

THE Auger



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The Newsletter of the Minnesota Association of Professional Soil Scientists

President's Message by James C. Balogh, Ph.D., PSS

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Since 1974 the Minnesota Association of Professional Soil Scientists has evolved from a small group of academic and government soil classifiers to a much more diverse group of soil science practitioners. Scanning the members at the Winter 2002 MAPSS meeting, I observed a group of friends and colleagues with education and experience ranging across the entire practice of soil science. These are the members MAPSS serves. Our original mission of educating the public concerning the importance of soil resources and maintaining our own continuing education has expanded as many of our members have become licensed professionals. The results of the MAPSS business meeting last December 2002, indicates our members interest in MAPSS as a truly professional association.

To maintain our relevance to many of our practicing soil scientists, it is important that our association of professionals expand its mission. Currently we are doing fairly well in meeting our mission of

- Educating the public on the importance of soil resources
- Educating our members on the diverse components of soil science practice
- Providing opportunities for members to interact professionally and socially

As technology advances and the economy changes, meeting the information and representation needs of our fellow colleagues has changed.

(Continued on page 2)

NEWS FROM THE MAPSS EXECUTIVE COMMITTEE by James C. Balogh, Ph.D., PSS

New E-Mail Address

MAPSS now has a separate e-mail address for members wishing to contact the MAPSS Executive Committee, President, or Executive Director. The new address is mnssoils@aol.com. News updates regarding professional issues and the electronic issues of future newsletter also will be launched from this address. This site is being provided free of charge to MAPSS by Spectrum Research, Inc.

New Auger Editor

A new student member of MAPSS, Sara Beth Scadlock, has volunteered to be the

new Auger Editor. You may remember Ms. Scadlock's presentation on watershed monitoring at the December 2002 MAPSS technical meeting. Ms. Scadlock is a student at the University of Minnesota Department of Soil, Water, and Climate. She is enthusiastic about participating in developing newsletters with timely and interesting information. She welcomes any articles or sources for articles from you.

Return to the Original MAPSS Permanent Address

The original permanent MAPSS address was established at Spectrum Research, Inc.

(Continued on page 3)

The Auger is made up of volunteered articles from the MAPSS membership. If you would like to contribute, please contact me at the following:

Sara Beth Scadlock
c/o Spectrum Research,
Inc.
4915 E. Superior St., Suite
100
Duluth, MN 55804
mnssoils@aol.com

(President's Message, Continued from page 1)

Although we were successful in maintaining our professional existence and identity through passage of the Geoscience Licensing Bill, the struggle to maintain the core practice of soil science for our professionals continues. Without a whimper from MAPSS, the Minnesota Board of AELSLAGID recently had a virtually uncontested discussion laying the ground work for the claim that the practice of soil morphology and field interpretation of soil morphological and physical properties may be conducted by professional geologists and professional engineers. This claim is based on the "training and experience" of geologists and engineers and the paucity of licensed practicing soil scientists. The consequences of this discussion should be disturbing to our members. Not only does it appear that cross practice is being condoned by the Minnesota Board because we have "few" licensees, but that MAPSS may not be willing to do anything effective. Apparently we are able to rise to large challenges (e.g. licensing). However, our effectiveness in meeting the debilitating smaller incursions into the practice of soil scientists may be limited. The recent discussion at Minnesota Board meeting reveals several activities of a true professional association, which require our attention. This includes:

- Keeping members informed in a timely fashion of issues directly related to the practice of soil scientist
- Encouraging younger students and potential members to become licensed professionals
- Re-establishing **effective** ongoing contact with the Minnesota Board, the State Legislature, and other professional organizations (e.g. Joint Professional Council)
- Re-establishing effective ongoing contact with the University of Minnesota, Department of Soil, Climate and Water
- Establishing effective contact with State agencies involved with making rules involving the practice of soil science
- Invigorating our continuing education programs for current and aspiring professionals without compromising our public outreach program

Increasing number of licensed professionals, increasing active membership in MAPSS, keeping State government, (e.g. agencies and legislature) informed of the importance of the appropriate practice of soil science should be primary professional association goals. I ask my association members and profession colleagues whether we can meet this challenge. A willingness to participate in our committees, whether the executive, membership or professional development committees is an important place to start. The active participation of members at our last business meeting is an indication that you are interested in the future of the professional practice of soil science. Some of the

following updates in MAPSS services are being implemented by the Executive Committee to keep you more informed and involved:

- Electronic distribution of the newsletter and improving the substantive content of the newsletter
- Developing an e-mail system to send interested members information on the important developments related to the professional practice of soil science.
- Updating the MAPSS website on a regular basis
- Maintaining the high continuing education value at meetings for professional soil scientists
- Prompting the MAPSS Professional Development committee to take a more active role in promoting the practice of soil science
- Developing programs (e.g. CSSE Exam Scholarships) with the University of Minnesota to encourage development of more licensed professional soil scientists and participation of students, staff, and faculty with MAPSS
- Establishing a uniform set of priority goals for MAPSS in relation to all external funding requests

These objectives will take multiple years to achieve and maintain. If you have ideas and additional ways to achieve these goals, please e-mail them to MAPSS at mnsoils@aol.com. Although I can facilitate positive change for a while, it is our members that sustain the long-term effort. I look forward to hearing from many of you during the next year.

Welcome to new MAPSS members

There are 2 new additions to the MAPSS family. Please welcome Ms. Sara Beth Scadlock, a Grad student in the Dept. of Soil, Water, and Climate at the UofM (and new newsletter editor), and Mr. Peter Miller.

WELCOME!



(News from the EC, Continued from page 1)

in Duluth, Minnesota. When Dr. Balogh was appointed to the Minnesota Board of AELSLAGID, the address was temporarily changed to the University of Minnesota, Department of Climate, Soil and Water. Now the potential conflict of interest no longer exists, the permanent address will revert back to its original location. All future MAPSS correspondence should be addressed to:

MAPSS, c/o Spectrum Research, Inc., 4915 E. Superior St., Suite 100, Duluth, MN 55804.

Given the current state of the economy and the Spectrum Research, Inc. retirement program, James Balogh has assured the MAPSS Executive Committee that Spectrum will remain in business for at least another 50 years.

Scholarship and Funding Committee

At the directive of the MAPSS membership a Scholarship Committee has been established. The temporary chair is James Balogh. Several members have been contacted as volunteers for this committee. The first task of the committee is to prepare a proposal for an annual \$500 dollar scholarship for soil science undergraduates at the University of Minnesota. The proposal will be published in the July MAPSS Newsletter. This proposal will include a description of the level of endowment required to sustain such a scholarship. It is anticipated that a permanent endowment of at least \$10,000 will be needed to avoid negative effects on the overall fiscal responsibility to MAPSS members and their professional goals.

Future Funding Requests

We have all noticed a rather astonishing increase in the number and size of funding requests from MAPSS in the last few years. In order to keep the members informed of these requests, the following procedures should be followed so all requests can be considered objectively and consistently. All funding requests must be:

1. Submitted in writing to MAPSS prior to September 30 for consideration at the next winter business meeting.
2. Published in the MAPSS October Newsletter prior to the winter business meeting
3. Contain the amount, purpose, and recipient(s) of the funding
4. Contain a detailed description of the organization requesting the funding
5. Contain a detailed explanation of how the funding request will benefit MAPSS and the professional practice of soil science in Minnesota
6. Contain a detailed explanation of how the funding request meets the established professional priority goals of MAPSS
7. Contain a detailed description of how MAPSS will secure the funding for the request (e.g. establish an additional endowed fund, increase the dues of the members, sell hats)

8. Reviewed by the MAPSS Executive Committee to determine if the request is consistent with overall MAPSS priorities, mission, and goals
9. Reviewed by the MAPSS Treasurer and Scholarship and Funding Committee to determine whether the MAPSS budget will sustain the request without negative effects on current association commitments

Before MAPSS considers any future funding requests, MAPSS should consider its overall priorities and goals. A survey will be enclosed in the July 2002 MAPSS Newsletter. Your responses will be critical not only for consideration of funding requests, but also for future direction of MAPSS as a professional association.

Any additional suggestions should be submitted to the MAPSS e-mail address at mnsoils@aol.com.

AL GIENCKE RECEIVES NATIONAL AWARD

by Joe McCloskey, State Soil Scientist/MLRA Region 10 Leader

I am pleased to announce that Al Giencke, Soil Data Quality Specialist on the USDA-NRCS Region 10 MLRA Office staff in St. Paul, has been awarded the National Cooperative Soil Survey (NCSS) Soil Scientist Achievement award for 2002.

Al received this award for his excellent work in conducting all aspects of soil survey related business during the past year (and throughout his career). The bottom-line results of Al's efforts are the high quality soils information available in Minnesota and in Region 10.

This national award was presented at the Soil Science Society of America annual meeting on November 13, 2002 in Indianapolis by John Doran, Past President of SSSA.



HIGHLIGHTS FROM THE WINTER 2002 TECHNICAL MEETING:

FORENSIC SOIL SCIENCE: METHODS AND EXPERIENCES FOR SOIL AND SITE INVESTIGATIONS

By James C. Balogh, Ph.D., PSS

2002 MAPSS Winter Meeting Facilitator

The 2002 MAPSS Winter Meeting focused on forensic methods for complex soil and site investigations. The meeting was attended by over 55 members at the Radisson Suite Hotel in St. Cloud, Minnesota on December 6, 2002. The objectives of the technical meeting were to:

- Introduce attendees to the concept of forensic soil investigations
- Introduce attendees to methods and techniques for complex site and soil investigations
- Update soil science professionals on recent changes in BWSR wetland rules
- Update soil science professionals on changes in the Minnesota Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience, and Interior Design signature rules

Members will receive 6.0 hours of direct education time or 6.0 professional development units for attending the entire meeting. Certificates for those members paying the CEU fee will be mailed shortly.

Dr. James C. Balogh, PSS of Spectrum Research, Inc., introduced the concepts and fundamentals of forensic environmental and soil science. The fundamental questions asked in a forensic soil science and environmental investigations are:

- Who caused the disturbance or contamination?
- Who is responsible?
- When did the disturbance or contamination occur?
- How did the disturbance of contamination occur?
- How extensive is the disturbance or contamination?
- Are the test results valid?
- Is there evidence of fraud?
- What are the potential exposure levels?
- What is the risk for harm?
- What can be done with the site now?

The focus of most of the technical presentations at the meeting was on methods to answer these questions during soil and site investigations. The technology ranged from small plot assessments to whole watershed evaluations.

Dr. James Arndt, PSS of Peterson Environmental, Inc. gave an informative presentation on field, air photograph interpretation and geographic information system methods for investigating

the history of soil and soil hydrology disturbance. These techniques can be critical for identifying the disturbance history and soil conditions on sites in the urban fringe.

Dan Wheeler, Research Fellow in the Department of Soil, Climate and Water at the University of Minnesota, discussed using piezometers and soil morphology to determine depth of saturation in problem soils. Understanding the relationship of high water tables and soil morphology is critical for many applications including wetland delineations, design of on-site wastewater treatment systems, or establishing locations suitable for soil application of municipal biosolids. Mr. Wheeler also discussed the soils training program for on-site wastewater treatment contractors developed by the University of Minnesota.

Robert Whitmyer, PSS of Matrix Soils and Systems, Inc. gave an excellent demonstration of determining soil permeability and determination of saturated soil conductivity. Establishing the rate of water movement through soil is essential for determining site suitability for many urban and rural conditions especially on sites with disturbed soils. Mr. Whitmyer demonstrated the importance of using soil physics methods for practicing professional soil scientists.

Determining the water and soil quality in urban watersheds is becoming increasingly important from a regulatory and environmental perspective. Establishing the input of runoff, nutrients, pesticides, and other potential contaminants such as metals and organics into surface and groundwater is essential for many urban and suburban landscape managers especially those under regulatory scrutiny. Sara Beth Scadlock, environmental scientist, and James C. Balogh, Ph.D., PSS of Spectrum Research, Inc. gave a presentation on using whole watershed monitoring techniques for establishing the potential level of surface water contamination and allocation of responsibility for the contamination. Use of watershed monitoring with h-flumes, lysimeters, and continuous samplers is an intensive method used to determine the real (vs assumed) runoff, nutrient, and pesticides losses from discrete management areas within a watershed. The results from an urban watershed monitoring project in Duluth, Minnesota was discussed.

Thomas Mings, a senior Wetland Specialist with the Minnesota Board of Soil and Water Resources gave a thorough update on recent WCA rules for delineation and mitigation plans for wetland projects in Minnesota. He also gave a brief outline of the proposed establishment of a certification program for wetland delineators in Minnesota.

Dawn Tracy, Ph.D., PSS, and Geoscience Board Member of the Minnesota Board of AELSLAGID reviewed the Board mission and recent statute and rule changes. The change of rules regarding the requirement for signing work was especially important for licensed soil scientists. Signing all work with soil science content has always been required as part of Minnesota Statute 326.01 – 326.15. The recent changes in the statute clarify the signing process.

2003 Executive Committee Election Results

by Robert Anderson

I received a total of 24 ballots for the 2003 election; which represents approximately 25% of the eligible voters in MAPSS. All of the ballots received were from eligible full members and all ballots were received in envelopes with the required member signature on the outside. No ballots were received after the deadline. The results are:

President-elect

Roger Berggren - 21 votes
Al Giencke - 1 write in vote
No Vote Indicated - 2 ballots

Secretary

Laurie Brown - 13 votes
Patricia Wright - 10 votes
Both Selected - 1 ballot

I would like to assure all members that your vote is secret and

kept that way. Some members have raised the question of how this can be true if voting members are required to sign the envelope containing their ballot. The method used as long as I can remember is to simply receive the ballots in their sealed envelopes until the deadline for submittal. Then I meet with another full member to count the ballots. We tally the envelopes received by the dead line, check for a membership signature on the envelope and check the name against a current membership list to ensure voter is a full member in good standing. Once the ballot has been determined to be eligible it is separated from the envelope and set aside (unviewed, left folded and unknown). The envelopes and ballots are then separately re-counted to double check the total. The envelopes are set aside and finally the ballots are unfolded, viewed and counted. A recount is automatically done to ensure the totals match. At no time is a name associated with the ballot. After the election results are announced at the Winter Business Meeting, I turn over a sealed envelope with the original envelopes and ballots (separately bound) to the Executive Committee for disposal or safekeeping.

There are no hanging chads here, and no curiosity.

United States Consortium of Soil Science Associations (USC SSA)

by Charles Saari

The main purpose of the Association is to promote communication between, and visibility of, State Professional Soil Scientists Societies/Associations and similar groups in the United States on common soil science issues. (from the by-laws)

The goals of the group are to promote communication between the state societies and associations and to promote the visibility of these organizations. Common issues that the organizations share include soil interpretations, recommendations, and the acquisition and application of soils data. Emphasis is on outreach to the general public and elected officials. Outreach hopes to promote the wise-use of science-based soils information for the protection and management of the Nation's soil resources.

Some of the consortiums current objectives are to assist in collectively working toward the goals are:

- Enhancing communication and networking among the societies and associations;
- Outreach to the general public and decision-makers;
- Technical issues: applications, operations, and science;
- Listing of available training and workshops
- Information on potential available contacts for obtaining information on professional groups and services; and
- Professional recognition.

A brief history of the consortium. The group was first talked about at the August, 2000, meeting of the Nebraska Society of Professional Soil Scientists; it was noted that there were about 44 organizations similar to MAPSS around the country. They realized that there were no common links and no effective methods to share information and communication with each

other or the private sector. During the 2000 annual meeting of the Soil Science Society of America, a group of members discussed the opportunity for all of the state societies and associations to work together and to have an impact on common issues. On January 3, 2001, a letter was sent to all state soil science societies asking for input into this project. They held their first national teleconference on April 25, 2001. Since then, they have conducted 5 such teleconferences.

They have developed a Web site at [Http://soilsassociation.org](http://soilsassociation.org) that has a lot of information about the soil science groups around the county. They have a list of states that have certification toward the bottom of the site. I think Minnesota as a state has the most Licensed Soil Scientists of any state as far as I can tell from the site.

From the outgoing Newsletter editor

by David Kelley

It has been my privilege to serve our organization as newsletter editor for the past 3 years. The choice of Ms. Sara Beth Scadlock as the new editor is an excellent one to revitalize and reshape the Auger as it enters its digital phase. Hopefully, most of you will opt to receive the Auger in email format, which will allow for the inclusion of web links to sites of interest, color formatting, and more pictures, as well as saving MAPSS several hundred dollars per year in printing and mailing costs. As always, the newsletter will be available on the MAPSS website.

I will remain webmaster for the MAPSS website, which will also be going through some changes. The Executive Committee has authorized the registration of a domain name for MAPSS, which will enable MAPSS members and the public to find our site using web searches. The look and feel of the site will be refreshed as well, improving navigation and content. More on this in the July newsletter, or keep checking on the status at the current URL:

<http://134.84.160.1/infoserv/orgs/mapss/>

Certified Professionals to Serve as Technical Service Providers Agreement signed by USDA, American Society of Agronomy for Farm Conservation Programs

submitted by Sara Uttech, American Society of Agronomy

MADISON, WI, FEBRUARY 6, 2003 -- Certified professionals are eligible to serve as Technical Service Providers for farm conservation programs under a Memorandum of Understanding signed today in Washington, D.C., by the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) and the American Society of Agronomy (ASA).

Technical Service Providers will provide assistance to farmers of private lands in protecting resources through conservation planning in soil and water, nutrient, pest, and crop management. The agreement officially recognizes that a person who has met the standards of one of the four certifying programs of the American Society of Agronomy also meets the NRCS standards for providing conservation assistance. The four certifying programs of the ASA are: Certified Crop Adviser, Certified Professional Agronomist, Certified Professional Crop Scientist, and Certified Professional Soil Scientist.

This agreement will allow certified professionals the opportunity to become certified by NRCS and to be placed on the NRCS approved list of Technical Service Providers.

Taking part in the signing of the Memorandum of Understanding were Jim Moseley, Deputy Secretary of Agriculture; Bruce Knight, Chief, NRCS; Tom Bruulsema, Chair, Certified Crop Advisers Board; Robert Hoeft, President, American Society of Agronomy; and Luther Smith, Executive Director, Certified Crop Adviser Program.

"Those certified in one of the ASA programs have the opportunity to utilize their scientific expertise to develop management

plans that are both economically and environmentally sound. They have the opportunity to help preserve natural resources while at the same time creating management systems to allow U. S. agriculture to continue to compete in the world market," said Hoeft.

Section 2701 of the Farm Security and Rural Investment Act of 2002 (The Farm Bill) requires the USDA to provide conservation technical assistance to farmers and authorizes the department to approve individuals who can provide technical assistance.

"This memorandum of understanding would not have been possible were it not for the record that ASA has established of requiring all certified members prove their abilities through a strenuous application review and/or examination procedure and they maintain their expertise through continuing education," said Hoeft.

Secretary of Agriculture Ann Veneman announced that President Bush is proposing \$3.9 billion for conservation programs in his budget, with a portion of those funds going to the Environmental Quality Incentives Program (EQIP). The proposed EQIP rules released on Jan. 29, 2003, include an incentive payment for the development of comprehensive nutrient management plans and NRCS will encourage producers to use the services of certified professionals to provide technical assistance.

"Farmers needing assistance on their conservation plans and programs will be able to find a registry of certified professionals who serve as Technical Service Providers at USDA service centers and local conservation districts," said Smith. "The registry also will provide their area of expertise and the geographic area they serve."

The Memorandum of Understanding between NRCS and ASA is effective for the next five years.

Help Needed for MAPSS Tabletop Display

by Gary Elsner

As many of you know, MAPSS received a grant from ASA for the purchase of a tabletop display. A committee was formed and we designed 4 interchangeable themes for the display. We completed all of the materials for one of the themes but the other three have not been done because I have only received a few items for use on the display. I NEED YOUR HELP! Actually, for you it will be relatively easy.

I need photos and other pertinent graphics with appropriate text for underneath them, bulleted lists, and other pertinent text. The photos can be digital, or negatives, or plain photos but make sure they are clear. The text can be plain text e-mail or in a word document. The graphics can be in whatever format you have. 12-15 items usually does it, the panels are not that large. I will do all the production, enlargement, formatting and laminating.

Here are the themes and the individual panels I need infor-

mation for. If possible, please prepare an entire panel so the information is coordinated. Choose things that stand out.

For Theme #2, "Practice of Professional SS in MN", I need information for "What is Soil Science", "Soil Science Divisions", "Soil Science in Government & Research", and "Soil Science in Private Industry".

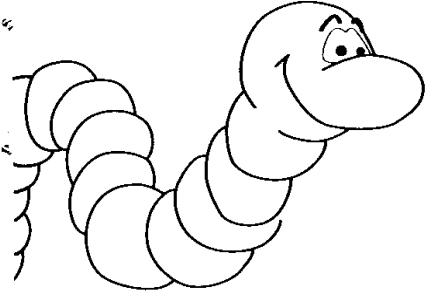
Themes 3 & 4 are "Urban Soil Science" and "Soil Science in Agriculture". For these two themes, we can use some of the same photos and perhaps change the text to match the theme. The panels are the same on both and titled "Soil Mapping, Investigation and Interpretation", "Nutrient Management", "Land Use Planning", and "Waste Management". I have some photos and text for the Waste Management and Soil Mapping themes but need more text. I do not have anything for the other two themes.

E-mail the items to me at: gary.elsner@state.mn.us or mail them to Gary Elsner, 1299 130th Ln NE, Blaine, MN 55434. If you have questions you can e-mail me or call me at 651.297.7268. Thanks in advance for your help!

You Don't Have To Dig Deeply (the earthworms are here)

Reprinted with Permission from *BetterForests Magazine*

EARTHWORMS. They move slowly. They *are* insidious. They wriggle their way through Minnesota's hardwood forests, eating the forest floor right out from under the forest plants!



Earthworms are not native to the United States. The initial source of those invaders came more than 150 years ago when European settlers unwittingly introduced them as stowaways in potted plants, in the bundled roots of fruit trees, and in the hay and

straw bedding of animals they brought to America. Minnesota now 'boasts' the presence of at least seven species of earthworms, all of European origin.

Native earthworms were presumably killed or pushed back during the glacial period 10,000 years ago. The native worms were poor colonizers and never came back. All earthworms we know of today are of European origin.

Despite their seemingly low profile in life, earthworms are threatening natural forest habitat and causing widespread loss of native plants. Here is how they work: When earthworms move into a rich sugar maple-dominated hardwood forest, they consume the very thick *duff* on the forest floor.

This duff is partly decomposed plant material. It is important to the hardwood ecosystem because it provides habitat for fungi and small animals. It is also the perfect rooting medium for many species of forest herbs and tree seedlings. When that duff is destroyed, correspondingly, the main species of native plants, trees, and even some animals that rely on this duff also decrease. Although they advance slowly — five to 10 meters per year — the effects they are having on Minnesota's woodlands are becoming obvious.

So, just what do these foreigners do to the forest floor of Minnesota? We share the following information, taken from a site prepared by the University of Minnesota: Minnesota Worm Watch website at www.nrri.umn.edu/worms. We encourage you to check it out.

What do earthworms do to the forests?

The first thing that earthworms do when they invade a forest is to eat the "O" horizon (*see diagram*). Within a matter of a few years (3-5), they can consume the whole layer of litter and all the organisms that live in it. (Worms advance about a quarter mile a year.) In many forests, the "O" layer is completely eliminated so that all that is left is bare soil with small piles of cast material by the entrance to the earthworm burrows. Each fall the trees deposit a new supply of leaves to the forest floor. The earthworms will eat some of these leaves in the fall before winter arrives and then they become dormant. During spring and early summer, the worms can usually eat the rest of the litter so by late summer, only bare soil remains.

The "A" horizon was very thin before the earthworms arrived (1 cm), but now it gets very thick, between 10 and 15 centimeters. The soil that makes up this new horizon is composed of the earthworm casts produced after eating the litter. It is a dark black layer with earthworm burrows throughout. The original "A" horizon was kept loose and moist because of the amount of organic material present. The new "A" horizon lacks this organic material and therefore is compacted in comparison.

A new "E" horizon develops beneath the new "A" horizon. It looks pretty much the same as it did before, but now it is lower in the soil.

Earthworm burrows can be seen on the top of the soil and, if you were to dig a hole, all through the "A" horizon. Each kind of earthworm has its own type of burrow system. The small, reddish worms living in the litter and at the surface usually don't burrow down very far. However, they will create burrows along the surface underneath the litter or logs. If you dig under these logs for example, you will see their "tracks" that are usually 1-2 millimeters in diameter.

The large red worms (night crawlers) create large burrows that go almost straight down into the soil. You can see the holes at the surface of the soil, usually 3-4 millimeters in diameter, surrounded by a small pile of cast material called a *midden*. Night crawlers also line their burrow with cast material. To see this, cut a cross section of a burrow with a hand shovel. Each burrow is home to one night crawler so estimating the population can be done by counting the number of holes and middens in an area. The whitish gray worms create branching burrows that

wind through the "A" horizon. They are smaller than night crawler burrows, usually 1-2 millimeters in diameter. The burrow will come to the surface occasionally, typically under a log and may connect to night crawler burrows.

The forest floor, centerpiece of the hardwood forest ecosystem, has been radically changed and for all practical purposes is gone due to earthworms eating the "O" horizon. All of the processes that used to occur in the forest floor have been moved into the deeper soil layers. Many of the organisms that used to live in the forest floor have lost their habitat, including food sources. They will either leave or die trying to find another habitat they can live in. The loose, spongy layer of litter is now gone. Plant roots have a harder time growing in the new A horizon than they did in the "O" horizon. Without the forest floor to insulate the soil, it will get warmer and drier in the summer and colder in the winter. These conditions may make it difficult to survive for organisms who had adapted to the particular conditions of what was the forest floor. Earthworms do not eat logs directly, but once the forest floor is gone, the logs can begin to dry out and get hard. The hard wood makes it difficult for insects to burrow into them and the log no longer provides the moist, protected habitat and food sources some animals need. The mosses and other plants that require moisture to survive may also die if the log has dried out.

Plant roots do not grow as densely in the new "A" horizon as they did in the forest floor. As a result, the remaining plants may become stressed more easily when the weather turns warm and

(Worms, Continued from page 7)

dry. There continues to be plenty of nutrients in the soil because of the nutrient rich casts left behind by the earthworms. However, some plants with poor root systems may not be able to get to the nutrients with the same efficiency. In addition, the tiny roots that plants use to absorb nutrients and water can easily get damaged by earthworms grazing around or on them.

Earthworms can also cause damage to the bulbs, rhizomes or corms that native perennial plants use to store food. When these fleshy roots are damaged and the stored food is lost or used up, the plant can no longer divide and grow new plants through vegetative reproduction.

Fungi are a preferred food of earthworms and they graze it heavily, which could dramatically impact their abundance in the soil. By grazing fungi on or near plant roots, the earthworms not only can damage the roots, but they prevent the plant and fungi from forming the symbiotic relationship where mycorrhizal fungi exchange nutrients and water for carbohydrates with green plants. If the fungi can't get enough food, they will die back even further. For some of the native plants that need mycorrhizal fungi, especially when the plant is young and small, survival will be difficult if earthworms prevent this relationship from being formed.

Seeds produced by the few surviving plants are no longer protected by the forest floor allowing animals, including worms, to find and eat the seeds. If the seeds survive to germinate, they are no longer protected from temperature extremes. The seeds will be more vulnerable to death, especially native herbaceous plants that germinate very slowly, taking two or more years to grow into a small plant. Seed that one buys in a garden store will germinate upon putting them in the soil. In a hardwood forest ecosystem, most native plant seeds don't germinate fully in one season. Most need to go through a freezing and warming cycle

(winter and summer) at least once and sometimes twice before growing into a small plant. The forest floor protects these seeds and tiny plants from predators and extremes in temperature and moisture, making the loss of the forest floor devastating to native plant production.

Leaves and twigs continue to fall to the forest floor each year but are rapidly eaten by the earthworms. Thus the forest floor never redevelops.

Earthworms change the nutrient cycling in the forest by increasing the rate at which litter disappears. They do this in two ways: First, earthworms break up the litter into tiny pieces and second, those tiny pieces get broken down by bacteria. Imagine eating a tootsie roll sucker and your favorite part is the chewy center. To get to the chewy center, you would have to eat through the hard candy exterior. Bacteria prefer the "center" of the litter (sugars and carbohydrates) found on the forest floor but first have to get through the fiber (lignin and cellulose). If you imagine licking your way to the center of a tootsie roll, it would be much slower than biting through the hard candy exterior.

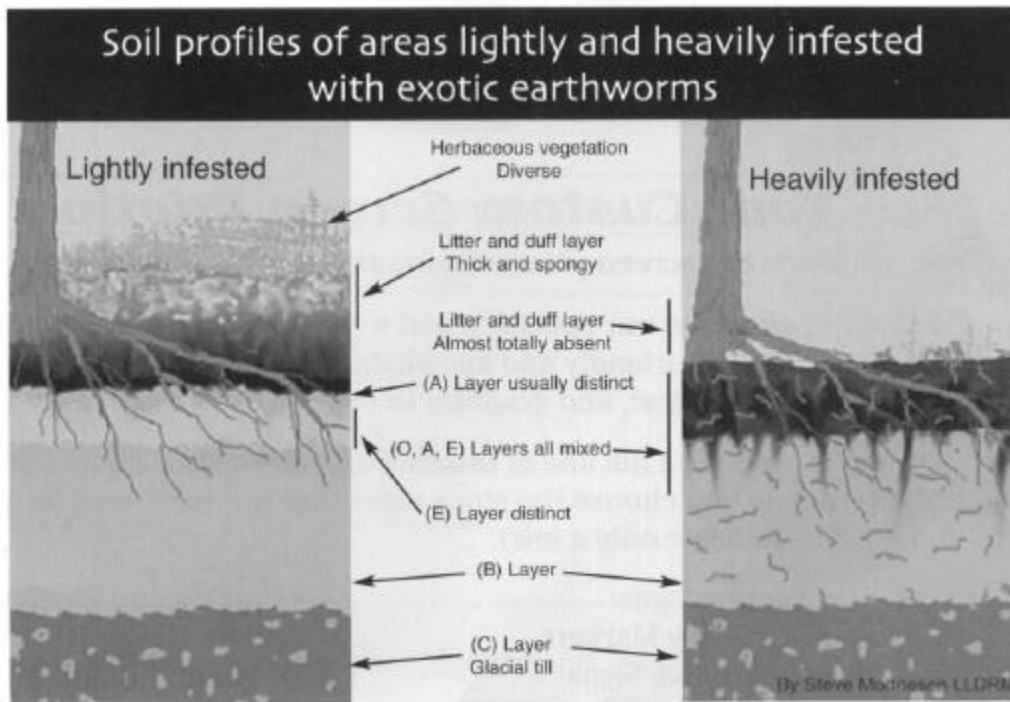
Likewise, it takes time for bacteria to get through the fiber except when earthworms are part of the system. Earthworms act as the teeth and expose the sugars and carbohydrates to the bacteria, allowing for a relatively quick breakdown of the litter compared to bacteria consuming the litter alone. The end result is leaf litter will be consumed at a rate faster than it is produced.

Nutrients needed for plants to grow are now found in the new "A" horizon composed of earthworm casts. Earthworm casts don't have more nutrients than the forest floor (since it came from the forest floor, it couldn't) but as the litter passes through the earthworm gut, a lot of it is converted to forms of nutrients that plants can easily absorb. Although the total amount of nutrients does not exceed the forest floor, earthworms cause more nutrients to be available to plants at any given time. However, if

the plants don't absorb these nutrients quickly, they can be washed away or leached when it rains.

Two things increase the likelihood of nutrient leaching. First, there are not enough plants or root systems to absorb the amount of nutrients available. Second, with all of those earthworm burrows, water can wash the dissolved nutrients down through the soil, below the plant roots or out into rivers and streams. Nutrients that would have been cycled within the hardwood forest ecosystem can either be lost underground or transferred out to another system.

Bacteria still primarily breakdown the litter into nutrients that plants can use. However, now most of that activity takes place in the earthworm gut and not in the litter, much like a compost pile.



NEW AUGER FORMAT

Starting with the July, 2003 AUGER, members will have the option to receive the AUGER via e-mail. You may receive the July, 2003 and October, 2003 AUGER in paper format free of charge. However, starting in 2004, anyone receiving a hardcopy of the newsletter will be charged a \$5.00 per year fee. Honorary members will continue to receive a paper copy of the AUGER at their request. The decision to send the AUGER in electronic format was based on a decision made at the December, 2002, MAPSS Business Meeting.

Please answer the following questions.

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