

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 replaced 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**

Annulohypoxyton annulatum
Annulohypoxyton 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

Hysteroglyphium #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
Metatrachia 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.
Resinomyцена 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 bifforme
Volvariella bombycina
Xeromphalina tenuipes
Xylobolus frustulatus

Ganoderma applanatum
Irpex lacteus
Ischnoderma resinosum
Lycoperdon pyriforme
Panellus stipticus
Pheogenea fagicola
Phlebia radiata
Phlebia tremellosa
Phellinus gilvus
Pleurotus pulmonarius
Stereum complicatum
Stereum ostrea
Trametes versicolor
Trichaptum biforme

Armillaria mellea rhizomorphs
Armillaria gallica
Armillaria mellea
Armillaria tabescens
Ascocoryne cylichnium
Auricularia auricula
Bactridium flava
Bisporella citrina
Bjerkandria adusta
Cerrena unicolor
Chlorosplenium auruginascens
Coprinus disseminatus
Coprinus micaceus
Coprinus radians
Coprinus variegatus
Crepidotus applanatus var. applanatus
Crepidotus applanatus var. globergi
Crepidotus crocophyllus
Creopus gelatinosus
Daldina concentrica
Dasyschyphus niveus
Daldaleopsis confragosa

Trelease Woods

Ductifera pululahuana
Dasyschyphus niveus
Flammulina velutipes
Fuligo septica
Galerina marginata
Gymnopus subnudus
Hohenbuehelia augustatus
Hypholoma sublateritium
Hydnochaete olivaceum
imperfect dark stem/ w/ green head
Inonotus #1 (resupinate on bark)
Laetiporus sulphureus
Lenzites betulina

Ganoderma applanatum
Irpex lacteus
Bjerkandria adusta
Cerrena unicolor
Kretzschmaria deusta
Ischnoderma resinosum
Lycoperdon pyriforme
Panellus stipticus
Phlebia radiata
Phlebia tremellosa
Phellinus gilvus
Pheogenea fagicola
Pleurotus pulmonarius
Stereum complicatum
Stereum ostrea
Trametes versicolor
Trichaptum biforme

Armillaria mellea
Armillaria mellea rhizomorphs
Armillaria tabescens
Artomyces pyxidata
Ascocoryne cylichnium
Auricularia auricula
Bactridium flava
Bisporella citrina
Chlorosplenium fruitbody
Chlorosplenium auruginascens
Comatrachia aequalis
Coprinus micaceus
Coprinus radians
Coprinus variegatus
Crepidotus applanatus var. applanatus
Crepidotus applanatus var. globerii
Crepidotus crocophyllus
Daldina concentrica
Dasyschyphus niveus

Brownfield Woods

Daldaleopsis confusgosa
Ductifera pululahuana
Exidia granulosa
Flammulina velutipes
Fuligo septica
Galerina marginata
Gymnopus subnudus
Hohenbuehelia augustatus
Hypholoma sublateritium
Hydnochaete olivaceum
Xylaria w/ green head
Inontus #1
Laetiporus sulphureus

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

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

Trelease Woods

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

Brownfield Woods

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

Trametes elegans
Trametes hirsuta
Volvariella bombycina
Xerophalina tenuipes
Xylobolus fructulatus
Annulohyphoxylon truncatum
Annulohyphoxylon annulatum
Camillea punctata
Camillea tinctor
Biscogniauxia atropunctata
Kretzschmaria deusta
Hysteroglyphium #1
Rosellinia subiculata?
Eutypha spinosa
imperfect #1 (resembles bactridium)
Rosellinia subiculata?
Nemania illita

Tubifera ferruginea
Volvariella bombycina
Xerophalina tenuipes
Xylobolus fructulatus
Annulohyphoxylon annulatum
Annulohyphoxylon truncatum
Camillea punctata
Camillea tinctor
Biscogniauxia atropunctata
Eutypha spinosa
Rosellinia subiculata?
Hysteroglyphium #1
imperfect #1 (looks like bactridium)
Berkleasium
pyrenomycete #1 (long-necked)
pyrenomycete #2 (furfur. ostioles)
Nemania diffusa