 12, June 26, 2008. As part of her Master's thesis research, Kim Vernier collected wood decay macrofungi present on two decay classes of Northern red oak and sugar maple logs in Brownfield and Trelease Woods. Kim has finished collecting data and is writing her thesis. As part of his Master's thesis research, Vince Hustad collected terrestrial macrofungi within permanent transects in Brownfield and Trelease Woods. Vince will be defending his thesis on August 15, 2008 and enrolling in a Ph.D. in Plant Biology at the University of Illinois Urbana-Champaign.

Digital images of representative macrofungi were recorded in the field. Representative macrofungi were collected with minimal disruption of soil and vegetation. Macroscopic characteristics were recorded for representative macrofungi collected upon return to Eastern Illinois University. Taxa were identified using pertinent mycological literature available in the mycology laboratory at Eastern Illinois University. Representative macrofungi were dried, stored in Ziplock bags along with field labels and macroscopic notes, and accessioned into the cryptogamic herbarium at Eastern Illinois University. A database of macrofungi was prepared to allow for correlation of macrofungi, trees, and environmental and abiotic variables. Resemblance matrices were created using Bray-Curtis Similarity and analyzed using MDS, ANOSIM and SIMPER.

Results: Nearly 100 species of macrofungi have been identified from Brownfield and Trelease Woods (See separate file for a list of species). Environmental variables (precipitation, humidity, air temperature, soil temperature at 4" depth) and litter characteristics (pH, texture, organic content) were collected to assess which variables have the greatest influence on macrofungal community structure. Macrofungal community structure was found to differ significantly between forests (R=0.212, P=0.005) forest division within and between sites (R=0.233, P=0.007), and collection areas (R=0.200, P=0.005). Macrofungal assemblages from each forest were shown to significantly differ each month and year of the study (R = 0.526, P = 0.0001). Macrofungal community structure was shown by MDS and ANOSIM to be strongly influenced by seasonality, with soil temperature at 4" depth having the strongest correlation to changes in macrofungal seasonality. SIMPER analysis revealed sixteen genera to be most informative in seasonal differentiation of macrofungal communities: *Mycena, Irpex, Stereum, Hymenochaete, Xylaria, Schizophyllum, Gymnopus, Trichaptum, Poria, Marasmius, Coprinellus, Xeromphalina, Psathyrella, Eutypa, Polyporus,* and *Steccherinum*. The results of SIMPER analyses performed in this study suggest that it is possible in future studies to evaluate only a subset of the macrofungal community and still maintain a large degree of confidence. These results will be used in a management context to prioritize collection efforts focused on the most informative, most abundant genera present at a site at a given time. The results of this study will also be used for comparison during habitat restoration projects in order to gauge the effectiveness of restoration efforts.

Future Directions: An inherent problem in studying macrofungal communities using sporocarp data is that sporocarp production is a relatively random even. The production of Sporocarps by a species in a particular year may be very different from subsequent years, despite the vegetative mycelium at the site being relatively unchanged. The ethereality of Sporocarps proposes significantly challenges when studying fungal communities as well. Novel methods of studying fungal communities such as mycelia DNA extracted from soil and wood samples may prove to be the most effective method of consistently analyzing terrestrial macrofungi and avoiding the confounding variability of sporocarp production over time.

Fungal DNA will be extracted and isolated from soil cores and fallen trees using fungal specific primers and soil extraction kits during Fall Semester 2008. The ITS region of amplified cloned sequences will be compared to published sequences to further identify macrofungal assemblages within each area. Fungal communities detected through ITS sequencing will be compared with macrofungal communities observed fruiting over different seasons.

Total Project Expenditures:

Travel – 15 trips to Brownfield and Trelease Woods – 110 miles/trip @ $0.485/mile = $800.25
(Only $689.83 reimbursed from the grant; $110.42 paid by principal investigator)

Material Supplies – Dneasy Plant Mini Kit (Qiagen Inc) = $550.17
Ultraclean Soil DNA Kit (MoBio Laboratory) = $672.00

Total = $1912

Project expenditures paid by funds other than Special Wildlife Grant Funds

Travel – 4 trips to Brownfield and Trelease Woods – 110 miles/trip @ $0.485/mile = $213.40
(Paid by principal investigator)

Brownfield and Trelease Woods Fungi

Annulohypoxylon annulatum
Annulohypoxylon truncatum
Armillaria gallica
Armillaria mellea
Armillaria mellea rhizomorphs
Armillaria tabescens
Ascocoryne cylichnium
Auricularia auricula
Bactridium flava
Biscogniauxia atropunctata
Bisporella citrina
Bjerkandera adusta
Camillea punctata
Camillea tinctor
Cerrena unicolor
Chlorosplenium aeruginascens
Coprinus disseminatus
Coprinus micaceus
Coprinus radians
Coprinus variegatus
Creopus gelatinosus
Crepidotus applanatus var. applanatus
Crepidotus applanatus var. globergi
Crepidotus crocophyllus
Dadaleopsis confragosa
Daldinia concentrica
Dasyscyphus niveus
Dasyscyphus niveus
Ductifera pululahuana
Eutypha spinosa
Flammulina velutipes
Fuligo septica
Galerina marginata
Ganoderma applanatum
Gymnopus subnudus
Hohenbuehelia angustatus
Hydnochaete olivaceum
Hypholoma sublateritium

Hysterographium #1
imperfect #1 (resembles Bactridium)
imperfect dark stem/ w/ green head
Inonotus #1 (resupinate on bark)
Irpex lacteus
Ischnoderma resinosum
Kretzschmaria deusta
Laetiporus sulphureus
Lenzites betulina
Lycogala epidendrum
Lycoperdon pyriforme
Marasmiellus nigripes
Marasmius rotula
Megacollybia platyphylla
Metatrichia vesparium
Mollisia sp.
Mycena #1 (gray gills)
Mycena #2 (furfuraceous base)
Mycena alcalina
Mycena corticola
Mycena galericulata
Mycena haematopus
Mycena haematopus parasite
Mycena leaiana
Mycena luteopallens
Mycena niveipes
Nemania illita
Orillia coccinella
Orillia sp.
Panellus stipticus
Panus conchatus
Paxillus corrugatus
Penicillium sp.
Peziza repanda
Phellinus gilvus
Phleogena fagicola
Phlebia incarnata
Phlebia radiata
Phlebia tremellosa
Pluteus granularis
Pleurotus pulmonarius
Pluteus #1 (choc. brown cap)
Pluteus cervinus
Pluteus longistriatus

Pluteus major
Pluteus petasatus
Pluteus seticeps
Pluteus tomentosulus
Polyporus alveolaris
Polyporus badius
Polyporus brumalis
Polyporus squamosus
Poria sp. (orangish)
Psathyrella hirtosquamosa
Psathyrella sp.
Resinomycena rhododendri
Rhodotus palmatus
Rosellinia subiculata?
Rosellinia subiculata?
Russula densifolia
Sacroscypha coccinea
Sacroscypha occidentalis
Schizophyllum commune
Scutellinia scutellata
Simocybe centunculus
Sphaerosporium (imperfect)
Spongipellis pachydon
Steccherinum ochraceum
Stereum complicatum
Stereum hirsutum
Stereum ostrea
Trametes elegans
Trametes hirsuta
Trametes versicolor
Trichaptum biforme
Volvariellla bombycina
Xeromphalina tenuipes
Xylobolus frustulatus

Ganoderma applanatum	Ganoderma applanatum
Irpex lacteus	Irpex lacteus
Ischnoderma resinosum	Bjerkandria adusta
Lycoperdon pyriforme	Cerrena unicolor
Panellus stipticus	Kretzschmaria deusta
Pheogenea fagicola	Ischnoderma resinosum
Phlebia radiata	Lycoperdon pyriforme
Phlebia tremellosa	Panellus stipticus
Phellinus gilvus	Phlebia radiata
Pleurotus pulmonarius	Phlebia tremellosa
Stereum complicatum	Phellinus gilvus
Stereum ostrea	Pheogenea fagicola
Trametes versicolor	Pleurotus pulmonarius
Trichaptum biforme	Stereum complicatum
	Stereum ostrea
Armillaria mellea rhizomorphs	Trametes versicolor
Armillaria gallica	Trichaptum biforme
Armillaria mellea	
Armillaria tabescens	Armillaria mellea
Ascocoryne cylichnium	Armillaria mellea rhizomorphs
Auricularia auricula	Armillaria tabescens
Bactridium flava	Artomyces pyxidata
Bisporella citrina	Ascocoryne cylichnium
Bjerkandria adusta	Auricularia auricula
Cerrena unicolor	Bactridium flava
Chlorosplenium auruginascens	Bisporella citrina
Coprinus disseminatus	Chlorosplenium fruitbody
Coprinus micaceus	Chlorosplenium auruginascens
Coprinus radians	Comatrichia aequalis
Coprinus variegatus	Coprinus micaceus
Crepidotus applanatus var. applanatus	Coprinus radians
Crepidotus applanatus var. globergi	Coprinus variegatus
Crepidotus crocophyllus	Crepidotus applanatus var. applanatus
Creopus gelatinosus	Crepidotus applanatus var. globerii
Daldina concentrica	Crepidotus crocophyllus
Dasyschyphus niveus	Daldina concentrica
Daldaleopsis confragosa	Dasyschyphus niveus

Trelease Woods	**Brownfield Woods**
Ductifera pululahuana	Daldaleopsis confusgosa
Dasyschyphus niveus	Ductifera pululahuana
Flammulina velutipes	Exidia grandulosa
Fuligo septica	Flammulina velutipes
Galerina marginata	Fuligo septica
Gymnopus subnudus	Galerina marginata
Hohenbuehelia augustatus	Gymnopus subnudus
Hyphloma sublateritium	Hohenbuehelia augustatus
Hydnochaete olivaceum	Hypholoma sublateritium
imperfect dark stem/ w/ green head	Hydnochaete olivaceum
Inonotus #1 (resupinate on bark)	Xylaria w/ green head
Laetiporus sulphureus	Inontus #1
Lenzites betulina	Laetiporus sulphureus

Lycogala epidendrum	Lenzites betulina
Marasmiellus nigripes	Lycogala epidendrum
Marasmius rotula	Marasmiellus nigripes
Megacollybia platyphylla	Marasmius rotula
Metatrichia vesparium	Megacollybia platyphylla
Mollisia sp.	Mollisia sp.
Mycena alcalina	Mycena alcalina
Mycena corticola	Mycena corticola
Mycena galericulata	Mycena galericulata
Mycena leaiana	Mycena leaiana
Mycena luteopallens	Mycena luteopallens
Mycena haematopus	Mycena haematopus
Mycena haematopus parasite	Mycena haematopus parasite
Mycena niveipes	Mycena niveipes
Mycena #1 (gray gills)	Mycena #1 (gray gills)
Mycena #2 (furfuraceous base)	Orbilia coccinella
Orbilia sp.	Panus conchatus
Orbilia coccinella	Penicillium sp.
Panus conchatus	Peziza repanda
Paxillus corrugatus	Phlebia incarnata
Penicillium sp.	Pluteus cervinus
Peziza repanda	Pluteus granularis
Phlebia incarnata	Pluteus longistriatus
Pluteus cervinus	Pluteus major
Phuteus granularis	Pluteus magnus
Pluteus longistriatus	Pluteus seticeps
Pluteus major	Pluteus petasatus
Pluteus petasatus	Pluteus umbrosus

Trelease Woods	**Brownfield Woods**
Pluteus seticeps	Pluteus #1 (choc. brown cap)
Pluteus tomentosulus	Polyporus alveolaris
Pluteus #1 (choc. brown cap)	Polyporus badius
Polyporus alveolaris	Polyporus brunalis
Polyporus badius	Polyporus squamosus
Polyporus brunalis	Poria unknown orangish
Polyporus squamosus	Psathyrellus sp.
Poria unknown orangish	Resinomycena rhododendri
Psathyrellus hirtosquamosa	Rhodotus palmatus
Psathyrellus sp.	Russula densifolia
Resinomycena rhododendri	Sacroscypha coccinea
Rhodotus palmatus	Sacroscypha occidentalis
Russula densifolia	Schizophyllum commune
Sacroscypha coccinea	Scutellinia scutellata
Sacroscypha occidentalis	Simocybe centrunculus
Schizophyllum commune	Sphaerosporium (imperfect)
Scutellinia scutellata	Spongipellis pachydon
Simocybe centrunculus	Steccherinum ochraceum
Sphaerosporium (imperfect)	Stereum hirtsutum
Spongipellis pachydon	Trametes elegans
Steccherinum ochraceum	Trametes hirtsutum
Stereum hirsutum	Tremella mesenterica

Trametes elegans	Tubifera ferruginea
Trametes hirsuta	Volvariellla bombycina
Volvariellla bombycina	Xerophalina tenuipes
Xerophalina tenuipes	Xylobolus fructulatus
Xylobolus fructulatus	Annulohypoxylon annulatum
Annulohyphoxylon truncatum	Annulohypoxylon truncatum
Annulohyphoxylon annulatum	Camillea punctata
Camillea punctata	Camillea tinctor
Camillea tinctor	Biscogniauxia atropunctata
Biscogniauxia atropunctata	Eutypha spinosa
Kretzschmaria deusta	Rosellinia subiculata?
Hysterographium #1	Hysterographium #1
Rosellinia subiculata?	imperfect #1 (looks like bactridium)
Eutypha spinosa	Berkleasmium
imperfect #1 (resembles bactridium)	pyrenomycete #1 (long-necked)
Rosellinia subiculata?	pyrenomycete #2 (furfur. ostioles)
Nemania illita	Nemania diffusa