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SDWRI Water News

South Dakota Water Resources Institute

Spring 2007

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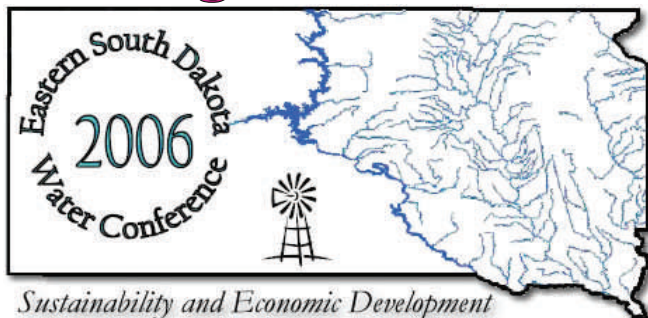
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Eastern South Dakota Water Conference Huge Success, To Be an Annual Event



BROOKINGS, S.D. – The South Dakota Water Resources Institute at South Dakota State University (SDSU) co-hosted a water conference November 1-2, 2006, to provide a forum for water professionals to interact and share ideas.

Water is an important piece of the economic future of South Dakota, and the Eastern South Dakota Water Conference was started to serve as a mechanism to educate participants on this resource.

“The goal of the conference, and the theme for the first year, was sustainability and economic development,” Russell Persyn, SDSU Extension Environmental Quality Engineer said. “We worked to bring together technical and real world presentations from a variety of constituencies across the region.”

Senator Tim Johnson kicked off the conference with an opening address on the importance of water resources. A state and regional panel included Secretary John Cooper of the South Dakota Department of Game Fish and Parks; Secretary Larry Gabriel of the South Dakota Department of Agriculture; Kevin Smith of the Sioux Falls Department of Public Works; and Dave Templeton of the South Dakota Department of Environment and Natural Resources.

Concurrent sessions throughout the conference offered information important to wide array of stakeholders including engineers, industry, public officials, agricultural producers, and conservation groups. On Nov. 1 the sessions focused on watershed management/non-point source pollution, and land use and remote sensing.

Rep. Stephanie Herseth delivered the keynote address during the November 1st evening banquet.

Concurrent sessions on Nov. 2nd covered water use/management, surface water quality, sustainable infrastructure, and watershed assessment.

Mark Anderson, director of the U.S. Geological Survey in South Dakota, gave the closing luncheon address on Nov 2nd.

Sponsors were the South Dakota Water Resource Institute in SDSU’s College of Agriculture and Biological Sciences, the Water and Environmental Engineering Research Center in SDSU’s College of Engineering, the East Dakota Water Development District in Brookings, and the U.S. Geological Survey.

Find more information and to view abstracts from 2006 go online to <http://wri.sdstate.edu/esdwc>.

The conference will now be an annual event and information on the 2007 event will be available in February 2007.





Feature Project: Microbial Indices of Soils and Water

SD WRI is pleased to feature a 2006 USGS 104b-funded project, "Microbial indices of soils and water associated with vegetated treatment areas (VTAs) from five animal feeding operations (AFOs) in South Dakota." The principal investigators of this project are Dr. Bruce Bleakley, Professor in the Biology/Microbiology and Plant Science Department, and Dr. Todd Trooien, Professor in the Agricultural and Biosystems Engineering Department, both from South Dakota State University.

By Dr. Bruce Bleakley
South Dakota State University

Nutrient and sediment loads from animal feeding operations (AFOs) such as cattle feedlots can have a negative effect on the quality of surface waters and groundwaters. An

accepted way to reduce nutrient and sediment loads from AFOs is by using basin technologies, which are effective but can be costly, and can lead to air quality problems caused by unpleasant odors. The potential for development and implementation of alternative non-basin technologies interests a variety of groups, including the South Dakota Cattlemen's Association, South Dakota Farm Bureau, South Dakota Association of Agriculture, Natural Resources Conservation Service, South Dakota DENR, and The Iowa Cattlemen's Association (ICA).

An EPA funded grant, "Evaluating the Performance of Vegetated Treatment Areas," (Dr. Todd Trooien, P.I.), is in progress, with a goal of evaluating the technical and financial feasibility of vegetated treatment areas (VTAs) as a non-basin

alternative for reducing nutrient and sediment loads from AFOs having less than 1,000 animal units. Each of four AFOs in different areas of South Dakota have had or will have VTAs established. Performance of each VTA will be measured by sampling inflows and outflows from vegetated areas. The samples will be analyzed for nutrients (N and P), salts, sediment, and numbers of fecal coliform bacteria (*Escherichia coli*). Data from these measurements will allow calculation of water and salt balances, loss or gain of nutrients, removal of sediment, and fecal coliform numbers. Data will be compared to output from a computer model that simulates VTA performance. Samples have been obtained during 2005 and 2006, and will continue to be obtained during 2007.



Vegetated area used for treating feedlot runoff.

For the EPA project described above, counts of *E. coli* before and after each VTA are the only measure being taken of bacterial effects on water quality in pre- and post-VTA areas. Other microbial measures affecting water quality would also be valuable, such as detecting presence or absence of toxigenic *E. coli*, such as *E. coli* O157:H7; and total fecal coliforms (including both non-toxicogenic *E. coli* and

other genera that are found in feces) in pre- and post-VTA areas at each site, to better assess whether water quality in post VTA areas is better (has lower numbers of these bacteria) than in pre-VTA areas. Also, since microbial activity can influence physical and chemical parameters of soil and water, such as whether aerobic or anaerobic processes are

(Continued on page 3)



Microbial Indices of Soils and Water

(Continued from page 2)

occurring, other measures of microbial activity would be valuable for both pre-VTA and post-VTA areas at each site, to further assess water quality in these areas. The project “Microbial indices of soils and water associated with vegetated treatment areas (VTAs) from five animal feeding operations (AFOs) in South Dakota” is being conducted to provide a more detailed and broader understanding of some microbiological issues relating to this waste management system. This project was funded by the South Dakota Water Resources Institute.

Differences in the microbiology of soils in the inflow and outflow areas associated with VTAs will be assayed by measuring the selected microbial indices of soil respiration, oxidation/reduction potential, heterotrophic microbial activity, soil bacterial diversity, numbers of total culturable fecal coliforms (including non-pathogenic *E. coli* but including other culturable fecal coliforms as well), and presence or absence of pathogenic *E. coli* O157:H7. Data on these microbial indices is being collected, and will be added to the data sets from the EPA project, to get a better idea of the number and activity of microbes in soils associated with inflow and outflow areas.

We are evaluating the numbers of specific fecal coliforms and/or potential pathogens of humans and animals in both inflow and outflow water by use of several agar media that are selective and differential for specific bacterial types. Water samples from

one of the VTA sites have been analyzed by counting coliforms on mfc agar. Picking these colonies over onto Chromagar plates has shown that most but not all of the initial isolated colonies were *E. coli*. Both non-pathogenic *E. coli* and *E. coli* O157:H7 were detected in both pre-VTA and post-VTA areas; but were not detected in the river close by and further downstream from the post VTA area.

We are testing the hypothesis that numbers of all these bacterial types will be less in post-VTA areas than pre-VTA areas.

Soil respiration is being measured in the field with a portable soil respirometer. The amount of carbon dioxide evolved from soil due to microbial respiration is an index of soil microbial activity. Both plant root respiration and

microbial respiration can contribute to the values obtained. At the same VTA site in 2006, there did not seem to be significant differences in CO₂ production between pre VTA and post VTA areas on the dates sampled, possibly because the respiration of grass roots was so dominant and equivalent in both areas. Soil temperature is a major determinant of soil respiration, more so than moisture. Soil temperatures around 21° C gave respiration values (g CO₂/m²/hour) ranging from 2 to 6; while soil temperatures around 8° C gave values that were three to eight times lower. We are testing the hypothesis that respiration will be higher in inflow areas compared to outflow areas, due to greater organic matter load stimulating microbial respiration in the inflow areas than in the outflow



Sediment basin on far left is used to remove solids before feedlot runoff enters the vegetated area.

(Continued on page 6)



South Dakota Drought Status Update

January 2, 2007

Dr. Dennis Todey is South Dakota's State Climatologist.

http://climate.sdstate.edu/climate_site/climate.htm

By Dr. Dennis Todey

South Dakota State University

Fall precipitation across the state was less than average across most of the state limiting soil moisture recharge for next growing season. Some areas of the eastern part of the state were wet earlier, but shut off in the end of September.

More recently two major winter storms dropped large amounts of precipitation, liquid and frozen across much of the eastern part of the state. While the frozen precipitation will help with surface water less soil moisture recharge has occurred except in the far southeast. Here enough precipitation fell as rain to cause some soil thawing and lead to some soil moisture recharge in an area roughly south of I-90 and generally east of Highway 281.

Current Conditions

Few changes in the drought status on the US Drought Monitor Map (Fig. 1) have occurred during the fall as the dry areas tended to get little additional precipitation. The dryness in the east has been reflected in an expansion of the D0 category across the eastern part of the state. Recent heavier precipitation in the southeast has removed the D0 level there because of record high liquid water events there. Yankton set a record high December precipitation of 3.4" more than 1.4" above the previous record.

The precipitation in the last two winter storms has been sufficient to overcome the fall precipitation deficit in the far southeast part of the state. The snowfall did move precipitation totals in the right direction, not to the point of overcoming deficits from the fall over the central and northeast parts of

(Continued on page 5)

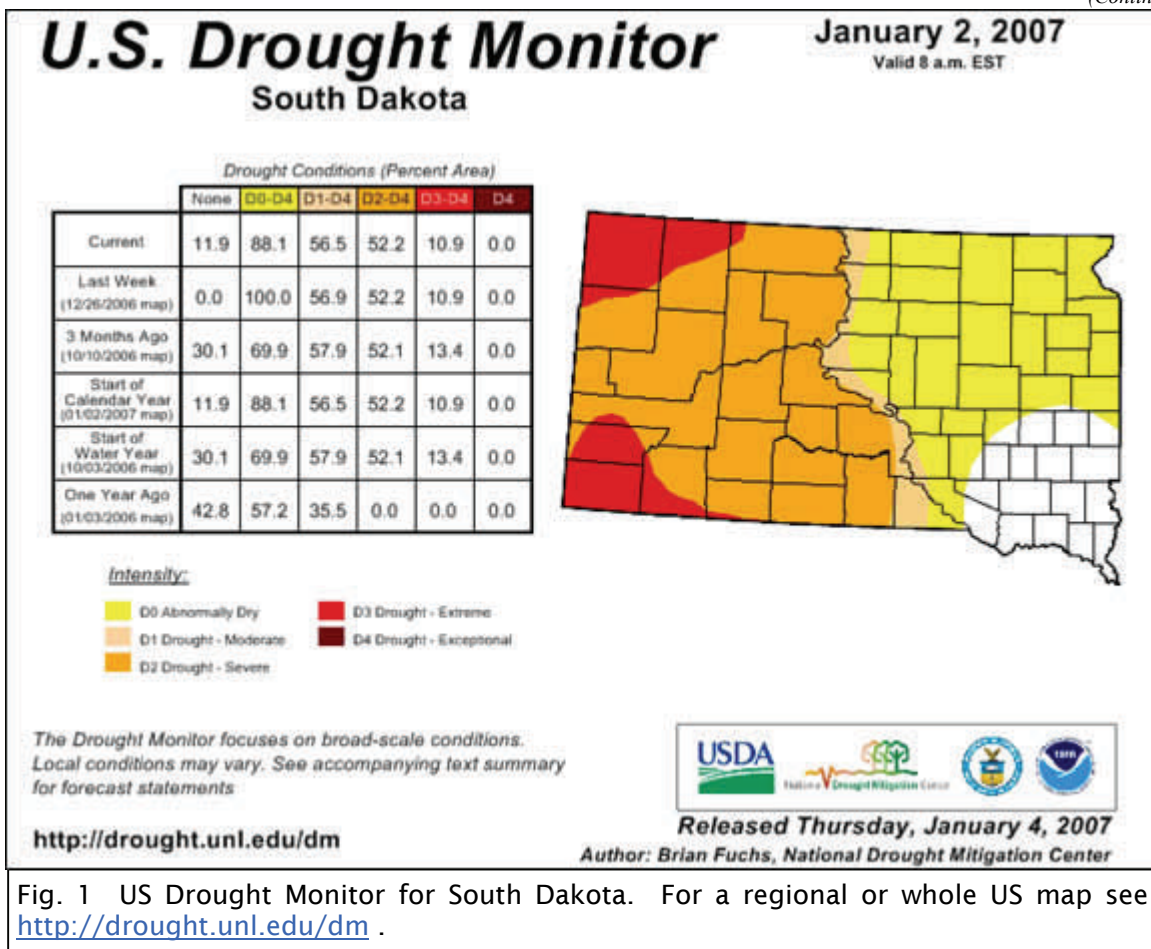


Fig. 1 US Drought Monitor for South Dakota. For a regional or whole US map see <http://drought.unl.edu/dm> .



Drought Update continued

(Continued from page 4)

the state. Total accumulated precipitation over the last 90 days has lagged well behind average over the whole state (Fig. 2).

Drought Impacts

The dry fall conditions are of greatest concern in soil moisture recharge for production agriculture. Little water is used by the crops from the soil during the fall and evaporation is usually confined to the top 4-6" of soil. While this fall recharge is not absolutely necessary, it does help reduce some potential risk for production by having some soil moisture "in the bank" for the coming spring and summer.

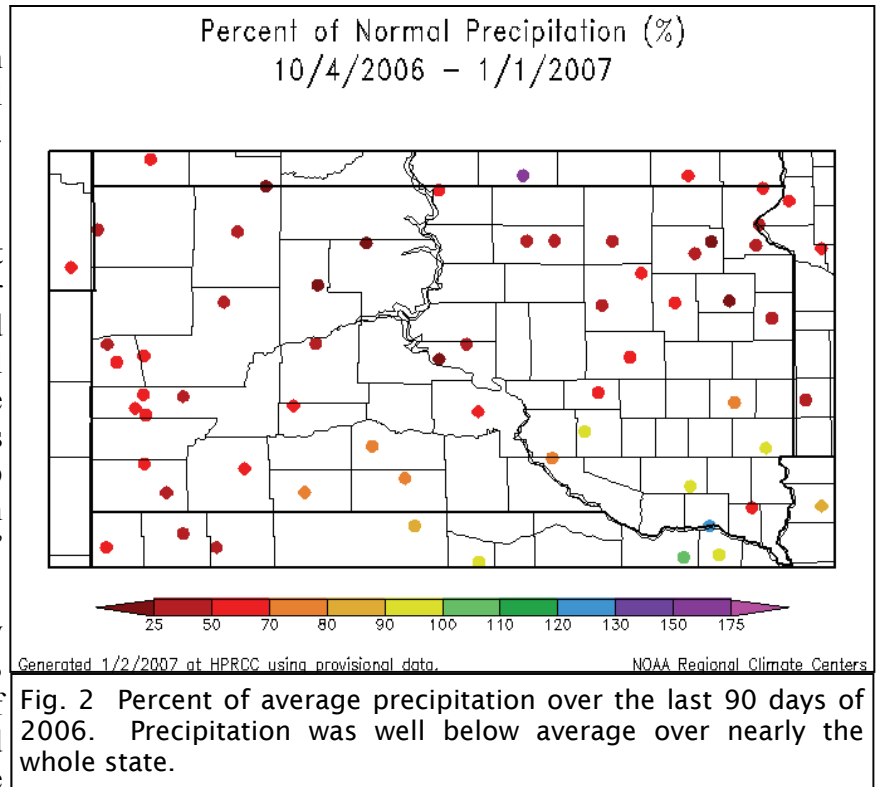
Soil moisture data is measured regularly at only one location in the state, an NRCS station at EROS Data Center north of Sioux Falls. The soil moisture sensors did show some accumulation of soil moisture down to about 8" from the two storms over Christmas and New Years. This makes me think that some recharge did occur in the southeastern part of the state. Other areas may not have been so lucky as less liquid precipitation occurred and soils were likely somewhat colder.

Snowfall over the Black Hills again is lagging behind average limiting the winter sports industry. While ski resorts are open, little snowmobiling has been reported. This snow is also necessary to run-off into reservoirs in the Black Hills area. While the wettest part of the winter season is still coming, the loss of early new requires more later snowfall to make up the difference.

Snowfall reports from Wyoming and Montana are also well below average in the Missouri drainage basin. This was expected with the occurring El Nino. But without a significant snowfall year, the Missouri River will again lag behind water for the reservoirs in the system. The first run-off outlook will be issued soon.

Outlook

Temperatures have been warmer than average throughout most of the last month. Expect this trend



to continue overall with the existing El Nino. Precipitation is much more fickle with an El Nino. There continue to be hints at slightly above average precipitation in the eastern part of the state. These are very much individually driven events.

Precipitation in the western part of the state will likely continue to lag based on the El Nino. This will probably extend into the headwaters of the Missouri as El Nino typically leads to lower snowfall totals in northern Wyoming and western Montana.

Current discussions indicate that the El Nino will last into the spring. This will help spring potential for precipitation as weak El Nino conditions during the summer usually aren't dry. The best scenario would be for continuation of the El Nino into the summer as hot and dry conditions are usually not associated with El Nino conditions during the summer.

Current forecasts can be found at:

<http://www.weather.gov>

Links to current longer range outlooks can be found at:

<http://www.cpc.ncep.noaa.gov/>



Microbial continued

Meetings of Interest

(Continued from page 3)

areas.

Oxidation/reduction potential of wet soils will be assayed in the field with a portable meter fitted with an oxidation/reduction electrode. In 2006, because of dry conditions, redox potential was not measured, but will be when moist soil conditions allow. The hypothesis being tested is that redox values will be more negative in areas having largest amounts of organic load from the AFOs; where microbial respiration will have depleted oxygen gas concentration and led to anaerobiosis.

Heterotrophic microbial activity will be assayed in the laboratory by assaying ability of soil samples to hydrolyze fluorescein diacetate. We suspect that FDA hydrolysis will be greater in inflow areas than outflow areas, since higher amounts of organic matter in inflow areas should stimulate more microbial activity than in outflow areas.

Soil bacterial diversity will be assayed by use of Biolog EcoPlates that show the ability of a soil microbial community to utilize 96 different carbon sources; and by molecular methods, using polymerase chain reaction (PCR) and denaturing gradient gel electrophoresis (DGGE). We expect that bacterial diversity will be greater in inflow versus outflow areas, due to greater amounts and types of organic matter available in the inflow areas; and more likely frequent periodic aerobic/anaerobic transitions in the inflow areas, versus the outflow areas.

Management issues that could be impacted by results of this study include management of undesirable odors affiliated with the AFOs; extent of anaerobic versus aerobic microbial processes in inflow versus outflow areas; ability of the VTAs to filter out specific pathogenic bacteria such as *Escherichia coli* O157:H7; amount of CO₂ gas produced from soil in pre-TA versus post-TA areas; and overall heterotrophic microbial activity and microbial community diversity in soil and water in pre-VTA versus post-VTA areas as a measure of the ability of the VTA in removing organic compounds from the AFO inflow. For further information about this project, contact Dr. Bleakley (bruce.bleakley@sdstate.edu).

January 2007

- 5-8: [SD Board of Water and Natural Resources](#)
- 16-18: [Wastewater Collection/Water Distribution](#)
- 17-18: [Board of Minerals and Environment](#)
- 18: [Operator certification exams](#)
- 29: [State Emergency Response Commission](#)

February 2007

- 12-13: [Non-point Source Workshop](#)
- 13-15: [Basic Water Treatment](#)
- 14-15: [Board of Minerals and Environment](#)
- 15: [Operator certification exams](#)
- 27-3/1: [Basic Water Treatment](#)

March 2007

- 1: [Operator certification exams](#)
- 7-8: [Water Management Board meeting](#)
- 13, 14, 15: [Small Water Treatment Workshop](#)
- 14-15: [Board of Minerals and Environment](#)
- 20, 21: [Small Water Treatment Workshop](#)
- 29-30: [SD Board of Water and Natural Resources](#)

April 2007

- 10-12: [Wastewater Collection/Water Distribution](#)
- 18-19: [Board of Minerals and Environment](#)
- 30: [State Emergency Response Commission](#)

May 2007

- 9-10: [Water Management Board meeting](#)
- 15-18: [Advanced Water Treatment](#)
- 16-17: [Board of Minerals and Environment](#)
- 15: [Big Sioux Water Festival, Brookings, SD](#)
- 16: [Huron Water Festival](#)
- 29-6/1: [Advanced Water Treatment](#)

June 2007

- 19-21: [Intermediate Water Treatment](#)

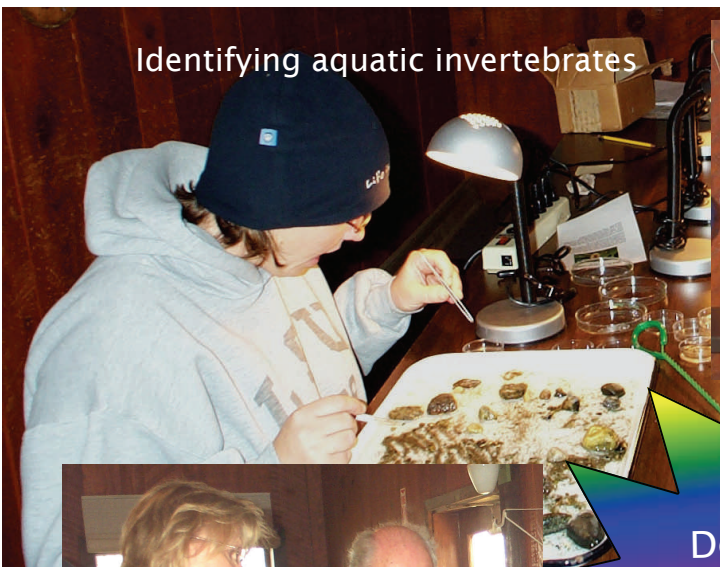


Water Quality Workshop

The second Water Quality Workshop was held October 21-22 on Enemy Swim Lake at NeSoDak Camp. Participants received a crash-course on aquatic invertebrates, lake processes, water quality monitoring, and pollution. The attendees received materials to share with their lake associations about how lakeshore activities affect lake habitat and even constructed Secchi disks to begin their own monitoring programs.

Another workshop has been scheduled for August 11-12, 2007 at NeSoDak. If you have any questions, please feel free to contact Jennifer at 605-688-4910 or sdsu.wri@sdsu.edu.

This free Water Quality Workshop was made possible by a grant from the Environmental Protection Agency's 319 Non-point Source Pollution program in through the South Dakota Department of Environment and Natural Resources.



Identifying aquatic invertebrates



Here's how ya play the Lake Game



Up-close view of aquatic invertebrates



Making Secchi disks



Photos by:
Deb Springman,
East Dakota Water
Development District



Freshly frosted Mercury Cookies—mmm!

Next Basic Limnology Workshop

August 11-12, 2007
NeSoDak Camp



Dissolved Oxygen anyone?



Links of Interest

- [South Dakota Water Resources Institute](#)
- [Eastern South Dakota Water Conference](#)
- [Water & Environmental Engineering Research Center](#)
- [South Dakota Climate and Weather](#)
- [South Dakota Section of the American Water Works Association](#)
- [Missouri River Institute](#)
- [South Dakota Drought Task Force](#)
- [South Dakota Water and Wastewater Association](#)
- [Missouri River Basin Association](#)

"Anyone who can solve the problems of water will be worthy of two Nobel prizes - one for peace and one for science."

—John F. Kennedy

Water News

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