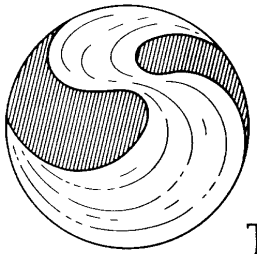
STREAM SYSTEMS TECHNOLOGY CENTER



STREAM NOTES

To Aid in Securing Favorable Conditions of Water Flows

January, 1993

User Needs Assessment Summary

At the National Hydrology Workshop held in Phoenix last spring and during contacts with the Regions throughout last year, the STREAM TEAM passed out a User Needs Assessment. We asked field personnel to respond to two basic items:

1. Identify three local stream or watershed related issues for which you need additional research information or technology.

2. Based on your knowledge of the Stream Systems Technology Center mission, list three tasks or areas that you would like to see us emphasize.

Keep in mind that the response rate was lower than expected and that this was not a scientifically designed survey. Also note that of the 65 replies, roughly 80 percent were hydrologists with the next largest group consisting of fisheries biologists. Nevertheless, the response provides an indication of user needs.

Local Needs & Priorities

Responses were highly divergent and covered a wide range of concerns reflective of the diversity of local issues that the various Forests deal with on a daily basis. While we recognize that every local issue or need is important, we were interested in identifying general areas of common concern.

The three most frequently identified local needs were:

1. cumulative effects analysis;
2. improved sediment yield models; and
3. the ability to define the linkages between sediment models, physical stream characteristics, fisheries habitat; and fish populations.

Other needs pertained to various kinds of monitoring, riparian management and/or inventories, and instream flow quantifications.

"One message comes through loud and clear from this survey: the need for improved technology transfer and better sharing of technical information among specialists working with stream systems"

STREAM NOTES *is produced quarterly by the Stream Systems Technology Center, Fort Collins, Colorado.*

The PRIMARY AIM *is to exchange technical ideas and transfer technology among scientists working with wild-land stream systems.*

CONTRIBUTIONS *are voluntary and will be accepted at any time. They should be typewritten, single-spaced, limited to two pages in length. Graphics and tables are encouraged.*

Ideas and opinions expressed are not necessarily Forest Service Policy. Trade names do not constitute endorsement by the Forest Service.

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For the most part, however, responses covered the full spectrum of possible watershed issues: watershed rehabilitation techniques, defining watershed condition and channel stability, ski area development, the economic value of riparian areas, placer mining impacts, buffer strip design, impacts of silviculture on wetlands, user friendly PC applications in hydrology, and so on.

The list indicates a need for improved communication of research results to the field and a need to communicate more effectively among ourselves since many of of the identified needs have been successfully addressed by others. Finally there may also be a need to improve the training of new professionals by passing down our experience to them more effectively.

Stream Systems Technology Center Priorities

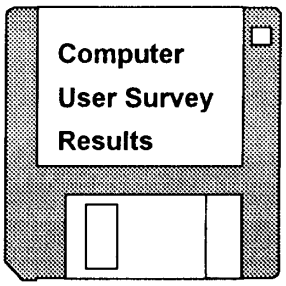
Feedback about STREAM TEAM priorities were equally varied although somewhat in line with local needs.

Cumulative impact assessment procedures were identified most frequently. This was followed closely by revision of the existing channel maintenance instream flow procedure to incorporate lessons learned in Colorado.

A role in training was commonly listed although there was no consensus on the content of the training. Opinions ranged from non-technical items such as expert witness training and marketing a watershed program to more technical training including development of continuing education courses.

Technology transfer and the summarizing of existing knowledge was another commonly identified area. Included here was improved knowledge about physical stream processes and better distribution of research findings. Finally, the general area of watershed condition, stream health concepts, linkages to fish habitat, and water quality monitoring techniques were often listed.

We will use this information as we plot the future direction for the Stream Systems Technology Center. The diversity of opinions about the direction the STREAM TEAM should take presents us with many challenges. One message comes through loud and clear from this survey: the need for improved technology transfer and better sharing of technical information among specialists working with stream systems. We hope that this newsletter, and your participation in it, will help do that.

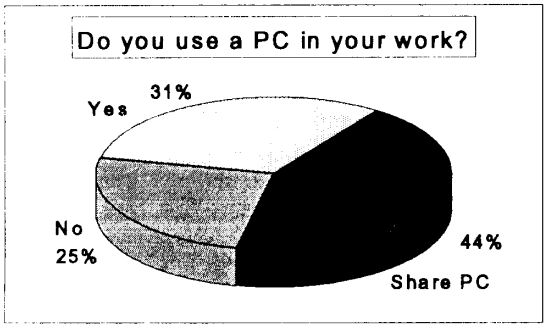


At the National Hydrology Workshop held in Phoenix last spring and during contacts with Regions during last year, the Stream Team also asked about PC computers. We were primarily interested in four questions about the state of personal computer (PC) use among Forest Service specialists:

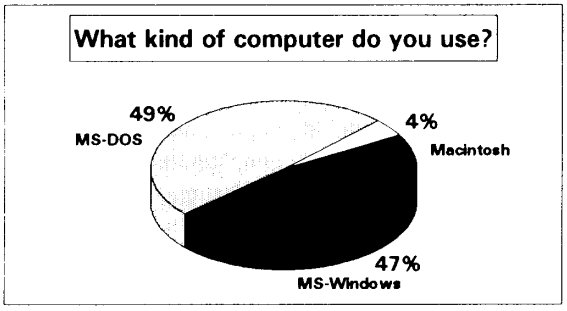
1. How widely are personal computers used?
2. What operating systems are most common?
3. What software is used?
4. What analyses are done with PCs?

Since this was not a scientifically designed survey, extensive details about the demographics of the respondents will not be provided. Suffice it to say that out of 65 respondents, roughly 80% were hydrologists with the next largest group consisting of fisheries biologists. Results are thought to be reasonable approximations of reality.

Seventy-five percent of respondents have access to a PC with the majority having to share a PC with another person or staff group. One out of 4 do not use PCs at all in their work.



IBM-compatible computers are the overwhelming systems of choice among users. IBM based operating systems are about evenly split between Microsoft DOS and Windows. No other operating systems were identified by those responding.



Hydrologists and fishery biologists are using the full array of available commercial software including spreadsheets, word processors, databases, graphics packages, and statistical programs. The following is a brief listing of favorite programs.

Word Processing: Wordperfect is the application of choice (86%) with Microsoft Word (5%) a distant second.

Spreadsheets: Lotus 1-2-3 has the lead (51%) followed by Quattro Pro (29%) and Excel (20%).

Databases: DBase IV is the overwhelming favorite (50%) with the closest competitors being R-Base (14%) and Paradox (14%).

Presentation Packages: Harvard Graphics is the clear choice (84%) with Freelance (6%) a distant second.

Statistical Analysis: A wide array of packages are being used with Statgraphics (30%) and Number Cruncher (NCSS) (26%) the favorites followed by SAS (15%), Systat (15%), and Minitab (7%).

In addition to commercial software, a large number of government or user developed software is used. Of the 39 programs identified most are used by only one or two respondents. Exceptions are the R-1 water yield and sediment program, WATSED, and SCS programs TR-20 and TR-55.

The following are examples of PC programs used by respondents:

CAGCOM
-Computer Assisted Gully Control Operational Model

HEC-1
- Corps of Engineers Flood Hydrograph

HEC-2
- Corps of Engineers Water Surface Profiles

HYSED
- Region 2 Water and Sediment Yield Model

PASSFA
- Parameter Selection System for Streams in Forested Areas

PEBBLES
- Wolman Pebble Count Data Reduction

RAINRUN
- SCS Runoff Curve Number Hydrograph Program

RASI
- Riffle Armor Stability Index

RUSLE
- Modified USLE Model

R1R4SED
- R1/R4 Sediment Yield Model

R4CROSS
- Stream Channel Hydraulics Program

SHADOW
- Stream Temperature Model

TR-20 - SCS Project Formulation (Runoff Curve Number Hydrographs)

TR-55 - SCS Graphical Peak Discharge Method

WATSED - R1 Water and Sediment Yield Model

WRENSS - Water Yield Model

"Most of the analysis appears to be done with commercial software programs rather than widespread use of specific PC-based hydrologic analysis programs."

Narrative responses about the types of analyses that are currently done with PCs indicate that they are used for a full range of technical tasks such as cumulative effects, water yield, sediment delivery, statistical data analysis, data storage, graphing, and presentations. Most of the analysis appears to be done with commercial software programs rather than widespread use of specific PC-based hydrologic analysis programs. This seems to suggest that each user is individually developing applications to suit local needs.

Reprint of "Stream Dynamics: An Overview for Land Managers"

Burchard Heede's report on stream dynamics, has been revised and reprinted by the Rocky Mountain Station. The reprint was supported by the Stream Systems Technology Center to enable land managers to "secure favorable conditions of water flows" from National Forests.

The report, originally issued in 1980, is still relevant and is intended to help land managers understand general concepts of stream behavior. The objective is to help managers understand how management actions affect streams.

The report presents a general outline of water flow and sediment transport as basic to all channel changes. It describes stream equilibrium conditions and adjustment processes that will result if equilibrium is lost or altered by nature or management actions.

Major topic areas covered include: basic fluvial processes, the concept of dynamic equilibrium, and complex channel responses. Major adjustment processes discussed include bar formation, channel pattern, channel shape, channel banks, longitudinal profile relationships, aggradation, degradation, and armoring. Theory is included only where helpful to explain concepts. The text is structured so the reader can consider only those processes of interest.

Copies of "Stream Dynamics: An Overview for Land Managers," USDA Forest Service General Technical Report RM-72, by Burchard H. Heede can be obtained from the STREAM TEAM upon request. Please send requests via the Data General to STREAM:S28A if possible. Alternatively, FAX requests to 303-498-2306, or phone Penny Williams at (303) 498-1731.

Improved Sediment Transport Model

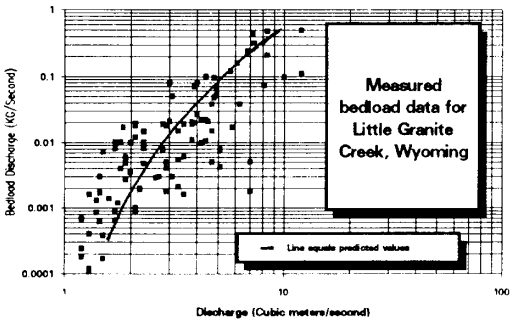
The Stream Systems Technology Center recently entered into a contract with the U.S. Geological Survey to develop an improved method for the calculation of flow and bed material transport in streams with large relative roughness. Ned Andrews and Jonathan Nelson of the U.S. Geological Survey, Water Resources Division, Boulder, Colorado will conduct the work.

Relative roughness as used in this context refers to channels with beds composed of sediment sizes that are a significant fraction of the flow depth (more than about 5%). Simply put, this translates into gravel and cobble-bed streams, or more generically, most of the channels found in steep, mountainous regions.

All of the information necessary to run the model can be collected in a single day and rely on relatively simply and commonly used measurement techniques (Wolman pebble counts, cross-section surveys, and survey of channel slope). The model can be used to examine the impacts of relatively rare flow events or to evaluate the long-term effects of natural or humanmade changes to streamflows, such as dams or diversions. For example, the procedure will allow hydrologists to estimate bedload transport at, above, and below bankfull flow.

The completed contract will include: (1) a field survey procedure for selecting suitable stream reaches, identifying significant channel features, and describing channel morphology and bed material size distribution, (2) an integrated, user friendly, menu driven, PC-based computer program for entering the necessary information, calculating stage-discharge and discharge-bed material transport relations, as well as tabular and graphical presentation of results, and (3) a handbook describing the method and interpretation of results. Products will be ready for evaluation before the end of FY 1993.

To date the method has been field tested on a reach of Little Granite Creek, a small creek located in the Bridger-Teton National Forest. Computed flow and sediment transport rating curves showed good agreement with measured data, especially considering that all of the data needed to apply the model to this site were collected in a single day.



Continued development and field testing of the model is planned. A cooperative effort is in the discussion stage between the U.S. Geological Survey and U.S. Forest Service researchers using experimental watersheds.

For additional information about the theoretical basis behind the method and specific information about the Little Granite Creek field test, see:

Nelson, J.M., W.W. Emmett, and J.D. Smith. 1991. Flow and sediment transport in rough channels. Pages 55-62, Section 4, *in* Interagency Committee on Water Data, Subcommittee on Sedimentation. Proceedings of the Fifth Interagency Sedimentation Conference, Las Vegas, Nevada, March 18-21, 1991. Volume 2. Document 1991 0-288-410. U.S. Government Printing Office, Washington, D.C., USA.

XSPRO

A Channel Cross-Section Analyzer

The U.S. Forest Service and the Bureau of Land Management recently completed work on development of an interactive, menu-driven personal computer software package named XSPRO designed to assist watershed specialists in analyzing stream channel cross section data.. Program developers include Gordon Grant, Joseph Duval, Greg Koerper, and James Fogg.

Surveys of stream channel cross-sections provide important information for hydrologists, river engineers, geomorphologists, fishery biologists, and other professionals associated with river management issues. Channel cross-section data are used for channel design, riparian areas restoration, placement of instream structures, and instream flow assessments.

XSPRO has been specifically designed to analyze cross-section data in an interactive, user-friendly PC environment. The menu-driven program has easy-to-read input and output screens, and an integrated graphics package to facilitate data entry.

XSPRO uses a resistance equation approach to single cross-section hydraulic analysis, and is capable of analyzing both the geometry and hydraulics of a given channel cross section. XSPRO was specifically designed for use in high-gradient streams and supports three alternative resistance equations for handling boundary roughness and resistance to flow. Resistance equations supported include: (1) Manning's Equation with provisions to vary n with changes in depth, (2) Resistance Equations suggested by Thorne and Zevenbergen, and (3) Jarrett's Equation for Manning's Roughness Coefficient.

XSPRO was specifically designed for use in high gradient streams. XSPRO will quickly become the cross-section analysis program of choice for many wildland hydrologists.

In addition, the program allows the user to subdivide the channel cross-section in order to separately analyze overbank areas, mid-channel islands, and high water overflow channels. The program further allows input of variable water-surface slopes so that slope may be varied with discharge to reflect natural conditions

Documentation comes in two parts. The first section, Program Theory and Techniques, provides exceptionally well written technical background material. Topics covered include assumptions and limitations, a detailed description of each of the resistance equations, and a section on field procedures. Field techniques discussed include reach selection, cross section surveys, water-slope measurements, bed-material particle size determinations, and discharge measurements.

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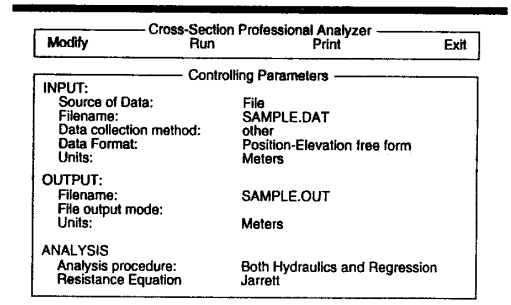
The second section, Program Operations, provides a comprehensive description of how to make the program run, including data input, output, and running an analysis. The section ends with an example data set to get users started quickly.

We found the program relatively easy to learn and use. The documentation is especially well written and clearer than many commercial software user guides. XSPRO will quickly become the cross section analysis program of choice for many wildland hydrologists. It has all of the features of R2-CROSS, is available on a PC platform, and is much easier to use. It also has all of the features of R4CROSS and exceeds that program in the fact that XSPRO is well documented.

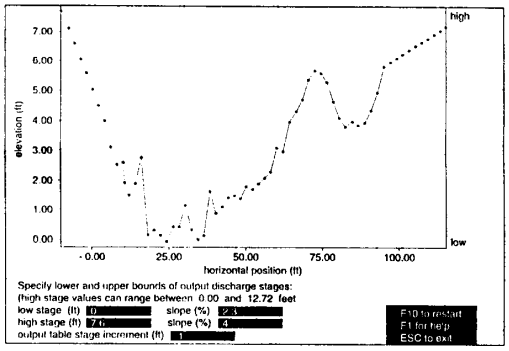
XSPRO will run on any 100 percent IBM PC/XT/AT compatible computer with DOS 2.1 or higher, 256K of RAM, EGA, VGA, Hercules, or AT&T 400 graphics, and at least one floppy drive. Copies of the program are provided along with the documentation on a 5.25 inch floppy disk.

XSPRO is in the public domain and is provided like most software on an "as-is" basis without warranty of any kind. The user must assume all responsibility for the accuracy and suitability of the program for any specific application. In no event will PNW, USFS, or BLM be liable for any damages arising from the use of or inability to properly use the program.

XSPRO is documented in USDI Bureau of Land Management and USDA Forest Service Technical Note 387 (BLM/SC/PT-92/001+7200), "XSPRO: A Channel Cross-section Analyzer," August 1992, authored by Gordon, E. Grant, Joseph E. Duval, Greg J. Koerper, and James L. Fogg.



XSPRO Main Screen showing a menu window across the top to modify, run, and print data and a second larger window, to control input, output, and analysis parameters



Sample XSPRO cross-section graph. Input to the bottom of the screen controls analysis parameters for any individual run. This part of the screen varies as a function of the resistance equation used.

Copies of Technical Note 387 are available at no charge by writing:

Bureau of Land Management Service Center
Printed Material Distribution Section
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Denver Federal Center
PO Box 25047
Denver, CO 80225-0047

Editorial Policy

We need voluntary contributions of relevant articles or items of general interest. To make this newsletter a success, YOU need to take the time to share innovative approaches to problem solving that you have developed.

Please submit typed, single-spaced contributions limited to two pages. Include graphics and photos that help explain ideas.

We will reserve editorial judgments regarding appropriate relevance, style, and content to meet our objectives of improving scientific knowledge. Send all contributions to: Stream Systems Technology Center, Attention: STREAM NOTES Editor.

Please share copies of STREAM NOTES with your friends and associates. We have attempted to mail a copy of the newsletter to each Forest Service hydrologist and fisheries biologist using lists provided by the Regional Offices. **Please check your address and notify us with any corrections.**

Anyone wishing to be added to our mailing list or requiring a change of address should send their name and street mailing address via DG to STREAM:S28A or write to our mailing address at USDA Forest Service, Stream Systems Technology Center, Rocky Mountain Station, 240 West Prospect, Fort Collins, CO 80525.

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