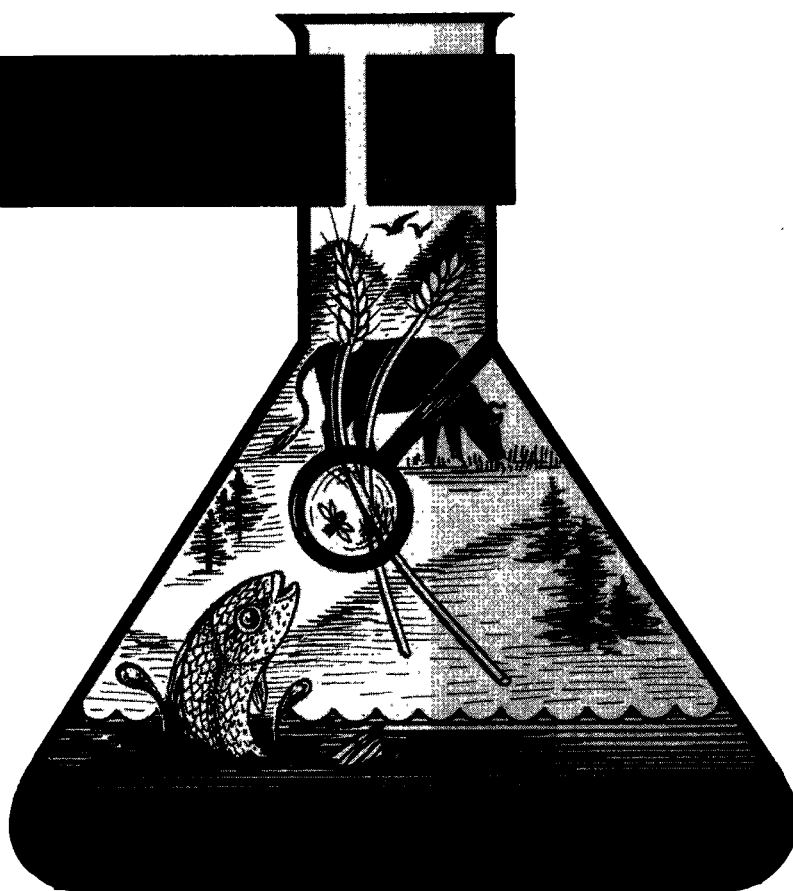




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NON POINT SOURCE PROGRAM

Status Report



**Corvallis Environmental Research Laboratory
Criteria and Assessment Development Division
Non Point Source Program**

Status Report

October - December 1977

printed on recycled paper

Environmental Protection Agency
Region 9
San Francisco, California
94104

ENTRANCE

AGENCY



NPS STATUS REPORT

576-213
The Corvallis Environmental Research Laboratory (CERL) has formally developed a comprehensive research program for the determination and evaluation of the ecological effects of non point source (NPS) pollutants. This program, initiated October 1, 1977, brings together 17 professional staff members (see staffing roster) and will approach the problem from an inter-disciplinary, systems effect perspective. To help insure that the research approach and outputs are compatible with EPA's operational programs, an NPS Research Advisory Committee (RAC) and a NPS Coordinator have been appointed. At the present time the RAC has membership representing the Office of Water Planning and Standards, Washington D.C. and Regions IV and X, Atlanta and Seattle, respectively. However, because of interest, the possible expansion to include additional members including non-EPA personnel, is currently under review. Walter Rittall has been appointed the CERL NPS Coordinator and has the overall responsibility for program direction.

Non point source research is being conducted at other EPA Laboratories with the Environmental Research Laboratory at Athens, Georgia, having the principal responsibility for developing methods to predict the transport of NPS pollutants and to quantify the resultant streamside loadings. These activities are coordinated thru the Office of the Associate Directors at Athens and program information can be obtained from either George W. Bailey or Walt Sanders (comm 404-546-3307 or FTS 250-3307).

Since this is the first mailing of this report please review the attached form and notify us, by returning the form (1) if you wish to continue to receive this report (2) desire an address change or (3) desire to add additional names to the list. In addition, please review Sections II and III for information relative to potential research interests and employment needs. This document contains preliminary information, therefore please do not act on the information without first communicating with the individual whose name and number (comm 503-757- and FTS 420-) appear with the item of interest.

As CERL's research on the ecological effects of NPS pollutants progresses, accomplishments will be described in subsequent progress reports. If the results are of a significant nature, Research Highlights will be issued to disseminate the information immediately. Copies of progress reports, Research Highlights and research reports can be obtained from CERL's Office of Public Awareness (Chris West - 4600).

I. Program Objective and Goals for FY-78

In the development of a comprehensive research approach, four broad program objectives were established. These objectives are all oriented toward aquatic ecosystems and are:

- (1) To determine the ecological effects of NPS pollutants and pollutant loadings.
- (2) To determine the ecological effectiveness of NPS controls.
- (3) To develop a regional approach relating land use activity to NPS pollution problems.
- (4) To develop a scientific basis for the establishment of "wet weather" stream standards* emphasizing the non-steady state nature of NPS pollutants.

The development of a specific work plan for FY-78 required more definition and consequently specific research goals were established.

The overall research goal established was the development of an understanding of how non-steady state phenomena and watershed activities relate to in-stream physical consequences and impact stream biotic communities. Three subgoals were then defined which are descriptive of the research approach being followed and serve to structure the in-house research activities actively being pursued. These are:

- Subgoal A: Develop, evaluate and/or verify methods for measuring change in community structure.
- Subgoal B: Define the relationship between stress and community structure.
- Subgoal C: Define how watershed characteristics and activities relate to stream flow and NPS inputs (i.e., stress factors).

What we are attempting to do is as follows:

Given that NPS stream inputs are driven by precipitation, they are therefore stochastic in nature and are the most severe during periods of increased flow. Existing water quality data and standards, predicated on dry weather flow conditions become of little value in describing NPS loadings and concentrations. To assist Regional personnel in controlling NPS inputs, wet weather "standards" and data bases must be developed.

* Standard in this context is meant to imply the broadest possible definition and is not restricted to strict numerical limits.

The Agency's current approach to NPS control is a form of source control [i.e., the Best Management Practice (BMP)]. While it is possible to predict reductions in yearly loadings as a result of imposed management practices, it is not currently possible to say that such reductions are effective in maintaining and enhancing many of the desired uses of the impacted water body. In this regard, the impact of, and protection of water use takes precedence over conventional water quality effects and standards. Thus CERL's researchers are attempting to develop assessment techniques that will predict the impact on the water body, as a function of desired water use. The current effort focuses on Pacific Northwest streams in forested watersheds where fish production is one of the desired uses, hence the emphasis on biological communities.

As will be seen in the following descriptions of the planned in-house research projects to be undertaken, CERL researchers are attempting to develop the methodology to quantify the in-stream NPS pollutant stress and to evaluate the resultant impact on the system relative to a desired use. These data, we hope, will serve as the basis for establishing rational assessment techniques for NPS pollutants.

II. In-House Projects FY-78

The NPS Program, subject to the availability of funds, is seeking to expand the technical expertise of its in-house staff thru use of the provisions of the Intergovernmental Personnel Act (IPA). This Act allows EPA to bring on board professionals from other governmental or state agencies, including universities, for a limited period (1-2 years), subject to a cost sharing agreement between the participating agencies.

Candidates with expertise in sediment transport and related in-stream processes of erosion and deposition are being sought to work with the Ecosystems Modeling and Analysis Branch. Candidates with expertise in functional analysis of benthic communities and biological data interpretation/statistics are being sought to support the activities of the Special Studies Branch. Prospective candidates should contact the NPS Coordinator directly for more details on programatic constraints and timing.

In-house research projects are briefly presented in the following section. If detailed information as to approach, scope, etc., is desired, copies of CERL's Work Plan For Ecological Effects of Non Point Source Pollutants can be obtained by contacting the NPS Coordinator (Walter Rittall - 4718).

Subgoal A:

Project Title:

Community Structure as a Measure of Stress

This project will be conducted at a small experimental stream with a highly stressed section (sedimented) and a natural upstream section. Several methods for measuring and evaluating community structure will be tried and, if necessary, modified. The work will culminate in the selection of an approach and the methodology for measuring stress via changes in community structure. (Frank Stay - 4762, Jeff Lee - 4758)

Subgoal B:

Project Title:

Stress-Community Relationships

Using channel and artificial stream facilities at Oregon State University's Oak Creek Laboratory of Biology, research will be conducted to: (1) determine the effect of bed composition and sediment loads on benthic community structure and fish production, (2) develop techniques to simulate the physical and biological characteristics of small woodland streams and (3) determine the need for additional test facilities for expanding the experimental range of flow and velocity. These efforts should aid in the development of upper limits of steady state sediment levels to preclude adverse effects on fish production. These facilities may be augmented in FY-78 to allow experiments simulating major storm events (Biological Aspects, Clarence Callahan - 4658; Physical Aspects, Mostafa Shirazi - 4751).

Subgoal C:

Project Title:

Effects of Silviculture Practices
on Streamflow and Sediment Load

Using existing data, this project will determine the modifications in flow (hydrograph) and sediment (concentration vs. time) for small streams impacted by various forest management practices. This work will be conducted using short time frames (i.e., hours) consistent with storm events. The output will be used to provide representative non-steady state flow and sediment data for input into ecological effects, laboratory and field experiments (Don Lewis - 4754).

Project Title:

Streamflow as Affected by Silviculture

Data on streamflow and the aerial extent of silvicultural activities will be used to determine how logging affects flow in large watersheds. Aerial photography will be used to examine logging trends, coupled with long-term discharge records to provide predictive relationships. The output will directly assist forest managers in assessing the hydrologic impact of watershed activities and to estimate discharge/sediment relationships for large watersheds (Jim Omernik - 4613).

Project Title:

Relationships Between Non-Point Source Nutrient
Concentrations in Streams and Land Use

This project will be an extension of the National Eutrophication Survey (NES) work completed in 1977. The objective is to increase the understanding of the relationships between NPS nutrient concentrations in streams and overall land usage. The importance of the areal distribution of land uses within watersheds will be specifically addressed and related to in-stream concentrations. (Jim Omernik - 4613).

III. Extramural Projects FY-78

The following section describes three on-going extramural research projects, two grants and one interagency agreement, which were funded in FY-77. In addition, program plans for expenditures in FY-78 are outlined. Pre-proposals relative to any of the identified areas should be mailed to NPS Coordinator, CERL, 200 S.W. 35th Street, Corvallis, Oregon 97330.

On-Going Projects

Project Title:

Plans for Investigation of Non-Steady State Phenomena of Stream
Sedimentation and Effects on Stream Communities and Salmonid Production

Charles Warren, Oregon State University

This project involves a joint EPA/OSU effort to develop a comprehensive research plan to deal with non-steady state stream sedimentation. Investigations to be planned will include laboratory stream, experimental stream channel and field study approaches. A preliminary rationale for integration, generalization and application of results of planned investigations will be developed. (M.S. Shirazi - 4751).

Project Title:

Loading Rates and Ecological Significance of Nutrients
and Acidity in Wet and Dry Atmospheric Precipitation

University of Florida

The principal objectives of this project address four aspects of atmospheric loading phenomena. These include (1) quantifying loadings, (2) evaluating input mechanisms, (3) documenting ecological significance and (4) determining natural and anthropogenic factors affecting atmospheric fluxes of nutrients and acidity via rainfall and dry precipitation. (T. Maloney - 4605)

Project Title:

Effects of Livestock Grazing at the
Starkey Experimental Forest and Range

IAG USFS/EPA

Research will be conducted to determine the effect of cattle grazing practices on water quality of adjacent stream in terms of NPS nutrient and sediment loadings. The scope of the work will include streamside sampling and measurement of physical, chemical and biological indicators of water quality as well as light, precipitation and flow conditions. Flow measurements will be taken under a separate IAG between USFS/EPA. (Ken Malueg - 4761)

Planned Extramural Projects

Literature Reviews:

Literature review(s) are being planned to ascertain the level of knowledge relative to (1) the relationship of macroinvertebrate communities to fish communities in freshwater streams, (2) the spawning requirements of warm water fish species and the effect of sedimentation on the spawning efficiency and (3) the natural variability in stream biotic communities.

Research Grants:

Three research efforts are being planned to supplement in-house studies.

The general areas are as follows:

1. Methodologies for differentiating land runoff from in-stream sources of sediment concentration and loadings.
2. Statistical concepts, designs and approaches for sampling stream biological communities to evaluate NPS pollutant effects.
3. Field application of functional group concepts in assessing NPS pollutant effects.

Grants or Contracts:

EPA has entered into an Interagency Agreement with the U.S. Department of Agriculture to conduct a "Model Implementation Program" where actual BMP's will be implemented to reduce NPS loads and improve water quality. CERL has agreed to support this effort and will conduct a maximum of two field assessments to examine the impact of the BMP's on stream ecology. This effort is subject to obtaining an adequate study site and management practice with acceptable control areas.

IV. Seminars/Workshops/Publications

Seminars:

The following seminars were given by scientists visiting CERL in October/November 1977.

- Dr. H.W. Shen, Colorado State University, "Basic Sedimentation Processes and Their Relationships to Non Point Source Pollution."
- Dave Heller and Diane Mayer, USFS Siuslaw National Forest, Mapleton District, "Land Slide Inventory - Mapleton District, November-December 1975."
- Charles Hawkins, Oregon State University, "Functional Group Approach."
- Dr. J. Neuhold, Utah State University and member of EPA's Ecological Advisory Committee, visited CERL and reviewed the approach of using biological community structural changes as an indicator of stress.

Publications:

- J. M. Omernik, "Nonpoint Source-Stream Nutrient Level Relationships: A Nationwide Study. EPA-600/3-77-105. September 1977. (See attached technical report data form)

NPS Program Staff

<u>Name/Branch</u>	<u>Discipline</u>	<u>ext.</u>
Ted Austin, SSB	Biologist	4659
Bev Bowman, SSB	Secretary SSB*	4612
Clarence Callahan, SSB	Biologist	4658
Cathy Cameron, EMAB	Secretary EMAB*	4752
Mike Crouse, SSB	Biologist	4650
Steve Dominquez, SSB	Biologist	4618
Jack Gakstatter, SSB*	Biologist	4611
Al Katko, SSB	Biologist	4781
Brenda Kennedy	Secretary CAB*	4711
Jeff Lee, EMAB	Physicist	4758
Don Lewis, EMAB	Systems Engineer	4754
Fred Lotspeich, SSB	Soil Scientist	4614
Larry Male, EMAB	Statistician	4753
Ken Malueg, SSB	Biologist	4761
Jim Omernik, SSB	Geographer	4613
Barry Reid, CAB	Civil Engineer	4853
Walt Rittall, CAB	Civil Engineer	4718
Safa Shirazi, EMAB*	Mechanical Engineer	4751
Frank Stay, SSB	Biologist	4762
Bruce Tichenor, CAB*	Sanitary Engineer	4712

*CAB = Criteria and Assessment Branch, B.A. Tichenor, Chief.

*SSB = Special Studies Branch, J. Gakstatter, Chief.

*EMAB = Ecosystems Modeling and Analysis Branch, S. Shirazi, Chief.

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)			
1 REPORT NO. EPA-600/3-77-105		2.	
4. TITLE AND SUBTITLE Nonpoint Source - Stream Nutrient Level Relationships; A Nationwide Study		5 REPORT DATE September 1977	
		6. PERFORMING ORGANIZATION CODE	
7 AUTHOR(S) James M. Omernik		8. PERFORMING ORGANIZATION REPORT NO.	
9 PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Research Laboratory-Corvallis, OR Office of Research and Development U.S.Environmental Protection Agency Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO. 1BA029	
		11. CONTRACT/GRANT NO.	
12 SPONSORING AGENCY NAME AND ADDRESS same		13. TYPE OF REPORT AND PERIOD COVERED Final - 1972-1977 - InHouse	
		14 SPONSORING AGENCY CODE EPA/600/02	
15 SUPPLEMENTARY NOTES			
16 ABSTRACT <p>National Eutrophication Survey (NES) data for a nationwide collection of 928 non-point source watersheds were studied for relationships between macro-drainage area characteristics (particularly land use) and nutrient levels in streams. Both the total and inorganic forms of phosphorus and nitrogen concentrations and loads in streams were considered.</p> <p>For both nationwide and regional data sets, significant correlations were found between general land use and nutrient concentrations in streams. Mean concentrations were considerably higher in streams draining agricultural watersheds than in streams draining forested watersheds. The overall relationships and regionalities of the relationships and interrelationships with other characteristics are illustrated cartographically and statistically.</p> <p>Two methods are provided for predicting nonpoint source nutrient levels in streams; one utilizing mapped interpretations of NES nonpoint source data and the other, regional mathematical equations and mapped residuals of these equations. Both methods afford a limited accountability for regional characteristics.</p>			
17 KEY WORDS AND DOCUMENT ANALYSIS			
a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Land Use* Nutrients* Watersheds* Phosphorus* Nitrogen* Loadings Concentrations		Eutrophication Stream Flow Animal Unit Density Soils Geology	Nonpoint Source Nutrients 02A 02E 04A 04C 05A 05C 05G
18 DISTRIBUTION STATEMENT RELEASE TO PUBLIC		19 SECURITY CLASS (This Report) UNCLASSIFIED	21. NO. OF PAGES 163
		20 SECURITY CLASS (This page) UNCLASSIFIED	22. PRICE



PLEASE NOTE

We are compiling a separate mailing list to provide information on the non point source research being conducted at the Corvallis Environmental Research Laboratory.

If you would like to continue to receive this kind of information or if you know of others who would, please fill out the address form below and return it to us.

To mail, detach and fold this sheet on the dashed line and staple so the preprinted CERL address and mailing imprint appear on the outside.

Check the appropriate item(s). To help us avoid errors, please type or print clearly. Don't forget your ZIP code.

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