

THE WHY AND HOW OF UNIVERSITY EDUCATION  
OUTSIDE THE CLASSROOM FOR WATER RESOURCES

By

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June 1971

No. 72-17

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Outside the Classroom for Water Resources

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This paper reviews the success of the water resources research activities of the nation's universities. Especially since the establishment of the 51 state institutes under the Water Resources Research Act of 1964 there has been a gratifying response to the nation's needs for new information. But too few of these findings are in the hands of their potential users. Too few are in a form to serve as the basis for communication through problem oriented educational experiences. The state institutes have the potential to meet this need, but they need specialized resources to do so.

We explore some of the differences between education for the individual as a practitioner in water resources management and use and education to equip an individual for a role in public affairs. Water resources implies problems that require public decision making. Here the university is rarely in a position to make strong recommendations for what ought to be done. That is decided in a political process. But by not having a program oriented stake in the decisions, the university has substantial advantage in mounting information programs that can improve that process. Information cannot be neutral in effect, yet programs should be developed without advocacy for particular positions. Since the most evenhanded of approaches cannot always avoid controversy, special thought must be given to achieving a critical mass in public affairs programming, and a broad strategy must be adopted in program development.

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- 1/ Presented at Symposium on Social and Economic Aspects of Water Resources Development, sponsored by American Water Resources Assoc. and Cornell University Water Resources and Marine Sciences Center, June 21-23, 1971, Ithaca, New York.
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Water Resources and University Service<sup>5/</sup>

Research and Education Needed to Manage Our Waters

This is a good time to take stock. What is being done in research and in structuring our educational programs to meet the requirements of the nation for improved management of its water resources? This part will focus on the 51 State Water Resources Research Institutes funded under the Water Resources Research Act of 1964. This is not to suggest that important work is only being done at these universities, nor that the relative emphasis should change between the universities enjoying support through these centers and others. It is simply that these 51 centers have now had a chance to get started and show what might be done with systematic support from the federal government.

Another focus for this discussion will be the need for non-degree, non-classroom educational programs. A review of the history of these 51 centers supported under the Water Resources Research Act of 1964 shows this to be the fundamental weakness of the current approach. Experience in other programs and an understanding of the way in which universities work suggest that broadly useful problem-solving research is more likely to come about when we provide for a formal linkage between the university researcher and the audiences that need new knowledge. In the language of the ecologist and the computer programmer, we must provide a "feedback loop." This is not a one-way street. The universities must hire professionals whose job it is to take the results of research to those who have problems and, most important, to bring back to the academic researcher an intimate knowledge of the situations faced in the real world.

A casual examination of the potential for economic and population growth in the foreseeable future should suggest to anyone that there will be substantial pressure for expanding the uses that we make of our waters. This will mean more demands for stream flow regulation, more reservoirs, more channel work, more canals, more conservative technology in water uses, more use of substitutes and demand management; in essence, moving water in time and place to serve man's needs. At the same time we must recognize that this will not be achieved easily and smoothly and with no stress and strain.

Certainly a major challenge that lies ahead of us is how to have our economically important services from water to serve one set of rising expectations and at the same time manage and preserve the environmental values to which water is so important in order to serve another set of rising expectations. Our traditional water resource development agencies are all unanimous in one aspect of their relationship to the new interest in the environment. They all agree that their present capacity to evaluate many of the questions being raised by environmentalists is inadequate. The Corps of Engineers, the Bureau of Reclamation,

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<sup>5/</sup> The material in this section is similar to that prepared by the authors for a task force of the Universities Council on Water Resources which was charged to review the first six years of operation under the Water Resources Research Act of 1964.

the Soil Conservation Service, municipal and state development agencies across the nation, find it difficult to find the trained staff or consultants who can help them avoid the time-consuming conflict that tends to arise. It is probably true that there is more misinformation on the environmental effects of water resource development than there is sound information. This doesn't make it any less effective in raising uncertainty and adding to our project backlog. The great need is for knowledge so that we can act because we know, rather than not act because of what we can speculate might happen.

In short, the programs of the 51 State Water Resources Research Institutes need to add a component of work that will help the developmental agencies of government respond to the environmental crisis. But past experience indicates that this will not occur unless those who do the research are assisted in the communication process by specialists at the universities, specialists in technology transfer.

The veto and supportive power of the environmental coalition must be recognized. It has been able to raise the federal public works budget for sewers and waste treatment plants from \$214 million to \$800 million and beyond. In this same period the Corps of Engineers, Bureau of Reclamation and Soil Conservation Service have faced the prospect of stable budgets which in a time of inflation really means a fall in real investment. The pressures for flood damage reduction are still there. The gains from expanded navigation works still bring many to the Congress asking for more facilities. Our cities are still looking to upstream reservoirs as a source of water supply. There are still farmers who ask the Congress to let them make the desert bloom. The environmental choices must be made and we must learn how to move ahead on enhancing environmental values and still accommodating the demand for other values.

### Some History

It is instructive at this point to turn to the reports of the Senate Select Committee often referred to as the Kerr Committee. This group conducted the last complete assessment of water resources policy in the United States. It is interesting to note that Ted Schad, who directed that study, is now staff director for the current review by the National Water Commission. Two extremely relevant pieces of legislation came out of that effort, the Water Resources Planning Act of 1965 and the Water Resources Research Act of 1964.

The Planning Act proposed the Water Resources Council as a formal mechanism for inter-agency coordination at the federal level. This was an outgrowth of many less formal inter-agency arrangements such as "Fire-brick" and "Ice Water" and, of course, the Ad Hoc Water Resources Council which evolved into the present arrangement.

The Water Resources Council has pressed for the resolution of a number of knotty policy problems. One example is the standardization of guidelines for the evaluation of hydrology between the several federal water resource development agencies. Differences over hydrology attract little public attention but have been as significant as differences over benefit evaluation. Of course, a major task has been the

coordination and development of guidelines for comprehensive water resource development planning. The Council's assessments of water resource development needs stand as a major contribution to the nation's response to its many needs. A current effort is the development of principles, standards and guidelines for project and plan evaluation.

As the Water Resources Council has undertaken these several tasks, it has had opportunity to call upon the university community. The university community has been in a position to respond more effectively in recent years as it has developed capacity through the State Institutes. The largest role has been in the most recent effort. The new evaluation principles which move substantially farther towards the full evaluation of all benefits of water resource development were tested by a number of university teams. Most of these teams came from universities with these Institutes and the skilled manpower was available because of the experience that had been gained on supported projects.

The Water Resources Research Act of 1964, administered through the Office of Water Resources Research in the U. S. Department of the Interior, was modeled closely on the Land Grant College and Agricultural Experiment Station system. The emphasis was to be on a mission orientation in the development tradition. A base fund of \$100,000 per year has been provided to each of the institutes with opportunities to obtain competitive matching grants and open grants through the program. It is probably fair to say that this has been one of the more carefully managed federal research programs with quite careful review of each project and development of guidelines that identify the nation's research needs. Nonetheless, the original program failed to provide explicitly for that important Land Grant College component, namely an extension education responsibility.

It is perhaps instructive to note that the Water Resources Planning Act of 1965 provides substantial support for the states to develop their own water resources planning programs. It also provides for their participation in river basin planning commissions. The passage of that Act was delayed while state objections were worked out to the original formulation by the Kerr Committee. The Water Resources Research Act, on the other hand, passed somewhat more quickly, perhaps because of the active support of the National Association of State Universities and Land Grant Colleges. In its original form, it was a tried and true format for organizing the capacity of the universities to meet some of the nation's needs.

There should be no question that the Water Resources Research Act has achieved a major part of its objective. The universities provide a reservoir of skilled academic talent, much of which has a much better understanding of the problems faced by those who would develop the water resources of the nation. Government agencies have been able to choose between a group of students far better trained for the tasks which are at hand. They have been able to send employees for advanced training to the universities and yet be assured of teaching that is more relevant. The academic literature has been enriched, indeed almost flooded with the results of new research.

The annual reports of the Office of Water Resources Research detail many of the advances that have been made. The same kind of picture can be gotten from the reports of the individual Institutes. Many of the Institutes have prepared summaries of their efforts over the last five or six years.

By involving members of the university faculties from a wide range of disciplines, the program has had a "ripple" effect throughout the Land Grant Universities and beyond. The problems of water have been effectively expressed at the university on an urgent and understandable level. The faculties have responded.

#### Some Examples of Recent Work

The planning of public projects by every level of government has the potential to be improved by the findings and analytical techniques developed in recent research. One example is the optimization of power generation, peaking power and water releases within the California water plan. Another is a new approach to integrating urban area water systems developed for the New York City area. Some of the concepts developed in this research are currently being incorporated by the Northeast Water Supply Study carried out by the U. S. Army Corps of Engineers.

Preventing the degradation of the environment or taking steps to enhance it has led to the development of the basis for a number of important pollution control measures. In one state criteria were developed for stream bank stability to be used in conjunction with highway construction. Sediment in our streams has been a major source of excess nutrient loading and fish habitat destruction. Stream banks are a substantial source of such silt. In other research it has been found that stream aeration systems have greater capability than we imagined for improving aquatic environment. In particular, it is apparently possible to artificially improve the quality of lake waters by this method.

The framers of the legislation sought to establish a federal-state partnership to mount an attack on these problems. But not enough of this new information is in the hands of those who can use it. The reports by the Office of Water Resources Research to the Congress each year provide tangible proof of the effective federal-state partnership which has been established. Hundreds of research findings like those cited above are reported. The performance of these Institutes over the past six years amply sustains the wisdom of the broad base of operation. Directors at the local level have been very successful in stimulating the faculty from a wide range of disciplines to focus their expertise on water problems which had heretofore gone unnoticed. The key to this stimulation was in part due to the fact that these experts became keenly aware of the water problems which surrounded them. Much of their motivation was the desire to provide input into solving local and state problems. In working on these problems they also made a large contribution to what might be considered national problems. None of the states are in isolation, the externalities are felt outside the state boundaries and Institute research has wide applicability and usefulness throughout the nation as a whole.

## Technology Transfer

An estimated \$149,000,000 was invested in water resources research by the federal government in FY 1969. Less than a tenth of this was under the Water Resources Research Act of 1964. Yet, it is recognized that procedures used by funding agencies for the identification and characterization of water research needs and the transfer of research results into practice are unsatisfactory. There is a marked need to improve communication between research users and researchers if the research supported by this large investment is to be responsive to the needs of water planning and management agencies and the resulting new information is to flow into the hands of practitioners in a form which can be utilized by the large variety of disciplines and levels of skill involved.

The Water Resources Research Institutes are ideally situated to assume responsibility for information dissemination at the state and local level. Their programs include the relationships with the users in local and state government, planning agencies, consulting engineers and other practitioners. They are currently involved with these groups in the identification of research needs and the development of research projects responsive to those needs. What they have lacked is legislative authorization for the appropriations and related activities necessary to develop the second phase of their programs -- the interpretation and dissemination of water research findings.<sup>6/</sup> Such programs would utilize existing state extension services such as agricultural, engineering and industrial, to the extent they are available in the same way that the Institutes currently utilize faculty and laboratory facilities for research. Where such services are not available, they would be developed along lines best fitted to the universities involved and the unique needs of each state.

Federal funds presently authorized for Institute annual allotments and matching grants are designated for research and related training. There is no specific authorization for information interpretation and dissemination programs, nor funds for this purpose.

The result is that there is little direct communication, on a systematic basis, between the researcher and his logical counterpart -- the individual or locality with a problem. It is probably true that our agricultural research program did not begin its maximum period of effectiveness until the technology transfer function was institutionalized at the university to complement the research programs that had begun some years before. Within the university community there is, unfortunately, considerable resistance to the development of outreach programs based upon general purpose funding. Dollars that can be used for any purpose are scarce at the university as elsewhere. Left to its own incentives, the university will use these funds for on-campus teaching and more research. Earmarked funds are needed to encourage the universities to provide this important service needed by the rest of society.

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<sup>6/</sup> Since this was written, P.L. 92-175 has corrected this deficiency in authority.

Improved communications between research users and the researchers would have wide benefits. For example, consulting engineers, particularly those in small firms, would welcome the support this program could provide. It would put at their disposal new tools, new technology, so that they in turn can do a better task of servicing their many customers.

Professionals in the transfer of technology can provide the interdisciplinary kind of information not now easily available to practitioners. Like researchers, agencies and firms today tend to be narrowly based in terms of the mix of specialties that they have represented in their staff. But the problems they face call for broader approaches.

To meet the need for more information in the hands of those who could use it and to insure that information is produced that can be used, a two-way process must be developed. Both the generator of the information and its receptor must be actively engaged in the process. Often, however, initial impedance may be so great that communication is ineffective without provision of special aides and specialized personnel.

At least four steps need to be taken in order to reduce the barriers that stand between those who produce new information and those that need it. First, specialists must be available who can define problems broadly and bring together the research from many researchers and disciplines that is potentially significant in solving those problems. Very few researchers are this sort of generalist. Second, the scientific information available must be repackaged for ready understanding by practitioners and other decision makers. The researcher writes for his fellow members of his discipline. Translation is required for the busy practitioner. Third, educational experiences must be designed that offer ready communication between both the generator of new information and the recipient of such repackaged information. Finally, feedback must be facilitated that will alert researchers to the scientific information needs of those involved in resource decisions and actions.

In order for the Water Resources Research Institutes to become authoritative and objective sources of information, not biased in favor of particular action programs, it will be necessary to provide stable year-to-year funding for this type of activity. Other available federal sources are not sufficient or suited to this need. A project-by-project type of authorization does not provide the basis on which to employ the necessary skilled personnel and establish the lasting relationships that are needed. "Hard funds" which the university may use this year and, more importantly, for which the university may plan its activities over future years, are needed. Only in the steady, continuing program can a university recruit the kind of quality personnel necessary to insure that the program will continue to be an effective impetus for progress.

The need in order to make an effective beginning is relatively modest by current standards for public programs. But the impact of such funds may have more concrete results in work being done on localized water problems all over the nation than practically any other recent legislation.



## Opportunities for a University Extension Role in Water Resources

The modern university has long recognized its opportunities for education outside of the classroom. It has not always seized them. The success of the colleges of agriculture in making "two blades of grass grow where one grew before" is well known. The unmet opportunities in water resources are very real.

There are two ways to classify the opportunities that exist, each with two sub-classes. First, we can distinguish between education for the individual as an individual and education for his role in public affairs. The transfer of technology from the laboratory, the textbook and from the world of experience, to those who need technical solutions for technically definable problems allows a very direct approach to communication calling for all of the techniques familiar to teachers of all kinds. Education needed to solve public problems, the second sub-class, calls for a different kind of approach and one where the universities have a unique comparative advantage but less experience.

The audience's motivation to seek information is the second way to classify the problem. Those that know that they need information and what they need are the easy challenge. Hold a conference, workshop or class and they come. Often they are quite willing to pay fees to cover a substantial part of the cost. They see their self-interest in more knowledge. The hard to meet challenge is posed by those who don't see how the educational experiences we can devise and any new information can help them. Public problems usually involve the potential of controversy and that means information is not likely to be neutral.

## Some Examples in Technology Transfer to Individuals

The role of water management in the farm business is a well-established part of the informed university education programs for agriculture. A number of activities have been carried out over the years relating to quantity and quality problems faced on the farm. Information on the advantages of improving the drainage in many of the soils that farmers use has been pointed out for many years. Some of the most exciting current developments include rather massive reforming of the surface of fields achieving quite dramatic results in terms of when fields can be worked and in resulting yields. Irrigation technology is becoming more sophisticated every day. The prospects of solid set sprinkler systems and perforated pipe add to the already large array of technical choices facing the individual choosing to go into this way of increasing yields. Disposing of animal waste has always been a problem. Animals confined in the winter or year round have meant that manure had to be transported and spread upon the land or disposed of otherwise. In recent years, of course, there has been considerable concern for the impact of manure runoffs into the receiving waters. Extensive research has been underway for some time to find solutions to these problems that are practical for the individual farm operator and the relatively narrow margins under which he must operate. New ideas to solve these problems are being developed rapidly and the time from test to trial on the farm is remarkably short.

Drainage, irrigation and animal waste disposal all have a public aspect to them. But the focus for a great deal of our work has been what the individual can do within the limits of his own enterprise. In other words, what management decisions does the individual operator face, and how can he make these decisions to his own best advantage.

In a similar vein, food processing plants have had water and waste problems. In cases where water supplies for seasonal food processing needs have proven inadequate, new ways have been devised to process the crops with a minimum of water usage. Irrigation of waste is a new development that has been aided by much of the know-how developed in agricultural experiment stations. Effort continues to develop in-plant process changes which would minimize the production of wastes. Again, the point of view has been to find ways of using technology to help the individual manager solve the problems that face him.

Some of the same kind of informal education work has been done with those who operate facilities and manage public programs. Schools for sewer plant operators are not unknown on the university campus. Schools for consulting engineers to brush up on some of the latest engineering techniques are a regular feature of summer programs. At Cornell University we have had planners study the problems of thermal pollution and how they might put knowledge of this subject to work in carrying out their jobs as planners. Public officials learn about sewer changes and steps in the consolidation of districts in schools that even are specialized as to the level of government that they serve. We have operated a school for town highway superintendents at Cornell in cooperation with the state organization of town officials. Our county officers school has almost as long a history. Biologists who work for state fish and game agencies have had post-graduate workshops for many years.

For the citizen at home or on vacation there is a regular flow of information that has had something to do with water resources. Pamphlets are available on the use of wells and septic tanks for homes that are not located where they can make use of municipal facilities. Technical information is available on the construction of docks and how to control the weeds that grow in the water near them. Washing the family and its clothes has been of concern to home economists and they have developed a fund of information for the homemaker. Educational programs on how to manage a pond near your rural home are available.

Surveying the kinds of offerings that we have available in existing programs leads to several conclusions. When the university focuses on the farm or the home or the fish habitat, it has considerable expertise and not a great deal of competition in the provision of information. Or perhaps it is more accurate to say that it has found a way to share the market with others who have information to provide. In other areas the university has less comparative advantage with respect to access to knowledge and expertise. Information in these other areas is where you find it. Finally, the examples we have cited so far have stressed the information needs of individuals managing their day-to-day activities.

The question might well be asked, "Are the kinds of things that we have listed so far the guts of what comes to mind when you think of the term 'Water Resources'?"

### Water Resources Implies Public Decision Making

The term 'Water Resources' implies public programs and public decision making. Public decision making in turn suggests potential for a variety of points of view and opinions, a variety of values and attitudes. In other words, the potential for conflict is there.

Flood control and recreation benefits may be posed as opportunities that mean the loss of farmland and natural streams and wetlands. Sewers and water supply mean spending public money. But when? Now? Wait a decade? Should water supply reservoirs be only available for heavily restricted recreational use? How much can we afford to spend to have no restrictions on lawn watering in the occasional drought? Should farmers get together to develop irrigation or drainage projects? Should the county or the state help them do it? Would a river basin commission mean the loss of home rule powers?

Some of these questions have a technological component. All of them have a strong element of public values. Where there is an interaction between means and values, the ways to get things done and people's preferences, there is going to be an ambiguity about objectives and issues. This requires a different educational posture than when the problem is primarily technological. As long as the question is how to make two blades of grass grow where one grew before, our problem is easier than if we have to answer at the same time why we should want two blades of grass. Objectives in water resource problems are usually not subject to what might be called technological definitions.

Take as an example Canadarago Lake in the headwaters of the Susquehanna River. The Village of Richfield Springs has for some years emptied its wastes into Canadarago Lake. It is clear that nutrients come into the lake from many other sources. The lake has recently been subject to algae blooms. A study by the New York Department of Environmental Conservation in which Cornell University has cooperated closely has indicated that phosphorus is the limiting element in the growth of the algae. A new sewage treatment plant will make a substantial impact in the amount of phosphorus coming into the lake. Cottages around the lake make a small contribution and they are in the process of improving their septic tanks. A very, very small fraction of the fertilizers and animal wastes used and produced in the watershed could easily explain the remaining phosphorus inflow. And we have only the crudest ideas about identifying and controlling that fraction. There is probably some phosphorus in the natural water and certainly some is coming into the lake attached to soil particles that have been in motion down through the watershed for many years. Which source of phosphorus should be limited and how? That question cannot be answered without making a whole series of value judgments, not the least of which is whether or not it is worth the cost for the return in improved water quality of the lake. Deciding what should be done to do something about the algae blooms in Canadarago Lake is a different kind of educational problem than developing fertilizer recommendations or information on how to manage the pond you own in the field in back of the house.

The emphasis must be on process and understanding. The content and objectives of the educational experiences that we devise need to stress how things work and what happens, who does what, and how do you "get your two cents' worth in." And there is a special need for the evenhanded presentations of critique and unanswered questions. When the immediate objectives are clear cut, the university can make strong recommendations, but this will be unusual. It probably must eschew advocacy of particular solutions for public problems except in the name of the broadest kinds of "motherhood" issues. Why avoid advocacy? There is both a practical view of this question and a moral view.

Informal education programs sponsored by a university have what might be called a constituency dilemma. On the one hand, the credibility of the educational experiences offered is put to question when the university is too closely identified with some subset of the potential conflicting groups. On the other hand, programs need support. Someone has to feel that the university's effort is worthwhile and worthy of the use of either public or philanthropic funds. Yet the most effective supporters are those who believe very strongly in something and work to support what they believe in. These beliefs are usually translated into advocacy for particular public actions. Education for education's sake gives the university a very narrow base. There is always the temptation to seek a more particular clientele, with the resulting loss of creditability and effectiveness. A posture of non-advocacy is a viable solution in the long run, still allowing some clientele recruitment but reducing the identification with particular interests.

The moral view of eschewing advocacy is probably summed up by saying, "Who are we at the university to set values for others?" But this has a practical side to it, too. People don't like to have others set values for them. They prefer to set them for themselves.

The task is helping people understand the problem -- why it came about, who can do something about it, will it work, what will it cost, what can "we" do about it. These are the questions. To list them should be enough to make it clear that education in the water resources area cannot be neutral, even though it may eschew advocacy. Alternative courses of action are not neutral in their effect and this is why we have conflict. Neither is information neutral; therefore, information becomes a part of the process of conflict. For example, all of the above questions are elements of the debate in any contentious situation.

### The Role of Information

There are at least three kinds of situations where the role of information varies in terms of its effect and in terms of needs. First, participant reaction varies with the perceptions that they have of whether or not they are in control and winning or out of control and losing on the issue at hand. If in control and winning, the natural reaction is to want to limit new information available in hopes this will limit participation and maintain the winning position. If a participant feels that he and his group are out of control and/or losing, there is a natural reaction to want to broaden the base and increase the amount

of information available. Some of the reactions to universities providing information in potentially contentious situations can perhaps be explained by these reactions.

Second, the effect and need for information varies depending on whether or not there will be a major change in the status quo or simply a small incremental shift if one course of action is taken as opposed to another. Suppose a proposal is made that, if adopted, makes a substantial change in the structure of local government. We might be able to agree that it would be a "good" change. But the chances are quite high that the effects are diffused, they will occur in the future, they may be real but uncertain, and perhaps intangible. The status quo, on the other hand, may be interpreted by potential losers in the change as representing quite immediate effects, highly particularized, quite certain and tangible. Given what motivates people to be most effective in political situations the "good" change is going to have a tough time winning an election if more information is provided to more potential participants. But how do we get such "good" changes adopted? Probably only when we've tried a few times and have had so much information available that there has been a substantial shift in the expectations and attitudes of the active public.

The role of information is also quite different depending upon the decision structure that exists in the community.<sup>7/</sup> A monolithic hierarchy among decision makers implies that the role of educator is much like that of a technician -- values, goals, objectives are all set by the monolithic hierarchy. Any educator, including those in the university, has only the function of providing the information needed to implement those goals and values. The opposite extreme is a highly fragmented decision structure where to have an audience at all the educator must be a part of a process that mobilizes that audience. In between are various forms of shifting coalitions. Then the role of information and education is to help find the basis for organization, but the main burden of forming such coalitions will be in the hands of other participants than the educators seeking an audience for their wares.

#### Implications of the Role of Information

The above three points do not by any means exhaust what can be said about the role of information in public affairs. They happen to have faced the authors in recent attempts to develop water resource education programs. What do they, and questions like them, imply about organizing a university program? At least two implications have occurred to us. The first is the need to recognize a critical mass principle, and the second is the need to insure that a broadly based strategy is the basis for educational programming in water resources.

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<sup>7/</sup> We are indebted here to the intellectual contributions of our colleague, Alan Hahn, a political scientist who has effectively related the role of technical information and its communicators to the structure of community decision making.

Educational programming for public affairs cannot be entered into lightly. The individual faculty member who gets "turned on" by a particular issue can be a valuable input to an ongoing program. But water resources public education that consists of only the ad-hoc efforts of such faculty runs the risk of being both ineffective and of undermining other parts of the university's water resources program. The public educational effort must be large enough so that it has enough visibility and enough strength in a variety of activities so that the reactions to any one activity cannot destroy the creditability of the others.

Multi-disciplinary capacity is an important part of the concept of critical mass. The technical expert is often placed in a very difficult position by the shifting and uncertain nature of the values involved as in environmental problems. Visualize the issue of detergents and their impact on aquatic environments. An expert on detergents is bound to be oriented to their uses. And such an expert should be sensitive to the technical problems of changing the constituents of detergents as it affects the benefits of detergent use. The benefits of such use obviously have significant social value. But to ask the detergent expert to provide and judge the trade off in social value between detergent use and the impact of detergents on an aquatic environment is asking a technical expert to go beyond the role for which his training and expertise is relevant. Yet he is regularly asked to assume this role of community leader, charged with balancing the social values of such things. But he is lucky indeed if his grasp of the problem even allows him to understand all the technical interrelationships. Some experts understand how detergents clean clothes; some understand how they affect particular aquatic environments; some may understand both to the point of being able to show what is gained and lost and by whom (although we have not seen such a balanced analysis). And some experts will and should be willing to say what they think should be the changes in detergents and their use, whether they understand all the relationships or not, much less the values involved. But just as war is too important to leave to the military, these environmental tradeoffs are too important to leave to the experts. As long as the values are shifting and uncertain, such decisions must be made in the political process. Therefore, as educators we must strive to achieve a balance of disciplinary participation that matches the values involved.

We have no easy guidelines for the critical mass needed. But in our own program we judge that we have almost reached it. We have one full time professional based at the university; another full time professional based in one of our key river basins and the continuous part time commitment of a number of faculty. Water resources programming is a recognized option in most of our county offices and for each of our five regional field specialists. They also deal with a variety of other public affairs subject areas.

In addition water resources public affairs educational programming in New York draws support from other university activities. Educational programming has been focused where there is faculty interest in research and research priorities have been influenced by educational needs. These interactions with research operate at both the general subject matter level and in terms of geographic focus. A teaching and research program called Science, Technology and Society has provided a number of

supportive links. The development of a Sea Grant Advisory Service with focus on marine and Great Lakes problems is adding much complementary capacity. We are also exploring how we can more effectively relate to faculty and programs at our sister educational institutions across the state, in particular the other 65 units of the State University of New York with whom we have worked on particular issues in the past.

After several attempts at spelling out what we mean by a broadly based strategy we decided that it is best summed up in five functions that must be addressed. The operating elements of the strategy will follow from these. The following quote expresses these five functions more effectively.

(1) Bring together facts and principles relating to each problem, its alternative solutions, and their consequences. One of the cornerstones of a public affairs decision is the facts upon which it is based. People make their decisions in public affairs on the basis of facts, beliefs, values, and impulses. The more facts they have available, the less they have to rely on their beliefs, values, or impulses.

(2) Create viable alternatives for solving a public problem. Extension personnel are in a unique position to study problems from their inception, to appraise the social, economic, and political climate, to associate with and understand various interest groups, and to discern values and/or goals which the people wish to satisfy.

(3) Place each problem in a decision-making framework. This involves organization of the information relevant to a particular problem or issue so that it can be easily understood and considered in an orderly manner. It helps reduce the confusion of people bombarded with bits and pieces of information by bringing to the surface the key factors to be considered. It helps clarify goals, identify alternative solutions, and provide key information on critical points which the public must weigh in reaching its decision.

(4) Diffuse information among the people. There are many audiences, and many channels for getting information to these audiences, from personal consultation to mass media. An important function of the Extension educator is to determine target audiences carefully and use the most effective channels to communicate with them.

(5) Encourage and organize interaction among individuals and groups concerned with solution of a public affairs problem. At the local level, where much of the public affairs education program is carried on, many of the citizens who can be involved in a public affairs education program have strong loyalties to various groups (private, public, local, state, national) and need horizontal group-to-group discussion and communication.<sup>8/</sup>

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8/ John O. Dunbar, et al. Public Affairs Education. A report of the Cooperative Extension Service Committee on Policy, October 1969, p. 14.