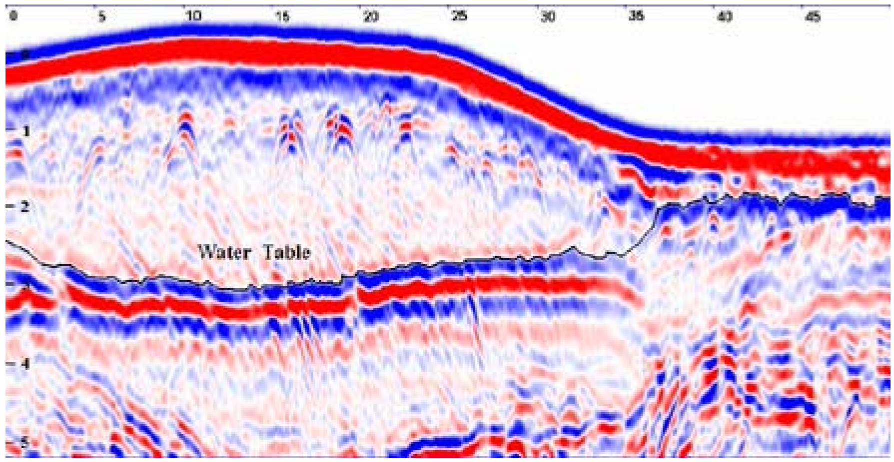
National Cooperative Soil Survey

Newsletter

February 2003
Issue 22

In This Issue—



Ground-penetrating radar trace pattern identifying a subsurface water table. Units of measure are in feet. The depth scale is exaggerated.

Editor's Note

Issues of this newsletter are available on the World Wide Web (http://soils.usda.gov/). Click on NCSS, then on Activities & Newsletters, and then on the desired issue number.

You are invited to submit stories for future issues of this newsletter to Stanley Anderson, National Soil Survey Center, Lincoln, Nebraska. Phone—402-437-5357; FAX—402-437-5336; email—stan.anderson@nssc.nrcs.usda.gov.

The Suitability of U.S. Soils for Ground-Penetrating Radar Applications

By Sharon W. Waltman, Soil Scientist, NRCS, National Soil Survey Center, Lincoln, Nebraska.

A map developed by National Soil Survey Center (NSSC) staff identifies areas of the conterminous United States where ground-penetrating radar (GPR) applications involving the upper meter of the soil are likely to be successful. The map provides field investigators with a broad overview of the dominant soil properties that affect radar signal attenuation and depth of penetration and shows the relative effectiveness of GPR applications within broadly defined areas. The NSSC staff developed a poster that includes this map, an explanation of how the map was made, and an example of a more detailed county map based on USDA-NRCS soil geographic databases (STATSGO and SSURGO).

James Doolittle, Research Soil Scientist, presented the poster and gave a keynote presentation on this work at the Ninth International Conference on Ground Penetrating Radar held in Santa Barbara, California, April 29 to May 2, 2002. The audience responded to this presentation in an overwhelmingly positive manner. Many academics, geophysicists, geophysical consultants, and engineers expressed interest in the map of the United States. After close scrutiny of the map, many expressed satisfaction and noted that the map was true to their experiences. Geophysical scientists from the USGS were impressed and inquired if the Soil

Onsite measurement by means of ground-penetrating radar.

Survey Division could develop a map for the upper 2 meters of the soil. Specialists from the FBI expressed interest in forensic applications, and specialists from the Department of Defense expressed interest in applications related to unexploded ordnance.

Based on recommendations from this meeting, additional work was added for detailed mapping and a second poster was developed for presentation at the 2002 International ESRI (Environmental Systems Research Institute) User Conference held in San Diego, California, July 8-12, 2002. Fred Minzenmayer and Sharon Waltman, NRCS Soil Scientists, entered the poster in the "Map Gallery," in the category "Best Cartographic Design for a Single Map Product." The poster was awarded a blue ribbon by the panel of judges. It will be published in the 2003 ESRI Map Book. Ellis Benham, Research Soil Scientist, and Tammy (Nepple) Umholtz, Visual Information Specialist, made significant contributions to the posters and to a paper describing this project. The final version of the paper has been submitted for publication in a special issue of *Journal of Environmental and Engineering Geophysics*. For additional information, contact Sharon Waltman (sharon.waltman@usda.gov).

The posters can be viewed on the Soils Web site (http://soils.usda.gov/research/results/posters/gpr_soil.pdf) and on the 2002 ESRI Map Library Web site (http://gallery.dcse.com/map_library/). At the ESRI site, search for map ID 20075.

The abstract for the paper is given below.

Abstract

The performance of ground-penetrating radar (GPR) is dependent upon the electrical conductivity of soils. Soils having high electrical conductivity rapidly attenuate radar energy, restrict penetration depths, and severely limit the effectiveness of GPR. Factors influencing the electrical conductivity of soils include the amount and type of salts in solution and the clay content. Data on the clay and soluble salt contents of soils were used to develop thematic maps showing at different scales the relative suitability of soils for GPR applications. The United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS), bases these maps on field experience and soil attribute data contained in the State Soil Geographic (STATSGO) and the Soil Survey Geographic (SSURGO) databases. Attribute data used to determine the suitability of soils include clay content, electrical conductivity, sodium adsorption ratio, and calcium carbonate content. Each soil attribute was rated and assigned a value ranging from 1 to 10. These attribute values were summed, and the most limiting (maximum) layer indices within depths of 1.0 or 1.25 m were selected to represent soil components. The dominant component value was selected as the GPR suitability index for each map unit. The GPR indices are displayed in graduated color maps. The STATSGO database was used to produce the "Ground-Penetrating Radar Soil Suitability Map of the Conterminous United States." This map can be used to assess the relative appropriateness of GPR for soil investigations within comparatively large areas of the conterminous United States. The SSURGO database, which contains the most detailed level of soil mapping and information provided by the USDA-NRCS, can be used to produce larger scale maps showing more varied and intricate soil patterns that influence the effectiveness of GPR within selected soil survey areas. ■

Taking Soil Survey Pictures Using Digital Cameras

By John Kelley, Soil Data Quality Specialist, USDA, Natural Resources Conservation Service, Raleigh, North Carolina; written for MO 14 soil survey project leaders.

Many of you now have access to digital cameras. Before you take to the field and begin shooting all those great pictures, there are a few basic concepts that you must understand to get the image you want in a format suitable for publication in the soil survey report.

As with any photography technique, you must be knowledgeable of the camera, its accessories, its strong points, and its limitations. You must understand what the camera can do to meet your needs.

Your needs.—Digital photographs used in printed soil survey reports must be of high quality. To be used in USDA publications, these photographs are required to have an image resolution of 300 ppi (pixels per linear inch) at the image size to be printed. A higher resolution exceeds the capacity of most offset printers. Any less resolution results in a degradation of image quality.

A soil survey color cover picture is typically 7.0 inches wide x 6.5 inches deep. At 300 ppi, the image would contain about 4 million pixels: [(7.0 x 300) x (6.5 x 300] = 4,095,000 pixels. Table 1 gives the resolution requirements and average file sizes for various types of images.

Limitations.—Digital images submitted for printing in soil survey reports *cannot* be in a compressed format. TIFF is the noncompressed file format used by most digital cameras and is the format preferred by the Government Printing Office. Images stored or recorded in a JPEG file format are compressed. These files do not retain all the digital data recorded by the camera's sensor. JPEG files, however, do work well if the image is to be posted on the Web or used in a PowerPoint presentation. When other formats are converted to a JPEG format, the amount of compression can be scaled by standard image-editing software. What this means is that *all* digital photos used in *published* soil surveys must be recorded in the TIFF format or must be recorded in another noncompressed file format, such as Windows bitmap (BMP), and then converted to a TIFF file.

Your equipment.—Many of you now have access to the Olympus Camedia C-4000 digital camera. This camera provides you with a new and interesting way to produce quality images. It has a still-image capture resolution of 2,288 x 1,712 pixels (3.92 megapixels). Images are stored in a JPEG or TIFF format. These images are suitable for posting on the Web; for use in software applications, such as PowerPoint presentations; and for printing in soil survey reports.

The camera utilizes a SmartMedia memory card. You will quickly learn that the 16-megabyte card that comes with the camera does not provide adequate storage capacity for soil survey images. You will be able to shoot only about five images at the highest resolution setting (2,288 x 1,712 for a TIFF format). Additional cards will be required. The largest storage capacity for the SmartMedia format is a 128-megabyte card that costs about $50 to $75. This card will allow you to shoot up to about 40 images at the highest resolution before downloading to the computer or changing cards. Such items as a lens adapter for use with a circular polarizer or UV filter, a battery charger, and a carrying case are nice additions. They can be purchased at most camera shops.

Editing digital images.—Once you have taken the picture, you may be

Table 1.—Resolution requirements and average file sizes for various image types

Image type	Print resolution requirements	Average publication dimensions	Pixel requirements	Average TIFF file size	Average JPEG file size*
Cover (color)	300 ppi	7.0 x 6.0 in	3.8 mp	11+ mb	500+ kb
Cover (color)	300 ppi	7.0 x 6.5 in	4.1 mp	11+ mb	500+ kb
Color profiles (2/page)	300 ppi	3.3 x 6.0 in	1.8 mp	5+ mb	200+ kb
Color profiles (1/page)	300 ppi	5.75 x 8.0 in	4.1 mp	12+ mb	350+ kb
Landscapes (b&w)	150 ppi	7.0 x 6.0 in	0.9 mp	1+ mb	200+ kb
Landscapes (color)	300 ppi	7.0 x 6.0 in	3.8 mp	11+ mb	300+ kb

* Medium compression.

tempted to use an image-editing software to edit color, contrast, saturation, etc., or to delete unwanted features or add new features. Editing the image has the potential not only for improvement but also for disaster. Remember, your monitor's settings for color, contrast, or brightness most likely will not match those of the editor or ultimately the printer. Editing images can be a creative and fun process. Caution should be taken, however, to ensure that you retain the concept the image was meant to portray.

Before you consider any editing, **SAVE** the image as originally captured by the camera. Most of the time, a great deal of work has gone into preparing the soil profile or selecting the right time to shoot a scene. If you get too far down the editing road, it may not be possible to recover the original image and reshooting the image may not be a practical alternative.

Storing and submitting digital images.—Digital images will require significant disk space for storage. Writing files to a CD is a good way to maintain a library of images without tying up your computer's hard drive.

Images used for printed soil surveys must be in a TIFF format. Do not submit images that were recorded in a JPEG format and converted to a TIFF format. When taken, these images, were compressed. When files are compressed, image data are irretrievably lost. These files can be resampled to a set resolution, but image quality will not be sufficient for the printed soil survey report. (*In other words—you can't make a silk purse out of a sow's ear!*)

Do not submit images that were initially shot in a TIFF format, stored as a JPEG file, and converted back to TIFF. When a file has been compressed and then uncompressed, the software deletes pixels and then adds or creates new pixels. The file size will increase to its original size, but image quality is not the same. Every time a file is resampled, image quality diminishes. (*In other words—you can't put spilled milk back into the bottle!*)

References.—You will want to build a reference library or bookmark helpful Web sites. "Digital Photography for Dummies" is a good place to start. It has very helpful information, references, and software goodies. It is especially helpful when you are using Adobe PhotoDeluxe or Photoshop.

Please contact the MO if you would like additional training or have questions about procedures, techniques, or the operation of your camera. ■

Cold Soil Data Available on CD

From "NRCS Technology News," December 2002.

The impact of fuel spills on the cold soils in Antarctica has been under study by the National Soil Survey Center (NSSC) and the National Water and Climate Center (NWCC) in collaboration with scientists in New Zealand. The study, initiated in 1999, uses soil climate stations in three areas: one site is on Ross Island, near Scott Base; one is on the Antarctic coast; and the third is in a dry valley (an area kept free of snow by high winds). Each site has two stations, one in a spill area and one in a nearby nonspill area for comparison. Hourly averages of soil water content, soil temperature, and atmospheric variables are recorded on dataloggers and retrieved annually.

This study also provides baseline data for global climate change research. Permafrost-affected areas are believed to be the most sensitive to global climate change. The soil climate station data provide valuable information to calibrate and verify models used to predict climate change and its effects.

The immediate use of the project information will be for Antarctica managers to decide whether to ameliorate oil-contaminated soils or let nature repair itself. NRCS will use the information collected to improve soil taxonomy, to classify soils for the proposed Southern Hemisphere Circumpolar Soils Map, and to better understand the behavior of cold soils.

Data are available on CD from the NSSC. Plans are to make the data available on the NWCC Web site and in various publications, including a Soil Survey Investigations Report.

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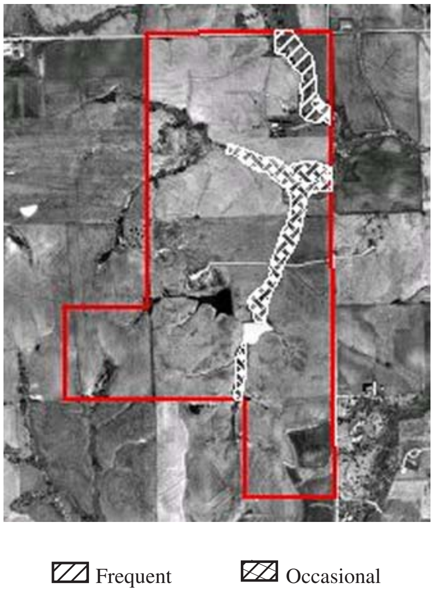
Soil Data Can Contribute to Golf Course Design, Construction, and Maintenance

From "NRCS Technology News," December 2002.

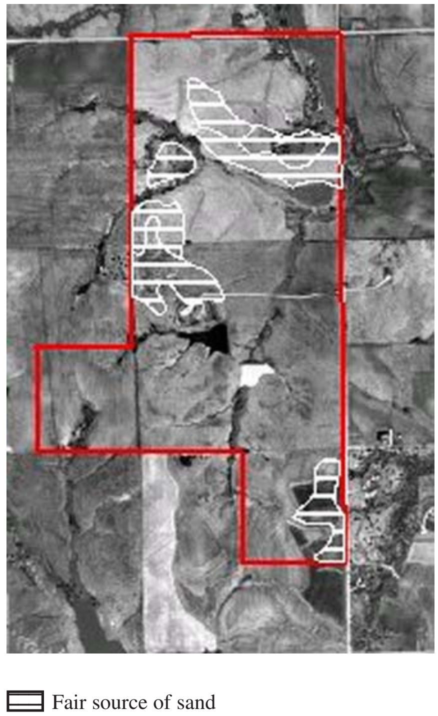
The National Soil Survey Center, in cooperation with the University of Nebraska, studied ways that soil data can be applied to support golf course design, construction, and maintenance practices. The study provided an initial assessment of the soil resources, using interpretive maps complemented with Geographic Information System (GIS) analytical tools to show areas with soil characteristics that may be beneficial or disadvantageous to golf course design, construction, and management. A set of thematic maps depicting considerations



Areas of flooding on a proposed site for a golf course.

and concerns was developed using NRCS Soil Data Viewer GIS analytical tools. The initial draft considered erosion during construction and establishment, irrigation design and efficiency, pesticide management, location of source material (such as topsoil and sand), and identification of suitable landscaping forbs, shrubs, and trees.

For the developer, this information aids the search for sites that can be economically developed as opposed to those that require additional resources to overcome natural constraints and limitations. Architects and builders can use NRCS soil information to take advantage of the site's soil characteristics and create a golfing facility that is economical to build and maintain and yet in harmony with its surrounding environment. Soil data can be used to design and install irrigation and surface and subsurface drainage systems that maximize irrigation and drainage efficacy and do not create an environmental risk to surface and ground water. The builder can locate areas where soil limitations may pose special construction concerns or areas that are potential sources of borrow materials, such as topsoil or sand. For the superintendent, soil data are essential to developing a golf course management plan that not only maximizes the soil's potential to support play, but also enhances the course's contribution to the surrounding environment. As such, soil information is a basic component of any environmentally sound fertility, weed, or pest management system.



Possible sources of sand for use during construction and for bunkering on a proposed site for a golf course.

Because this was a preliminary proof-of-concept study, the analyses reflect only a relatively small sampling of the system's analytical capabilities. A more complete assessment will be possible once the golf course requirements of the developer, architect, and superintendent are fully understood and developed.

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USDA NRCS Soil Survey Laboratory Data Quality

By Rebecca Burt, Research Soil Scientist, Soil Survey Laboratory, National Soil Survey Center, NRCS, Lincoln, Nebraska.

The quality and credibility of data are critical to any measurement program that collects analytical data over a long period of time for comparative purposes. The NRCS Soil Survey Laboratory is working and cooperating with other national and international agencies to confirm and sometimes achieve greater quality of laboratory data. Some of the quality-control activities are described in the following paragraphs.

Around the world there are many laboratories which analyze soil samples for content of carbon, nitrogen, phosphorus, metals, CEC, and many other elements and parameters. The results of these analyses are essential in the domains of agriculture (fertilization and soil management), nutrition, health, environmental management, etc. In order to evaluate the accuracy and precision of the analytical procedures used, an International Soil-Analytical Exchange (ISE) was established by Wageningen Agricultural University, The Netherlands, involving over 300 laboratories in many countries, including the NRCS Soil Survey Laboratory. As the ISE indicates in its quarterly reports:

> The ISE has proven useful to many laboratories just beginning work in the analyses of soil samples. On the other hand, laboratories with a long-

> standing experience in this field have an instrument to check their methods and analytical results continuously.

In the near future, accreditation bodies will oblige laboratories to participate in such programs. The Soil Survey Laboratory has no such obligation, but voluntary activity indicates an interest in and involvement with international groups that are working to improve the quality of laboratory data. The Soil Survey Laboratory provides comparative data on a quarterly basis for such analyses as CEC, NH_4OAc extractable bases, $CaCO_3$, pH (water, $CaCl_2$, KCl), phosphorus (Mehlich III, Olsen P, Bray P-1), and particle-size analysis.

The NRCS has provided assistance in obtaining bulk samples for the North American Proficiency Testing Program (NAPT), an activity of the Soil Science Society of America with over 200 participating laboratories, and the Soil and Plant Analysis Council. The Soil Survey Laboratory coordinated these efforts. The NRCS uses both field data (e.g., transects and pedon descriptions) and laboratory data to define map units and their component soils. The NRCS staff used this information and aerial photographs to select sampling sites for soil series suggested by NAPT and the Soil and Plant Analysis Council. Bulk samples were taken only after an onsite examination by NRCS soil scientists to ensure that the properties of the particular soil were within the range designated by the benchmark soil characteristics. NRCS has provided bulk samples for 20 benchmark soils from 20 states. NRCS soil scientists used the sample collection procedures described in Soil Survey Investigations Report (SSIR) No. 42, *Laboratory Methods Manual*. The soil survey sample collection procedures for laboratory analysis are an important part of the U.S. National Cooperative Soil Survey. The coordination of these procedures with mapping and site selection contributes to the quality assurance process for the laboratory characterization and for the overall U.S. National Cooperative Soil Survey. These bulk samples helped to maintain the programs of the Soil and Plant Analysis Council and NAPT for several years. Bulk samples of selected benchmark soils have also been collected for a collaborative effort between NRCS and the U.S. Geological Survey (USGS) to provide soil standards for total elemental analyses.

In addition to providing direct assistance to these testing and exchange programs, the Soil Survey Laboratory has actively participated in some of these programs by purchasing soil standards of “known values” and analyzing soils by our methods for purposes of providing comparative data. This participation has provided the Soil Survey Laboratory an opportunity to statistically compare our data with the data of many other laboratories for a number of important chemical and physical analyses. We have also cooperated with a number of individual private, university, and Federal laboratories (e.g., U.S. Salinity Laboratory) to exchange soil samples for purposes of providing comparative data of some less commonly determined analyses, such as gypsum and selective dissolutions (e.g., acid oxalate Fe, Al, Fe, Si, and P).

The Soil Survey Laboratory has participated in the method studies of the Association of Official Analytical Chemists (AOAC) International as “referees” and as “collaborators.” The laboratory participated as a collaborator in the method study of Bray P-1. Unlike ISE, the AOAC program does not study laboratory proficiency but rather evaluates the methods themselves. Participation is voluntary. Our involvement in such programs will provide useful information to an international standards group about the consistency and reproducibility of methods.

The Soil Survey Laboratory is an active voting member of the American Society of Testing and Materials (ASTM) International. ASTM was founded in 1898 as a scientific and technical organization formed for the development of standards. It is the world’s largest source of voluntary consensus standards with membership encompassing such diverse groups as government agencies, universities, and the private sector. The Soil Survey Laboratory has submitted some of our methods (e.g., particle-size analysis by sieve and pipette) for consideration as new ASTM methods.

Our participation in these national and international programs is in addition to the internal measures of quality control (QC) integral to each Soil Survey Laboratory standard operating procedure (SOP), documented in the SSIR No. 42. Some of these internal QC measures include the use of laboratory soil standards for each batch of analyzed samples, use of Standard Reference Materials (SRMs) and high-quality reagents, and the establishment of criteria for instrument and method calibration, data validation, and data reporting. The use of SSIR No. 42 as a reference by many laboratories, both nationally and internationally, has established the NRCS Soil Survey Laboratory as a leader in the development of standards. Current activities by laboratory personnel in this effort include the development of new methods, updating of current methods, and publication of an updated version of SSIR No. 42. Unlike the use of methods associated with accreditation bodies or voluntary consensus standards groups, the use of the Soil Survey Laboratory methods by other laboratories is primarily based on a scientific, field-related tradition.

The Soil Survey Laboratory quality-control efforts have improved data quality over time. Personnel at the Soil Survey Laboratory will continue to improve methodology and quality control of each procedure. Changes in procedures and development of new methodology are integral to the performance of the Soil Survey Laboratory as it answers the demands of agency scientists, conservationists, and other cooperators. ■

Review of *The Skeptical Environmentalist*

By Russ Kelsea, National Leader, Soil Survey Technical Services, National Soil Survey Center, NRCS, Lincoln, Nebraska.

When I was first introduced to Bjørn Lomborg's book, *The Skeptical Environmentalist: Measuring the Real State of the World*, published by Cambridge University Press in 2001 (ISBN 0 521 01068 3; paperback, 515 pages), I was a bit (ahem) skeptical. I had recently read another tome which took a contrarian view and found the logic unconvincing. Nevertheless, I was determined to keep an open mind about Lomborg's book because challenges to conventional wisdom are often rejected by the established scientific community, at least initially, even when the challenges ultimately prove correct (Kuhn, 1970).

Lomborg challenges the commonly accepted view that humans, by their policies and technology, have a detrimental impact on the environment. Lomborg calls the rhetoric associated with this point of view the "litany" and cites Worldwatch Institute, World Wide Fund for Nature, Greenpeace, and many others as purveyors of the litany. By way of challenge, Lomborg asserts that although problems exist, the state of the world is good; in fact, it is better than it has ever been and is likely to get even better. In a series of examples ranging from natural resources and global warming to energy and medicine, Lomborg attacks the statistical techniques used to perpetuate the litany. In so doing, he reinterprets many of the same statistical sources to demonstrate improvement instead of degradation.

I found from reading selected topics, including soil erosion, acid rain, forest decline, and a few others, that in some cases Lomborg makes a compelling argument. In other cases, however, he seems to commit the same sins of narrow data selection and over-generalization that he accuses others of making. I left the book with the impression that statistics alone do not imply an understanding of natural systems and that Lomborg's criticism directed at purveyors of the litany for predicting environmental catastrophes that failed to materialize is misplaced because the litany may have prompted humankind to take corrective action in time to avert the catastrophes.

This book is quite clearly controversial and has generated considerable debate. Scientists from many disciplines reject Lomborg's statistical approach and disagree with his conclusions. *Scientific American*, *Nature*, and *The Economist* each published some of the scientific debate, and Lomborg provides links to several of the articles on his Web site at http://www.lomborg.com. Of particular interest are the actions taken by the Danish Committees on Scientific Dishonesty (2003). Acting on complaints filed with the DCSD, the Committees first had to decide whether Lomborg's book even qualified as a scientific publication or was merely a provocative discussion-generating publication. In its final ruling, the DCSD treats Lomborg's book as a scientific publication and finds that by its systematically biased representation, the book is contrary to standards of good scientific practice and under Danish definition falls within the concept of scientific dishonesty.

Whether you agree with Lomborg or his critics, one thing is certain—the book has caused many scientists to look more closely at their science. We are challenged once again to gather facts, analyze the evidence, and think critically for ourselves. Not a bad challenge in my opinion.

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A Note on "40-Odd Sonatas"

By Stanley P. Anderson, Editor, National Soil Survey Center, NRCS, Lincoln, Nebraska.

When I started working as a soil survey editor in 1974, soil scientists in the Soil Survey Division let the editorial staff know that they were confused about how we hyphenated terms for drainage classes. We hyphenated "well-drained soil" but did not hyphenate the other drainage terms because they include *ly* adjectives (as in "poorly drained soil"). Also, we did not hyphenate "well drained" when it occurred as a predicate adjective (as in

"The soil is well drained"). We were following the rules of style manuals, including the *GPO Style Manual*, which specifies the following (page 78):

> **6.18.** Print without a hyphen a compound predicate adjective the second element of which is a past participle. Omit the hyphen in a predicate modifier of comparative or superlative degree.

The manual includes the following among the examples of rule 6.18: "The paper is fine grained."

The other relevant GPO rule is as follows (page 78):

> **6.20.** Do not use a hyphen in a two-word unit modifier the first element of which is an adverb ending in *ly*, nor use hyphens in a three-word unit modifier the first two elements of which are adverbs.

This rule applies to the *ly* drainage terms, such as "very poorly drained" and "poorly drained." The editors decided to banish the hyphens in "well-drained soil" and in color terms, such as "yellowish-brown," which were also perplexing to soil scientists (and to editors). I had no strong attachment to the hyphen in "well-drained soil" and rejoiced at the banishment of hyphens in color terms. Bill Hamilton, the head of the Soil Survey Editorial Staff in Hyattsville, Maryland, informed the Department of Agriculture that we were sending these hyphens into exile.

Having removed the hyphen in "well-drained soil," the editors were obliged to, uh, dehyphenate similar terms, such as "fine-textured soil" and "fine-grained soil." We thought that we needed a new rule for editors to follow. Noting that I was a budding Ph.D. type, Bill Hamilton asked me to write the rule. My notion was that we should hyphenate a unit modifier if one of the elements is a noun, as in "land-use planning" and "organic-matter content."

Hamilton passed around my new rule, which was promptly ignored by most of the editors on the staff. These editors included Phil Chavez, who was editing the prewritten material, in which I noted numerous instances of "organic matter content" and "land use planning." So much for my new rule.

I did not wish to reedit the prewritten material, so even I gave up on my clever little rule, deciding that the only time a hyphen must be used is when the meaning is affected, as in "40-odd sonatas" and "40 odd sonatas."

When I edited the 2002 Soil Planner, I followed the lax "40-odd-sonata" rule and thus did not hyphenate "well drained soil." At the last minute, the planner was reviewed by an editor in the Department of Agriculture, who added hyphens not only in references to "well drained soils" but also in the sentence "Antigo soils are well drained." I did not object to the hyphen in "well-drained soils," but I asked that the hyphen added to the sentence about Antigo soils be deleted because it violates GPO rule 6.18. When the planner was published, I turned to the pages for December and looked for the description of drainage, which reads as follows: "Antigo soils are well-drained." The offending hyphen speared me in the eye. ■

Soil Taxonomy Forum

By Bob Engel, Soil Scientist, National Soil Survey Center, NRCS, Lincoln, Nebraska.

The Soil Taxonomy forum is back. We were unable to continue the topical question and answer forums on the National Soil Survey Center Web site at its new location (http://soils.usda.gov). Dr. John Galbraith of Virginia Tech. University in Blacksburg, Virginia, is now hosting the Soil Taxonomy forum. The address of the forum is: http://clic.cses.vt.edu/soiltax/soilt.html. The forum can also be accessed from the "Classification" section of the National Soil Survey Center Web site.

This forum is for questions, discussions, and issues on topics concerning classification of soils using Soil Taxonomy. Anyone may post a question or join in the discussions. Bob Engel, Soil Scientist at the National Soil Survey Center, will continue as moderator for this forum. ■