WATER RESEARCH IN THE UNITED STATES
A ROLE FOR UCOWR

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The water resources research community in the United States has sprung from three intellectual heritages. The paradigm that dominated the recent past was expressed in a 1973 report by the National Water Commission that advocated a rationality based on the principles of economic efficiency as a basis for national water policy. The perspective of the second heritage, expressed in a 1991 report by the National Research Council, spoke for the need for a sharper scientific basis through establishment of hydrology as a distinct science or focus for critical inquiry. The community from the third heritage just recently published a research agenda called "The Freshwater Imperative" that focuses on both science and policy to promote ecological integrity.

The scientists who work from these three paradigms read separate literature, join different professional societies, and seldom interact in depth. Even though each expresses great concern on water issues, each is going its separate way and is often seen to be in opposition to the others to the detriment of their common cause. Science, the environment, and public policy are all losers.

One thing that the three groups have in common is that their intellectual leaders are largely in universities. However, UCOWR delegates are nearly entirely drawn from faculty with the first perspective. Almost none of the long lists of people who participated in preparing the research agenda found in "Opportunities in the Hydrologic Sciences" and in "The Fresh-water Imperative" are active in UCOWR. The same can be said for the many scientists whose water research is funded by the National Science Foundation.

In the early days of UCOWR, delegates were drawn from the top water scientists in the universities. I could list Ven Te Chow, Stephen Smith, Ray Linsley, Carl Kindsvater, Warren Hall, Len Dworsky, Bill Whipple, Emory Castle, and many others covering the full range of water-related disciplines. Senior scientists came together because they felt a need to define their common goals, set research agenda to fulfill them, and to gain popular support for water studies. People came to UCOWR because they felt that they were accomplishing things. People who did not come felt left out.

Today, few leading water scientists attend UCOWR meetings. Many do not even know about UCOWR. It would be a valuable exercise for the lead UCOWR delegates in our member institutions to go through lists of faculty who prepared the above water research agenda and whose water research is being funded and ask each person to become active in UCOWR. An effort could also be made to reach out to faculty in universities that are not UCOWR members, and these include many of the most prestigious water research programs in the country.

Where these leading scientists seem reluctant, UCOWR could then probe further to find what the Council would have to do to convert the recalcitrant to become enthusiastic participants. One answer seems obvious; UCOWR needs to become effective in championing the research to which those people are devoting so much time and energy. The exchange would generate other reasons and remedies.

Many current UCOWR members may feel that they differ with some of the programs that these other two groups are championing, but the very process of hosting honest intellectual debate to resolve those differences could attract many to our activities. More important, the end result could well bring the larger community together, and that would be a major benefit to all. UCOWR, with its foundations in developing water programs within universities, is in a far better position than any other national organization to accomplish this important national service.

Going from the larger world of water resources to the smaller realm of hydrology, I have been working within the program in hydrologic science at the National Science Foundation to bring researchers together. The summary funding statistics for the hydrology program in Table 1 show how the program has grown not by making an eloquent case for funding the basic program (that has actually shrunk) but by cooperation and coordination.

Last year, hydrology joined with other divisions at NSF to initiate special competitions in Environmental Geochemistry and Biogeochemistry and in Water and Watersheds. The numbers in Tables 2 and 3 show an unprecedented outpouring of proposals. Both the credentials of the people who submitted proposals and the assessments of the more than 100 members of the review panels confirm both the importance of the topic and the interest of large numbers of top people in doing the science.

After considering what has made this growth possible during a period in which governmental expenditures are generally in decline, I would like to make a number of observations:

1. Research programs grow through cooperation. If the NSF hydrology program operated entirely independently of what others were doing (the least work option for program officers), it would be shrinking.

2. Confrontation focuses energies on non-productive activities. It takes individual investigators away from science and, at a larger scale, causes programs to divert their efforts from conceptual issues to political processes. Reviewers who rate the work of others as poor receive poor scores themselves; and
communities that attack engineers, or environmentalists, or economists, or lawyers only hurt everyone.

3. Research support for hydrology is growing. It can continue to grow as the community builds productive relationships at the researcher scale to involve more disciplines and at the program scale to involve more agencies.

4. Funding competitions for research to support national needs is one program that is popular with both the current congress and the current administration.

5. A program officer spends a great deal of time nurturing good ideas to bring proposals to a fundable form and to make funded projects even better. One important piece of advice is that when you receive a review, do not become defensive or mad but instead think what the reviewers are really saying and how you might restructure either your approach or its explanation.

The need to nurture good proposals has lead me to list "things to do" and "things to avoid." The first list has four ingredients:

1. Select a topic important to society and make a convincing case that demonstrates its importance.

2. Define a puzzle that science cannot presently explain.

3. Present your hypothesis on what is happening.

4. Propose a test, where the data collection in feasible and the analysis applies accepted procedures, that can be used to reject a false hypothesis.

The negative list covers eight traps in proposal preparations:

1. Dwelling on the importance of a problem without offering a credible way to find solutions.

2. Defining a problem as interdisciplinary without recruiting credentialed expertise from more than one discipline.

3. Failing to present literature that describes contributions by others to proposal objectives.

4. Collecting data without adequate quality control on the sampling, laboratory work, and analytical methods.

5. Becoming enamored with applying a familiar laboratory or modeling tool to the neglect of understanding how nature works.

6. Selecting a handy study site without justifying its suitability for accomplishing research goals.

7. Failing to recognize how hydrologic processes vary with spatial and temporal scale.

8. Budgeting to cover a block of time without justifying why that duration is required to complete the promised work.

In conclusion, both the productivity of the individual researchers and the funding available for water research as a whole are strengthened by building inter-paradigm linkages. The logical place for this interdisciplinary work is through university water programs. UCOWR is the one national organization positioned to build these essential linkages, but we are not reaching out to academics from all three of the

intellectual heritages that I listed above.

UCOWR delegates need to reach out at each university. As the community broadens (just as you once did in converting from a Council on Hydrology to a Council on Water Resources), you will do better science, attract more funds, and receive more support from people who benefit. The program will grow. The water, water resources, watershed, and hydrology community can become one and grow stronger through cooperation. I am pulling for you to make it so.

BIBLIOGRAPHY

U. S. National Water Commission, "New Directions in U.S. Water Policy: Summary, Conclusions and Recommendations," Washington, U.S. Government Printing Office, 1973.

National Research Council, "Opportunities in the Hydrologic Sciences, Washington, National Academy Press, 1991.

Naiman, R. J.; J. J. Magnuson; D. M.McKnight; and J. A. Stanford, eds., "The Freshwater Imperative: A Research Agenda," Washington, Island Press, 1995.

This presentation is my personal assessment and does not represent any policy or position of the National Science Foundation.

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Table 1

NSF Research Funding in Hydrology
Regular SemiAnnual Competition

	Requested		Funded	
Fall 92	50	for $9.2m	15	$3,000k Annual Total
Spring 93	50	for $11.7m	19	Success Ratio 0.34
Fall 93	64	for $14.7m	15	$3,300k Annual Total
Spring 94	68	for $15.7m	12	Success Ratio 0.20
Fall 94	78	for $16.5m	17	$4,600k Annual Total*
Spring 95	70	for $15.6m	15	Success Ratio 0.21
Fall 95	57	for $13.6m	??	

*This amount includes $1,700k from the program in Hydrologic Sciences, $1,570k from a program called Water, Earth, Atmosphere, Vegetation, Energy Interactions, $363k through collaborations with other programs within NSF, and $973k through collaborations with research units from NASA, NOAA, the Corps of Engineers, and the Navy and Army research offices.

Table 2

Program in Environmental Chemistry & Biogeochemistry

	Numbers of Proposals	Numbers Funded
Total	144 for $60m	12 for $3,910k
Hydrology	35 for $14m	4 for $1,120k
		Success Ratio 0.08

Table 3

Program in Water and Watersheds

	Numbers of Proposals	Numbers Funded*
Total	655 for $300m	31 for $11m
Hydrology	165 for $68m	10 for $2,240k
		Success Ratio 0.05

*These numbers are still preliminary and likely to increase slightly.