TITLE:

Data from: Interactions between leaf litter quality, particle size, and microbial community during the earliest stage of decay

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PHYSICAL LOCATION:

Oak Openings Preserve Metropark, Northwest Ohio

Latitude: 41.55

Longitude: -83.83

Waterloo Wildlife Research Area, Southeast Ohio

Latitude: 39.33

Longitude: -82.25

DATA SET OVERVIEW:

This data set contributes information on soil enzyme activities; extractable nitrogen and phosphate; microbial biomass; soil carbon to nitrogen ratios; soil respiration; and relative assimilation of carbon, nitrogen, and phosphorous. Data was collected from a 2-week incubation experiment that included two leaf litter types: sugar maple (*Acer saccharum*) and white oak (*Quercus alba)* and two soils: 0.4% C sandy soil and 4.1% C loam soil. Litter was cut into the following sizes: (1) Ground litter (20 mesh), (2) Litter cut into 0.25 cm2 pieces, and (3) Litter cut into 1 cm2. Four replicates of twelve litter treatment groups (2 litter types × 3 litter particle sizes × 2 soil types) and two soil-only control groups were harvested for analysis at the end of the 2-week incubation.

BACKGROUND:

<http://www.eeescience.utoledo.edu/Faculty/weintraub/Projects.htm>

SAMPLE COLLECTION:

*Leaf and Soil Collection*: Freshly senesced sugar maple (*Acer saccharum)* and white oak (*Quercus alba)* leaf litter was collected daily from Oak Openings Preserve Metropark in Northwest Ohio using litter traps in October of 2011. Litter was air-dried and kept at constant humidity until incubation. Litter was cut into one of three sizes: ground (20 mesh), 0.25 cm², or 1 cm². Two types of soil were collected in May of 2011, a 0.4% C sandy soil from Oak Openings Preserve Metropark and a 4.1% C loam soil from Waterloo Wildlife Research Area. Each soil was collected using a metal soil corer with a diameter of 5 cm to a depth of 5 cm from a 5 m² area. Soils were then taken immediately back to the lab and sieved (2 mm mesh) to remove coarse debris and organic matter and then homogenized by hand. Soils were stored in the dark at 20 °C and 45% water holding capacity for 5 months prior to the incubation experiment. For more information, see Rinkes *et al*. (2013).

*Incubation*: Thirty six litter and soil treatment jars (2 litter types x 3 litter sizes x 2 soil types x 3 harvests) and six soil-only control jars (2 soil types x 3 harvests) were replicated four times. All replicates were conducted in 0.237 L mason jar (Ball Half Pint Wide Mouth Canning Jars, Jarden Corporation) with lid and septa. Litter and soil treatment jars received 50 g of soil (dry weight equivalent) at 45% water holding capacity and 1 g of dry litter. Soil-only control jars received only 50 g of soil (dry weight equivalent) at 45% water holding capacity. Jars were kept loosely covered (to minimize water loss, but allow gas exchange) in a dark incubator at 20 °C throughout the 2-week incubation. Jars were harvested for soil enzyme activities; extractable nitrogen and phosphate; soil carbon to nitrogen ratios; and relative assimilation of carbon, nitrogen, and phosphorus (see below for descriptions). During harvests, soils were extracted with 0.5 M potassium sulfate (K₂SO₄). Extractions were performed by placing samples on an orbital shaker at ~120 rpm for 1 hour, and then vacuum filtering the mixture through Millipore APM 15 glass fiber filters. These extracts are labeled as non-fumigated.

Samples were also harvested for microbial biomass analysis. Microbial biomass carbon (MB-C) and microbial biomass nitrogen (MB-N) was quantified using a modification of the chloroform fumigation-extraction technique (Brookes et al. 1985; Scott-Denton et al. 2006). Following chloroform fumigation, soils were extracted as described above. These extracts are labeled as fumigated. Fumigated and non-fumigated extracts were then frozen until time of analysis. For more information, see Rinkes *et al*. (2013).

DATA COLLECTION:

*Soil Nutrients*: Soil nutrients were analyzed using non-fumigated soil core samples. Nitrogen analyses included nitrate and ammonium. Nitrate was analyzed using the method described by Doane & Horwath (2003). Final nitrate values are reported in μg NO3⁻ g-1 dry soil. Ammonium was analyzed using the method described by Rhine *et al*. (1998). Final ammonium values are reported in μg NH4+ g-1 dry soil. Phosphate analysis was conducted using the method described by D’Angelo *et al*. (2001). Final phosphate values are reported in μg PO43- g-1 dry soil. For more information, see Rinkes *et al*. (2013).

*Microbial Biomass*: Microbial biomass C and microbial biomass N were analyzed using fumigated and non-fumigated soil extracts. Samples were analyzed for dissolved organic carbon (DOC) and total nitrogen (TN) using a Shimadzu total organic carbon (TOC-VCPN) analyzer equipped with total nitrogen unit (Shimadzu Scientific Instruments Inc., Columbia, MD, USA). Microbial biomass was calculated by subtracting non-fumigated sample concentrations of total organic carbon or total nitrogen from fumigated sample concentrations of carbon and nitrogen. Final values are reported in μg C or N g-1 dry soil. For more information, see Rinkes *et al*. (2013).

*Soil Enzyme Activities*: Samples were analyzed for hydrolytic extracellular enzyme activity. Samples were analyzed for β-glucosidase (BG), N-acetyl-β-glucosaminidase (NAG), α-glucosidasde (AG), and acid phosphatase (PHOS). BG produces glucose from the hydrolysis of cellulose oligomers; NAG, a chitinase, produces N-acetyl glucosamine from the hydrolysis of chitin derived oligomers; PHOS produces phosphate from the hydrolysis of phosphate monoesters such as sugar phosphates. Hydrolytic enzyme activities (BG, NAG, AG, and PHOS) were analyzed using the fluorometric assay described by Saiya-Cork *et al*. (2002) and Weintraub *et al*. (2007). Note: AG data is not reported because of undetectable concentrations. For more information, see Rinkes *et al* (2013).

*Respiration Analysis*: Respiration was measured on litter and soil treatment jars and soil-only control jars. Respiration was measured after 24, 46, 66, 86, 130, 154, and 325 hours of incubation. Respiration was analyzed using sodium hydroxide (NaOH) traps and the barium chloride (BaCl₂)/hydrochloric acid (HCl) titration method described by Snyder and Trofymow (1984). Final respiration values are reported in μmol CO2 g-1 dry soil day-1. For more information, see Rinkes *et al* (2013).

*Phospholipid-derived fatty acid (PLFA) analysis*: PLFA analysis was conducted on samples taken from destructive harvests take 0 and 3 days after incubation. For more information, see Rinkes *et al*. (2013).

*Relative assimilation*:

NAMING CONVENTIONS:

The following refer to headers or terms used in the data spreadsheets:

*General definitions:*

day: day of incubation when measurements occurred (day 0 = values before incubation; day 3; day 14)

litter type: maple (sugar maple); oak (white oak); control (no litter)

particle size: little particle size; ground, 0.25cm2, or 1cm2

soil type: sand or loam

replicate: replicate number; n=4

blank cells=no data available; cell value = 0 means no activity

*Harvests:*

BG: Beta glucosidase activity, nmol hr-1 g-1 soil (fluorescent enzyme assay protocol)

NAG: N-acetyl-beta-glucosaminidase activity, nmol hr-1 g-1 soil (fluorescent enzyme assay protocol)

PHOS: Phosphatase activity, nmol hr-1 g-1 soil (fluorescent enzyme assay protocol)

NH4: µg NH4-N g-1 soil from 0.5M K2SO4 extractions using microplate assay

NO3: µg NO3-N g-1 soil from 0.5M K2SO4 extractions using microplate assay

PO4: µg PO4-P g-1 soil from 0.5M K2SO4 extractions using microplate assay

MBC: microbial biomass C, μg C g-1 soil, measured in K2SO4 extract on Shimadzu analyzer

TOC: Total dissolved organic C, μg C g-1 soil, measured in K2SO4 extract on Shimadzu analyzer

TN: Total dissolved N, ug N g-1 soil, measured in K2SO4 extract on Shimadzu analyzer

MBN: microbial biomass N, ug N g-1 soil, measured in K2SO4 extract on Shimadzu analyzer

*Respiration*

0-24: µg C g-1 soil day-1 measured during 0-24 hour interval after

incubation start

25-46: µg C g-1 soil day-1 measured during 25-46 hour interval after

incubation start

47-66: µg C g-1 soil day-1 measured during 47-66 hour interval after

incubation start

67-86: µg C g-1 soil day-1 measured during 67-86 hour interval after

incubation start

87-130: µg C g-1 soil day-1 measured during 87-130 hour interval after incubation start

131-154: µg C g-1 soil day-1 measured during 131-154 hour interval after incubation start

155-325: µg C g-1 soil day-1 measured during155-325 hour interval after incubation start

*Litter Controls*

0-24: total mg C respired; measured during 0-24 hour interval after incubation start

25-46: total mg C respired; measured during 25-46 hour interval after incubation start

47-66: total mg C respired; measured during 47-66 hour interval after incubation start

67-86: total mg C respired; measured during 67-86 hour interval after incubation start

87-130: total mg C respired; measured during 87-130 hour interval after incubation start

131-154: total mg C respired; g-1 soil day-1 measured during 131-154 hour interval after incubation start

155-325: total mg C respired; measured during155-325 hour interval after incubation start

*CN Analysis*

Carbon%: initial C % of soil samples

Nitrogen%: initial N % of soil samples

*Vector*

Vectorlength: vector length is the square root of the sum of the squared ratios, BG/AP and BG/NAG; Shorter length = less C limitation

Vectorangle: vector angle is the degree measure of the atan of the X,Y locus defined by BG/AP (=X) and BG/NAG (=Y); angles <45 = more N than P limitation

*PLFA*

PLFA biomarkers are found in columns E through BQ: indicate % of total biomass for each specific PLFA biomarker, reported in nmol PLFA C/g ⁻¹

LINKS:

<http://www.eeescience.utoledo.edu/Faculty/weintraub/Projects.htm>

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