Biology Lab 1
Extraction of Macro and Meso-fauna from Soil & Assessment of Activity

Sue Grayston
Applied Biology Program Director
Faculty of Forestry & Faculty of Land & Food Systems
(sue.grayston@ubc.ca)

Macrofauna (molluscs, earthworms, millipedes, insect larvae cm's)

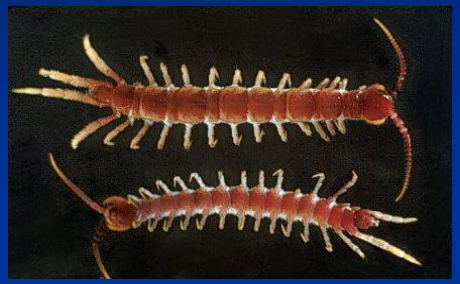
Movers & Shakers

Responsible for soil mixing. Large enough to disrupt soil structure.

Litter Transformers – ingest litter

Ecosystem Engineers – build physical structures

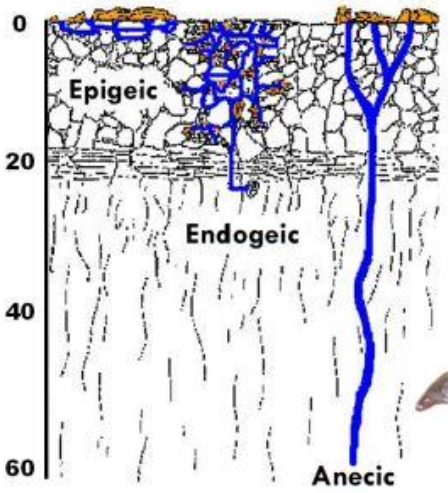
Macrofauna (ants, centipedes, beetles, spiders cm's)

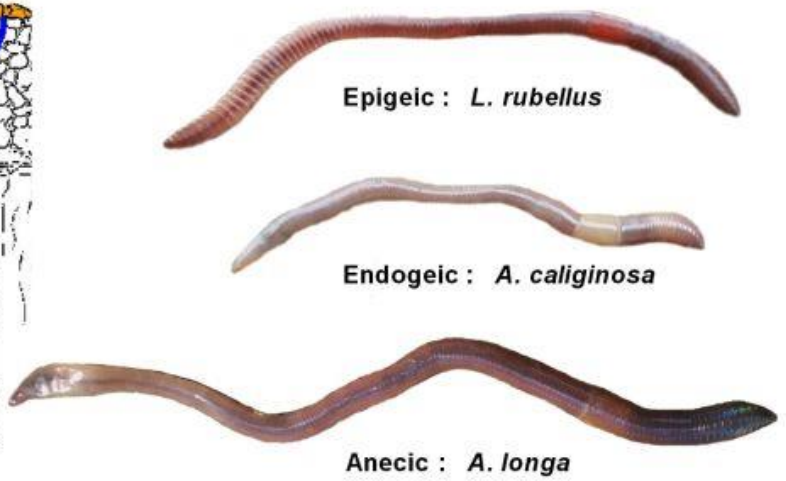


Centipedes, spiders, beetles - predatory - feed on other smaller fauna

Ants primarily carnivores but very important soil mixers

Earthworm bioturbation





Meso fauna (collembola, mites, tardigrades, enchytraeids 200 µm - 1cm)

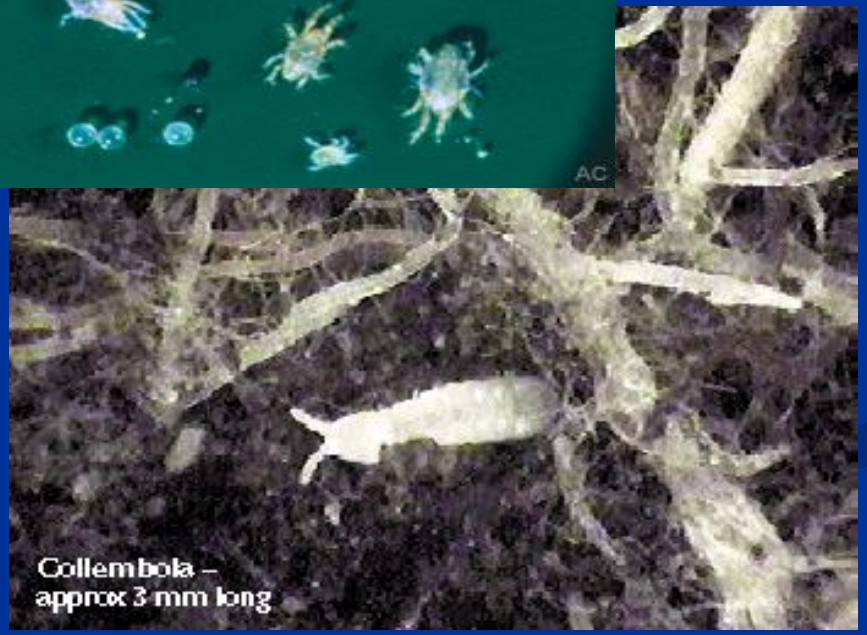
Fragment debris and promote soil structure

Enchytraeids - small 'pot' worms - mainly bacterial and fungal feeders

Mites - litter decomposers, fungal feeders, predators

Collembola - litter and fungal feeders

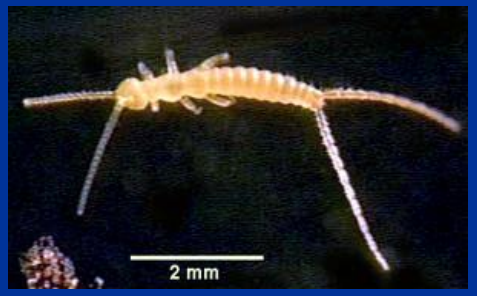
Tardigrades - litter and faunal (nematode) feeders



Meso fauna (pauropods, copepods 200 µm - 1cm)

Pauropods - small relatives of centipedes, live on detritus, fungi, bacteria & litter

Copepods - usually considered to be aquatic crustaceans, live on bacteria

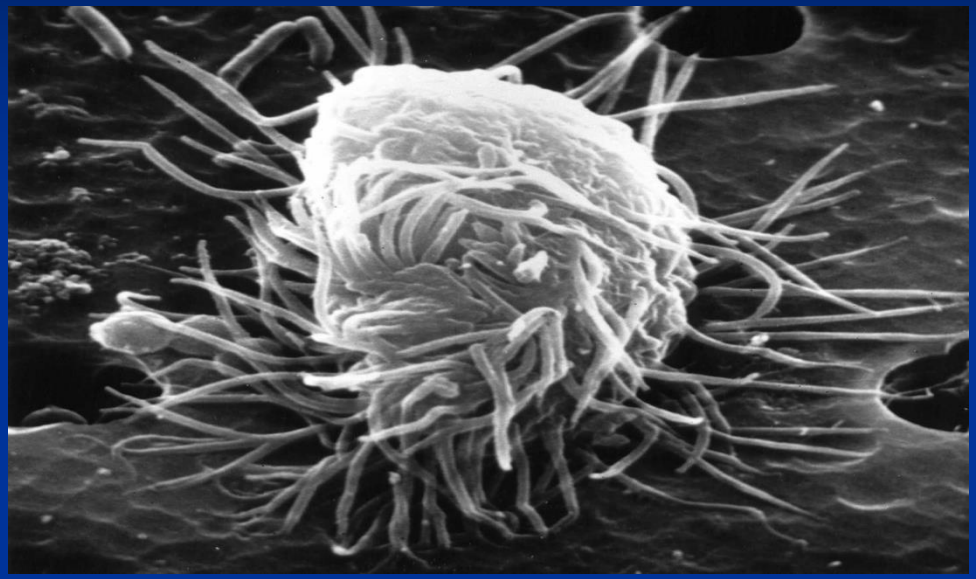


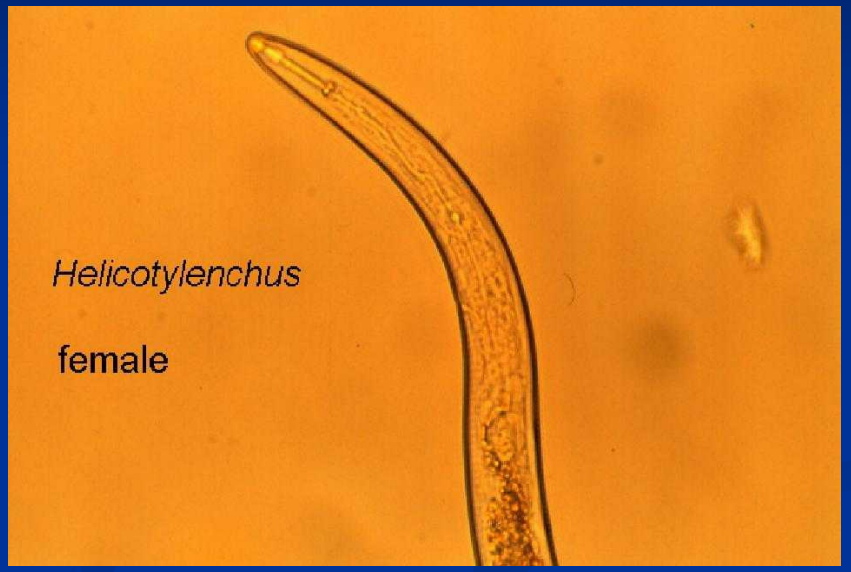
Diplura – fungi, mites, collembolan, litter

Symphyla
Fungal hyphae, roots

Pseudoscorpion –larvae, ants, mites

Microfauna (Protozoa, Nematodes <200 µm)

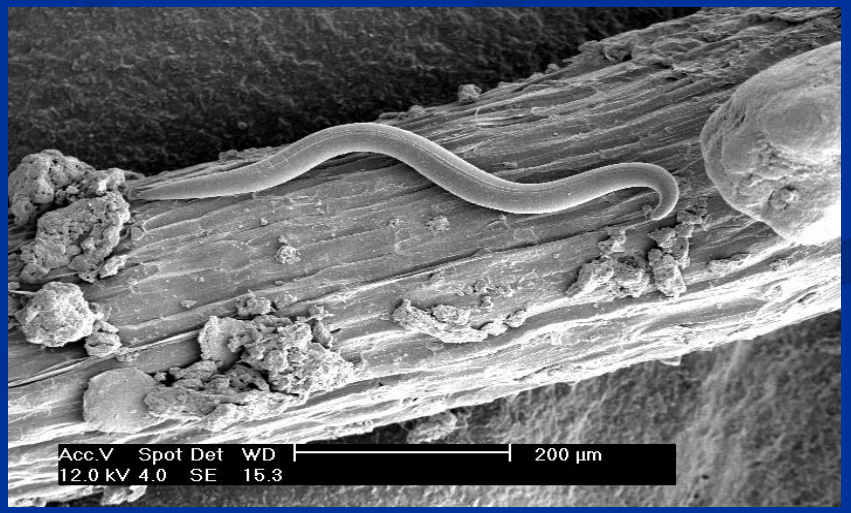




Confined to water films - regulate soil microbes

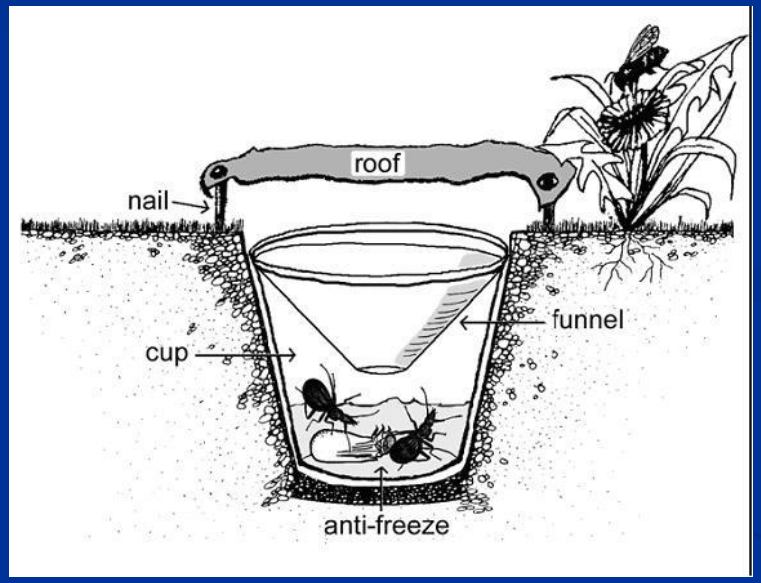
Protozoa - litter decomposers and bacterial feeders

Nematodes - bacterial, fungal, plant feeders, insect pathogens

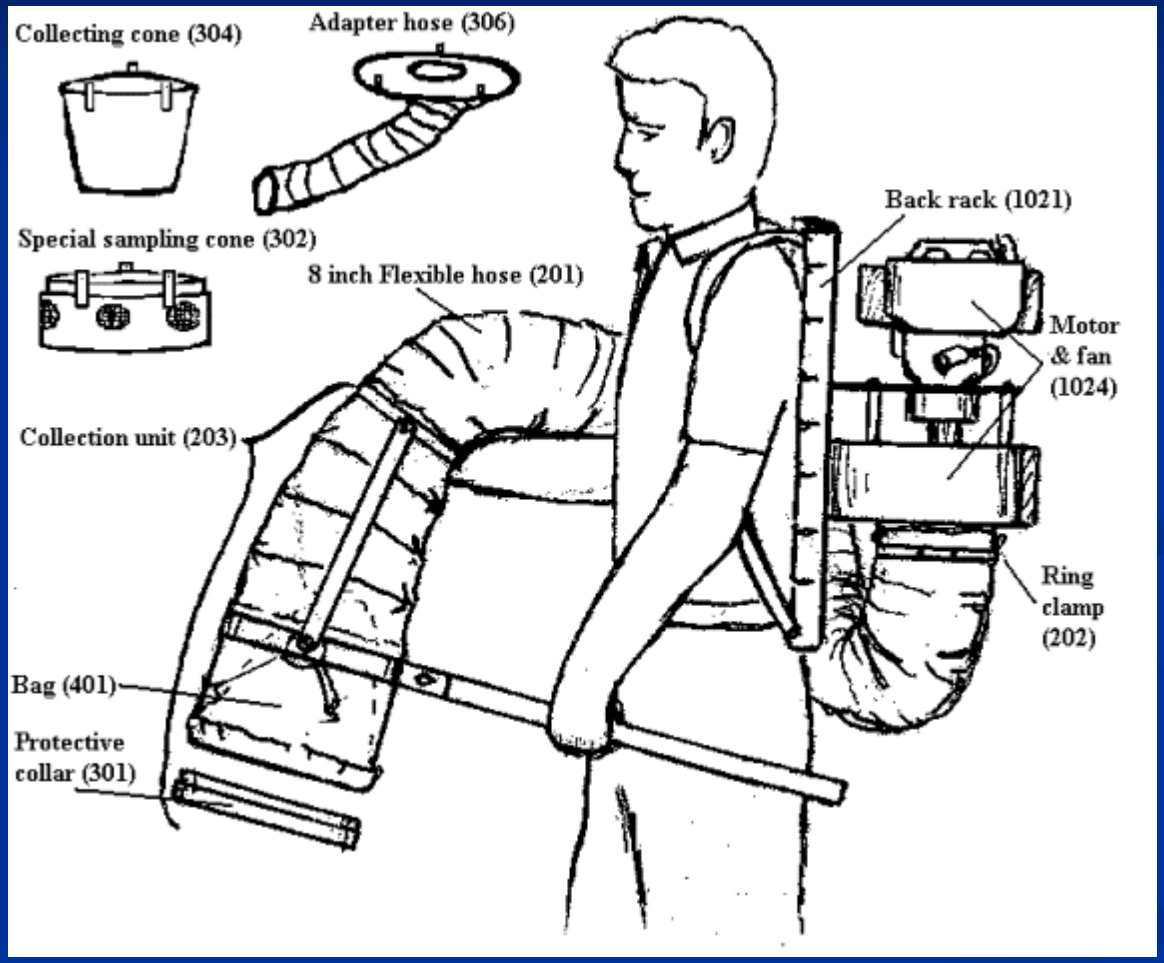


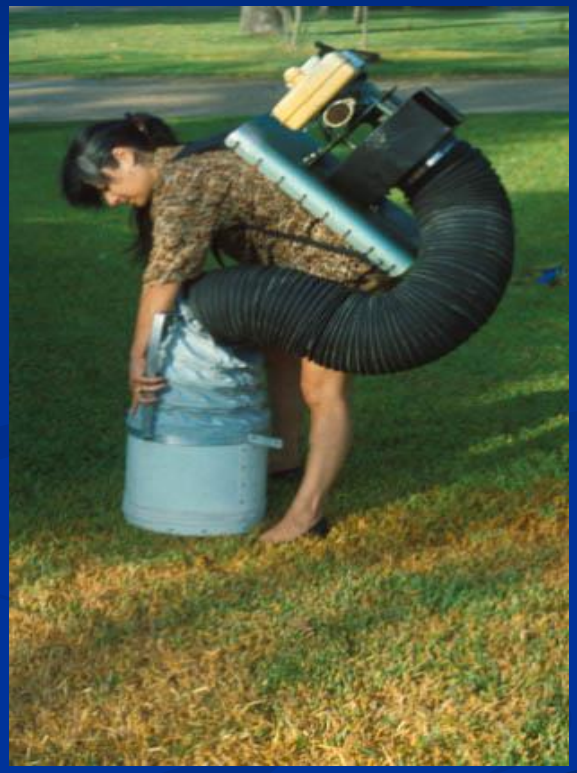
Biodiversity
How do we measure it?

- Macro fauna
  - **Pit-fall traps. Identification by morphology**



D-vac

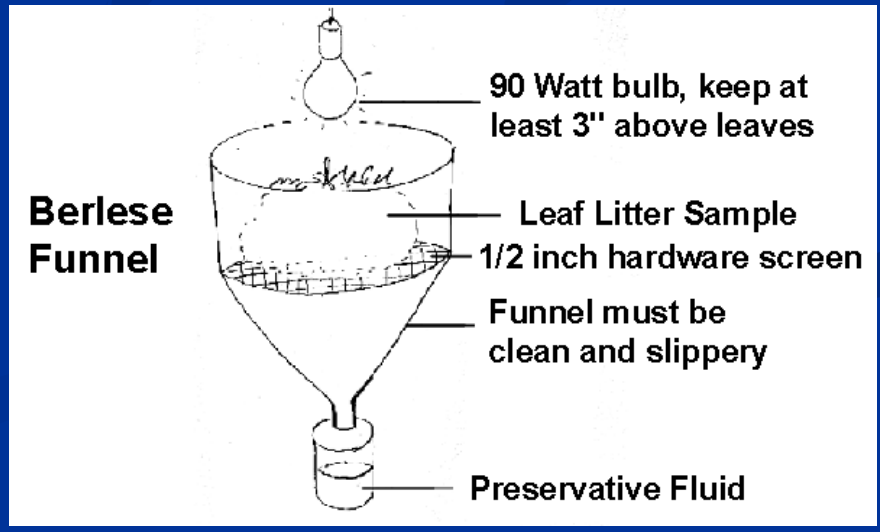

Collecting cone (304)
Adapter hose (306)
Special sampling cone (302)
8 inch Flexible hose (201)
Back rack (1021)
Motor & fan (1024)
Collection unit (203)
Ring clamp (202)
Bag (401)
Protective collar (301)



Soil blocks

Meso and micro fauna

- Extraction from soil samples using funnels, wet-sieving, flotation methods.
- Identification by morphology, microscopy and for micro fauna increasingly by molecular fingerprinting
- Diversity of soil fauna remains an enigma – also belowground food web and trophic interactions



Soil meso-faunal diversity in CWH forest

- 32,000 mites identified: 92 mite species; 303,300 individuals m^{-2}

Oribatid

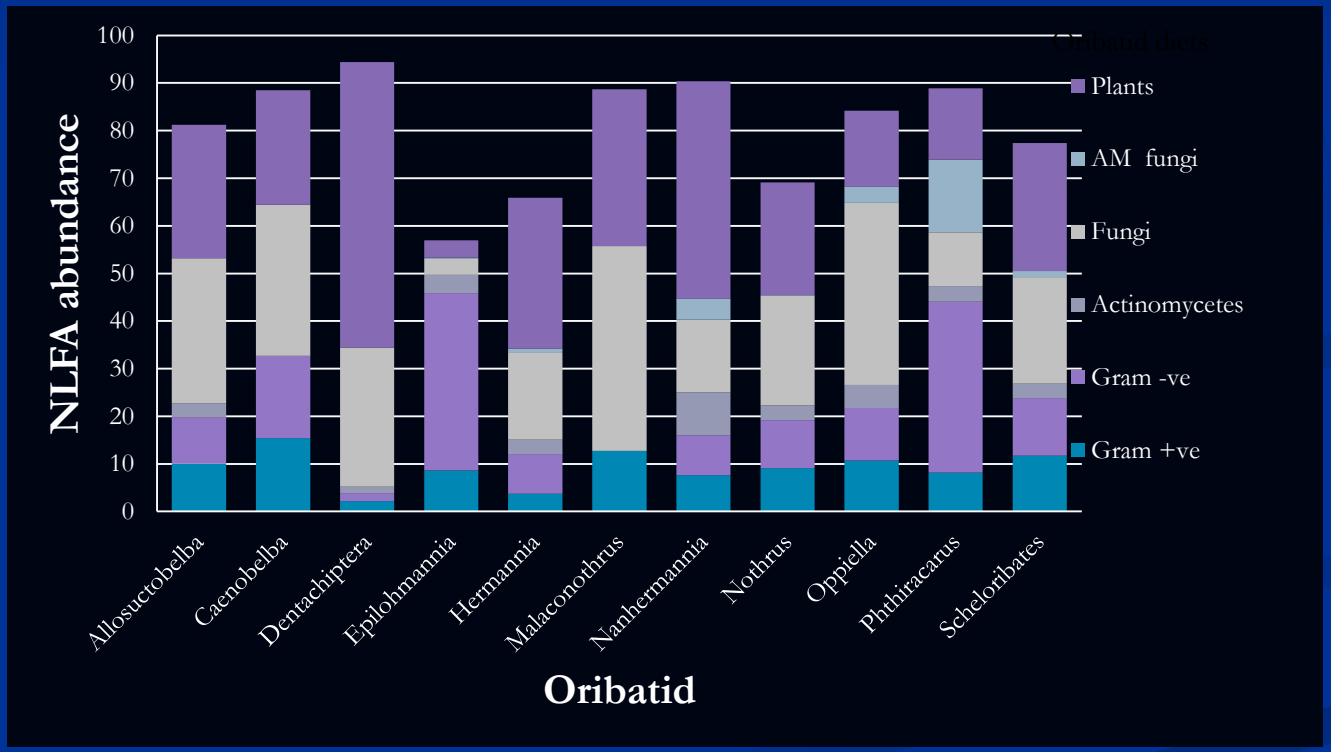
Mesostigmata

Prostigmata

- > 10,000 collembolans identified: 42 species; 83,500 m^{-2}

- Pauropods abundant: 3,637 m^{-2}
- <5% meso-fauna in mineral soil

Analysis of faunal NLFA to ascertain diet



Outline

- **Skills**
  - Collect and extract macro- and meso-fauna from soil samples; Identify fauna using keys

- **Objectives:**
  - **To isolate, observe and quantify soil macro- and meso-fauna. To calculate species diversity, richness and evenness.**
  - **To evaluate feeding activity of soil fauna using bait strips**

Soil Fauna

Methods

- Collect and extract macro- and meso-fauna from soil samples
- Use hand-sorting to extract macro-fauna from soil
- Identify macro-fauna using keys
- Use Berlese-Tullgren funnel to extract meso-fauna from soil
- Incubate funnels for 1 week under lights
- Identify meso-fauna using binocular microscope (will be week 2)
- Calculate faunal species richness, diversity and evenness
- Incubate bait-lamina strips in soil for 1 week
- Evaluate feeding activity of soil fauna (week 2)

Bait-lamina strips

Cellulose, bran flakes, coal

Richness, diversity and evenness

1. Calculate richness by summing the total of organism groups.

2. Calculate species diversity (H') using the Shannon Index:

$H' = - \Sigma [p_i * \ln (p_i)]$ p_i is the proportion of all observed organism groups

3. Using the H' from the other groups, calculate evenness of the communities:

$E = H' / H'_{max}$

	Species	Abundance	Proportion (p_i)	$- p_i * \ln (p_i)$
	Mites	50	0.5	0.347
	Springtails	30	0.3	0.361
	Isopods	10	0.1	0.230
	Millipedes	9	0.09	0.217
	Spider	1	0.01	0.046
Total	5	100	1.00	1.201 (H')

Faunal videos

Soil Biology (Microfauna) Terry Tollefson
Tardigrades are the toughest animal
www.globalsoilbiodiversity.org/videos

Lecture - Today

Microbial activity at the root-soil interface of a coniferous forest soil - response to seasonal changes of plant activity

Speaker: **Petr Baldrian**, Czech Academy of Sciences, Prague

Date & location: Friday Nov 1, 3:00-4:00 pm McMl 154