CSREES's National Research Initiative—Agroecosystems and Rural Prosperity Program Cluster

Natural Resources and Environment Programs

Program Name	National Program Leader	Program Specialist
Soil Processes	Nancy Cavallaro	Alexandra Raver
Integrated Water Quality (406)	Michael O'Neill	Lisa Duriancik
Water and Watersheds	Mary Ann Rozum	Alexandra Raver
Air Quality	Raymond Knighton	Lisa Duriancik

Natural Resources and Environment Programs

Program Name	National Program Leader	Program Specialist
Managed Ecosystems	Diana Jerkins	Alexandra Raver
Long-term Agricultural Research (proposed)	TBD	Lisa Duriancik
Biology of Weedy and Invasive Species	Michael Bowers	Alexandra Raver
Global and Climate Change	Nancy Cavallaro & Luis Tupas	Alexandra Raver

Other opportunities, various agencies

- Biofuels – overall environmental accounting
- North American Carbon Program and Mid-Continent intensive
- Molecular processes and ecosystem studies
- Climate change – Land Use, ecosystems, water, carbon movement, greenhouse gases

Soil Processes

Goals & Priorities FY 07

- Interdisciplinary studies (soil physical, chemical, and biological characteristics and processes) related to soil quality and sustainability, and environmental health.

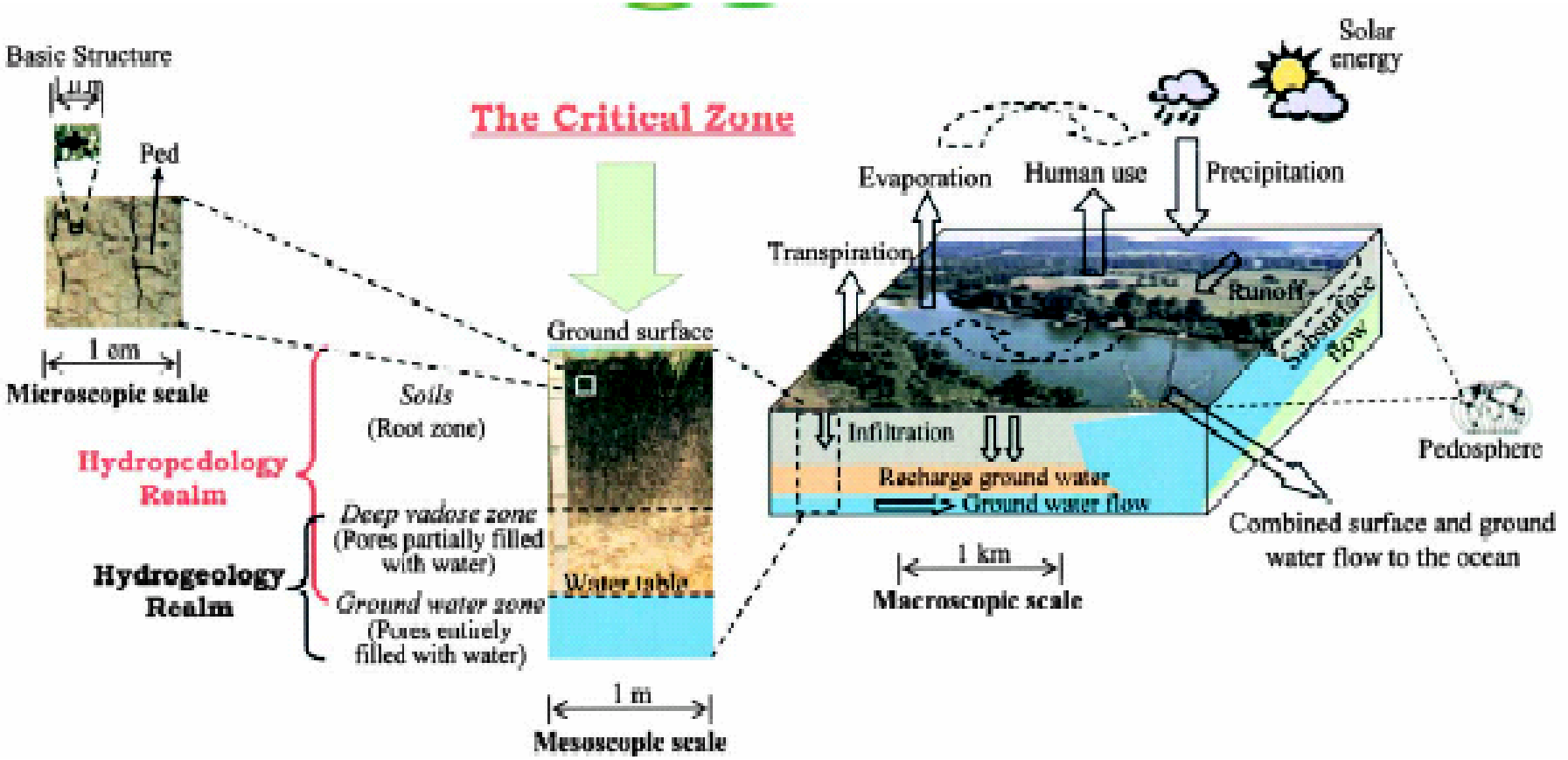
- Multi-scale research that can help bridge the gap between molecular and mechanistic process studies and field-landscape- and/or watershed-scale studies; and

- Development and or application of new or improved technologies, methodologies, tools or strategies to enhance our understanding of soil processes and dynamic properties in soils

Soil Processes

Significant Changes For FY 2007&8

- Letters of intent required
  - Response will be to encourage submission of a full proposal, or to reject
  - Evaluation based on relevance, scientific merit, potential impact
- Multi-scale research encouraged
- Dynamic soil properties emphasized


Basic Structure
Ped
1 cm
Microscopic scale
The Critical Zone
Solar energy
Evaporation
Human use
Precipitation
Transpiration
Runoff
Subsurface flow
Ground surface
Soils
(Root zone)
Hydropedology Realm
Deep vadose zone
(Pores partially filled with water)
Hydrogeology Realm
Ground water zone
(Pores entirely filled with water)
Water table
Infiltration
Recharge ground water
Ground water flow
Pedosphere
Combined surface and ground water flow to the ocean
1 km
Macroscopic scale
1 m
Mesoscopic scale

Cover Stories:

Major Scientific Publications Featuring NRI-funded Research

NRI
Knowledge For Tomorrow's Solutions

United States Department of Agriculture

USDA

Cooperative State Research, Education, and Extension Service

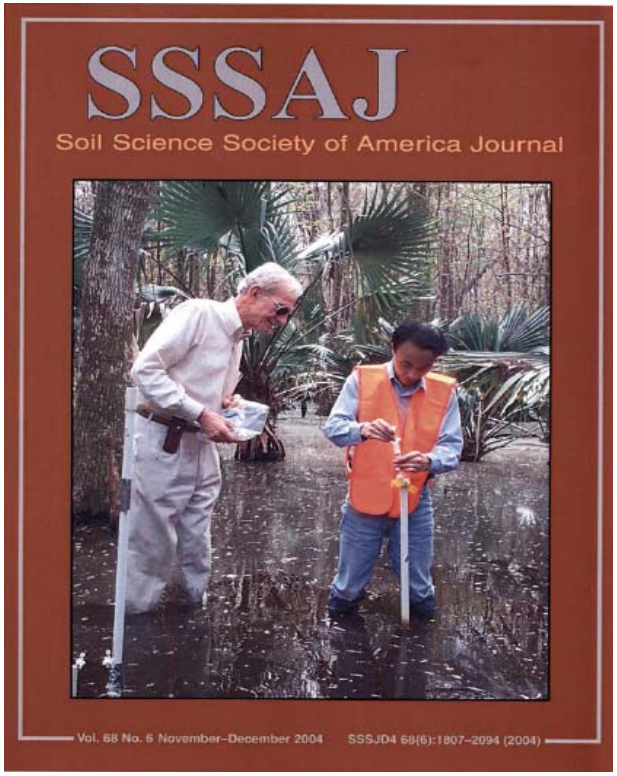
National Research Initiative Competitive Grants Program

2004 No. 7

N. Khare, D. Hesterberg, S. Beauchemin, and S. Wang. March-April 2004. XANES Determination of Absorbed Phosphate Distribution between Ferrihydrite and Boehmite in Mixtures. ***Soil Science Society of America Journal.*** *68(2): 460-469.*

Cover reprinted with permission by Soil Science Society of American Journal.

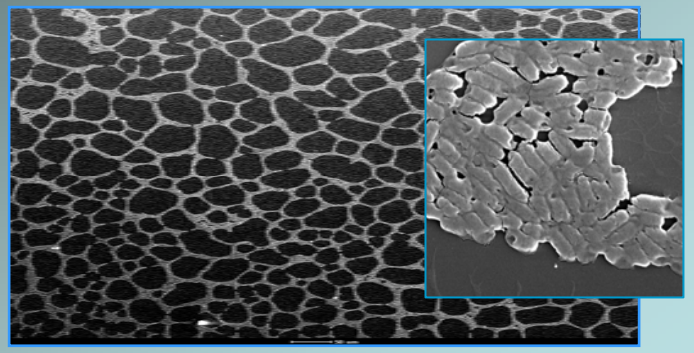
Severe environmental problems result when phosphorus and nitrogen move from agricultural lands to streams, rivers, and lakes. Problems including algal blooms, anoxia, and fish kills diminish water purity and its aesthetic character. Each year, more than 15-million tons of phosphorus and nitrogen are applied annually to agricultural soils in the US. Land management practices that diminish environmental problems with nitrogen may actually increase problems with phosphorus. For example, when agricultural soils are converted to wetlands, nitrogen is converted to harmless forms and



Wetlands: Control the Nitrogen, mobilize the phosphorus? Method to look at nanosites and phosphorus reactions with mixed minerals, microorganisms, varying redox→which wetlands will control both.

Rice production: methane and N2O source? Controlling water and redox potential to minimize GHG release. Efficient production, high yields→methane sink, not source

Physics, water, microorganisms



Dehydration and rehydration: effects on microorganisms, mobility/retention

Salts, pores, soil type, soil structure, virus type→effect on movement and viability of viruses

How and when do colloids/mo's move in unsaturated pores: coffee stain effect, statistics sticking factor, open channel flow, new model

Synchrotron methods, electrons, computed tomography

Advanced Photon source at Argonne National Lab for USAXS, McCarthy

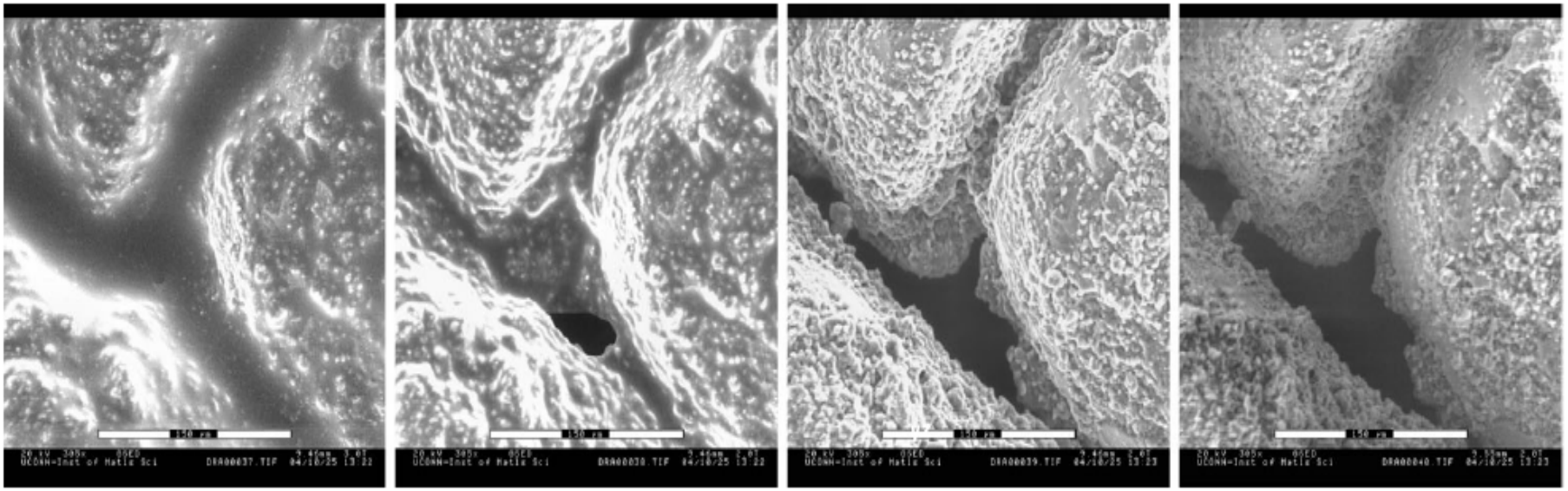


Fig.5: Sequence of ESEM micrographs showing the evolution of a mesopore between sand grains under drying conditions.

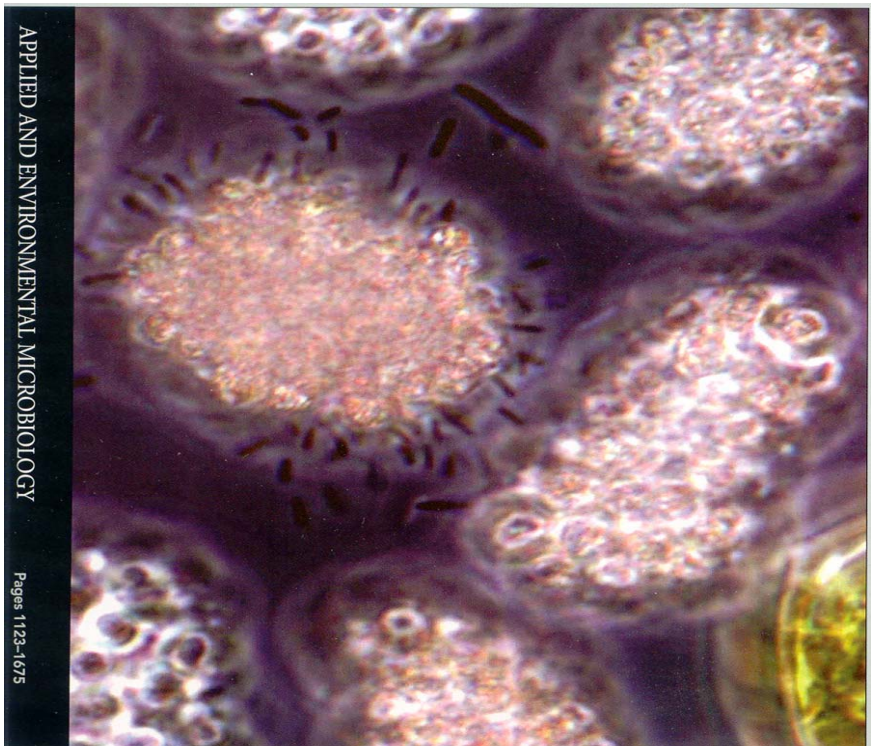
Tuller

Carbon and Nitrogen: Interdisciplinary studies

- Can we sequester C and also provide nutrients? How do Carbon and nitrogen interact? biodiversity, fertilization, increased CO_2
- Carbon in coastal wetlands and estuarine soils,
- physical and chemical fractionations, molecular studies, synchrotron radiation methods, aggregates, pedological studies, isotopes, colloid composition and mobility
- Toward understanding carbon in soil from landscape to microsite and processes that SOM controls.
- Methods developed for looking at these at micro and nanoscales up to landscape and regional scales.

- Soil aggregates and non-linear build up of resistant soil carbon (McCarthy).
- Interactive effects of CO2 and O3 (King)
- C/N ratio observations→ new understanding of recalcitrant N in soils (Sollins).
- Priming effect of roots and litter (Cheng, Lajtha)
- Changes due to biofuels production shift (Pierce)
- Rapid assessment (VNIR) and modeling soil carbon changes across landscapes (Grunwald)
- Pedogenic and climatic thresholds in carbon stabilization (Kramer)

Quorum sensing in soil conditions, biodegradation



APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Mar. 2005, p. 1291–1299
Vol. 71, No. 30099-2240/05/$08.00_0 doi:10.1128/AEM.71.3.1291–1299.2005

Rapid Acyl-Homoserine Lactone Quorum Signal Biodegradation (Leadbetter)

Soil environments: the rhizosphere, microbial communities, biodiversity,microsite sampling

- Microbial diversity versus plant biodiversity, productivity
- Enhanced biodegradation at microsites, innoculations—patent pending
- Fungal (Pseudomonas, Tricoderma) control of pathogenic bacteria
- Censuses, libraries

Soil Structure and visualization

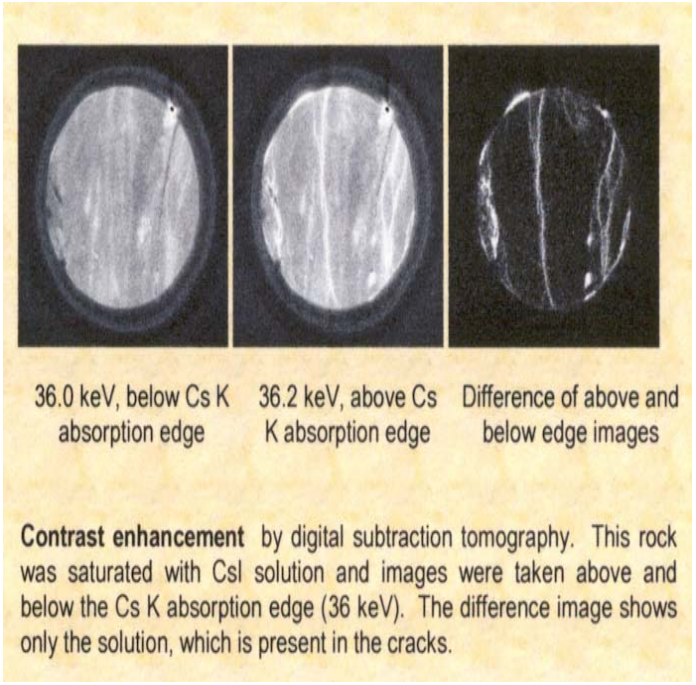


Fig. 2. Taken from the GeoSoil EnviroCARS poster "X-ray Computed Microtomography at the GeoSoil EnviroCARS by M. Rivers, S. Sutton, and P. Eng, (Used by permission).

- X-ray Computed Microtomography to visualize soil pores, 3D imaging,microstructural dynamics, air-water interfaces (Brusseau, Or, Tuller, Jin, Wraith), microsampling (Garcia-Pichel)

- New understanding of the 3D dynamics of pores and interfaces affecting gas exchange, colloid and contaminant transport, sorption, microsite biochemical processes, soil crusts

Soil Processes

Funding Year	2005	2006	2007
# of proposals	144	107	110
# of proposals awarded	17	17	16
% success	11.8	15.9	14.5
Average award size (standard)	352,300	280,000	332,000
Average award duration	2.6	2.4	2.9

Managed Ecosystems

Goals & Priorities:

- Agroecosystem functions –mechanisms and biogeochemical processes to improve agricultural productivity and environmental quality;

- Multifunctional management systems that *concurrently* provide for both agricultural productivity and ecosystem services; and

- Monitoring systems quality – Develop interdisciplinary approaches and processes to monitor agroecosystems to quantify improvements in production quality and environmental quality or ecosystem changes due to implementation of multifunctional management systems and strategies.

National Integrated Water Quality (406)

Goals & Priorities:

- Use of recycled water in agriculture.

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Water and Watersheds

Goals & Priorities

- Understand the sources, fate, and transport of pathogens such as bacteria, protozoa, and viruses in soil and in surface and ground water systems of agricultural and rural landscapes and watersheds to reduce zoonotic pathogens in the environment.
- Identify, evaluate, and understand producer management behaviors that improve agricultural water conservation, especially at spatial scales greater than a single field.

Biology of Weedy and Invasive Species

Goals and Priorities

- Research that establishes mechanisms determining the abundance and distribution of weedy and invasive species. Development, delivery and implementation of ecologically-based, invasive species management programs and/or strategies; and
- 2) Early detection–rapid response control strategies, especially those that use remote sensing and mapping.

Air Quality

Goals & Priorities

- Measurement and Monitoring Integrated projects are solicited to improve measurement protocols/instrumentation and remote sensing to measure and characterize particulate matter and gases for within field/facility and edge-of-field/facility boundaries.
- Fate and Transport Integrated projects are needed on the fate and transport of emitted particulates and gases with specific emphasis placed on ammonia and nitrous oxide.
- Mitigation Integrated projects on the efficacy of methods for mitigating emissions of nitrogen and other agricultural air pollutants to the atmosphere and the development of best management practices are solicited.

Long-term Agricultural Research (proposed)

- Assess farming practices and integrate into knowledge about soil carbon dynamics
- Assess the role of climate variability on soil carbon loss
- Conduct comprehensive carbon audits for farm operations

Global and Climate Change

1. Interactive effects of land use change, climate change, and invasive species
2. Carbon Cycle—carbon management, regional carbon studies, reducing major uncertainties in the North American carbon budget and fluxes