# FLOODS: A HUMAN ECOLOGICAL APPROACH

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## Abstract

General experience, notably in North America, indicates that floods tend to be thought about, responded to and planning for far too narrowly. Since at least the 1930's concerned professionals, decision-makers and the media have stressed the idea of floods as hazards or extreme geophysical events – acts of God – which are difficult to predict and manage or control. In this context considerable stress has been placed on prediction and on structural, engineering and emergency responses and these have become more effective, leading to a reduction in human deaths due to floods in for example, the United States. On the other hand flood costs have risen partly because structural measures and insurance have increased the tendency to encroach on now seemingly protected flood prone areas. This tendency has been mitigated to some degree by increased use of floodplain zoning and land use regulation, flood-proofing and behavioural modification approaches. In terms of prospects for the future, considerable promise seen to lie in a broad human ecological approach. On the one hand this involves recognizing that floodplains serve numerous hitherto insufficiently recognized wildlife and other natural functions which contribute to environmental health, economy and general quality of life. This recognition is leading to some curtailment of engineering and other attempts to control floods in highly susceptible areas, such as the Mississippi after the 1993 floods. The human ecological approach also involves greater recognition of the human dimensions of floods. These dimensions can be highlighted through a life cycle approach to floods which involves seeing them as part of an expectable series or general pattern of short to long term natural changes, typical of a place, and to which humans must constantly adapt. The human dimensions approach also has to do with developing research, education and communication systems that will build a broader understanding of floods in the minds of professionals, decision-makers and citizens. This effort is being enhanced at present by emerging research and information on the neglected psychological and social effects of floods on people. The effort also is being enhanced by increased civic awareness and understanding of global climate change and associated flood and other hazards. This is discussed with special reference to experience in the Great Lakes region of North America.

## Context

Whether their interest is in emergency measures or some other response, a broad perspective is useful for all who are concerned about floods or other hazards. Without a broad perspective it is possible to place excessive stress on one's own interest or approach and not have the general understanding that is ultimately essential to making effective, efficient, and equitable choices about public policy and practice. Without a broad understanding it is also not possible to have a full appreciation of the research opportunities and needs in the field.

To achieve a sound general understanding of floods and other hazards is, however, a challenging and exceedingly difficult task. Establishing that this is so requires an individual only to reflect on the various engineering, behavioural, economic, geographic, historic, and policy aspects of these phenomena. Understanding floods and other hazards in North America or Europe is different than in Africa, China, or other parts of the world if only because of differences in the culture, environment, and overall history of these areas. In this context this paper attempts to develop a broad perspective of floods in North America and to a lesser extent in Europe.

The idea of a broad perspective refers to an effort to think in wide and evolutionary terms about the concepts, policies, practices, and fields of science or ways of knowing that have been used and emphasized in responding to floods. Much of the information in this paper arises from the thought and work put into the organization of a workshop on comparative experience with floods in North America and Europe. This workshop was held in Krakow, Poland, and was stimulated by major floods which occurred in these two areas in the 1990's, for example, in the Mississippi Valley and the Oder, Vistula, and other central European rivers. (Nelson et al., 1999)

The workshop was a scientific and a civic event attended by about fifty people from an array of different scientific, professional, governmental, and private organizations, many of whom gave presentations on their experiences. Some of the papers have been published in two issues of the journal *Environments*. The majority were published in one issue, (Nelson et al., 1999), with three others published in a subsequent issue (Nelson, 2000). The information in these and related papers and reports could be organized for discussion in a number of different ways. They do, however, collectively reflect much of the general history of human responses to floods in North America and can be used to underpin a general historical perspective on the history of flood response, notably since about the 1930's.

### Early Flood Response: The Structural Approach

In the early 19$^{th}$ century the major approaches seem to have been two fold. One major response could be described as indigenous or contextual. The basic adaptation here was to adjust activities and behaviours to the anticipated occurrence of floods and their effects. The author observed such adjustments in the late 1960's in the western Canadian

prairies. One was the occupancy of many river floodplains only seasonally for specific purposes such as agriculture. Another was the removal of belongings and the abandonment of the first floor of houses in the spring at the usual time of flooding, the vacated spaces being cleaned and re-occupied after inundation.

The second, and increasingly predominant approach, because of the support of governments, was the use of dams, breakwaters, levees, and other structural or engineering approaches to floods. The outstanding historical study of the great 1927 Mississippi flood by John Barry (1998) provides excellent insights into the nature of the engineering response. In the case of the Mississippi, two engineering approaches and related scientific underpinnings were stressed and eventually came into conflict. Both approaches were ultimately based on the idea that floods could be controlled and prevented. The first approach was built on the idea that if the Mississippi were completely confined between embankments or levees throughout its middle and lower course that it would erode and lower its bed and not be likely to flood. The second approach combined this notion with the idea that distributor streams had to be open to spread the force of the high waters so that flooding would occur.

The conflict between these approaches and ideas was intense and protracted in the early part of the 20th century, with the first approach on confinement of the Mississippi to a controlled channel carrying the day. The confinement policy was continued up to 1927 when protracted flooding led to the decision to prevent major damage to New Orleans by deliberately breeching the levees and allowing the river to flood. One result was major damages in farmlands along the lower river. This and related effects of the flood control policies had many repercussions, one being some tendency to adopt a broader approach to flood response, although the strong interest in structural or engineering responses remained for a long time, and persists in numerous area to this day.

## The Non-Structural Approach

One aftermath of the 1927 Mississippi and other early to mid 20th century floods in the U.S. – and elsewhere – was a growing interest in non-structural, behavioural or land use planning responses. A leading advocate of this approach was Gilbert White, a geographer, who worked with many colleagues and graduate students on what was termed a human ecological approach to floods.

The general characteristics of the human ecological approach are shown in Table 1. Three general categories of responses are presented in this model. People can adjust technologically to hazards, adjust behaviourally to hazards, and adjust to losses. This approach has been criticized as basically still instrumental and as not really reflective of or applicable to responses in cultural contexts other than North America or Europe. Nevertheless, the approach has great advantages in that it provides for a much broader view of all the elements and responses that should be considered in planning, managing, and making decision about floods. The model moves far beyond an engineering approach to open up flood understanding and response in terms of its economic, social,

| | |
|---|---|
| **Adjust Technologically to Hazards** | |
| Modify the Cause | • Weather Modification<br>• Channelization of lakes<br>• Diversions<br>• Control of Great Lakes inflow with existing mechanisms (Lake Superior)<br>• Control of Great Lakes outflow with existing mechanisms (Lake Ontario)<br>• Regulation of existing diversions<br>• Various support programs of interest for the above |
| Modify the Hazard | • Flood proofing and flood fighting<br>• Concrete Crosses<br>• Breakwaters<br>• Seawalls<br>• Groynes<br>• Dykes<br>• Rip-Rap<br>• Gabions<br>• Landfill and Landscaping<br>• Vegetation and re-vegetation<br>• Beach and cliff nourishment<br>• Mechanical drainage and pumping<br>• Ice jam break-up<br>• Various loans and payments from senior governments and private groups |
| **Adjust Behaviourally to Hazards** | |
| Modify the Loss Potential | • Zoning and land use regulation<br>• Temporary and permanent relocation and evacuation<br>• Subsidized relocation and evacuation<br>• Building codes, designs<br>• Health codes and regulations and procedures<br>• Public participation and hazard education programs<br>• Hazard Research programs, public and private<br>• Weather Forecasting and warning systems<br>• Hydrographic mapping<br>• Various support measures from senior governments for research<br>• Various support programs for the above responses |
| **Adjust to Hazard Losses** | |
| Spread the Loss | • Public Emergency<br>• Relief<br>• Tax write-offs<br>• Subsidized public insurance<br>• Private insurance<br>• Government purchase and expropriation of land and property<br>• Subsidized temporary employment<br>• Various support programs of interest groups for the above |
| Plan for Loss | • Flood Insurance, public and private<br>• Tax write-offs.<br>• Relief funds and programs, public and private<br>• Formation of public and private study groups<br>• Formation of public and private administrative organizations<br>• Formation of public and private interest groups |
| Bear the Loss | • Loss bearing by individuals and groups |

**Table 1 Hazard Adjustment Model for Lake Erie Floods (modified from Needham and Nelson, 1978)**

psychological, institutional, and other dimensions. For these reasons the human ecological approach has had a significant impact on flood policy and practice in the U.S., Canada, and elsewhere. It has led to greater emphasis on preventing encroachment on floodplains and on flood proofing, flood insurance, flood warnings, and emergency measures. However, this approach and the continued emphasis on structural adjustments by many government agencies, has not reduced economic losses from flood prone areas

especially those with high investment, resource, or other characteristics which continue to attract development.

Indeed, according to Hunt,

> *"The costs of structural approaches to flood damage reduction in the U.S. have been enormous in both economic and environmental terms. Over the past 25 years, the federal government has spent nearly US$140 billion in federal tax revenue preparing for and recovering from natural disasters. Over the same period of time, the U.S. Army Corps of Engineers spent more than US$25 billion to build and operate flood control projects…In fact, the increases in U.S. government expenditures on flood control structures between 1936 and 1985 was 103 percent in real dollars, but was surpassed by the rise in flood damages, which increased 268 percent in real dollars between 1916 and 1885"* (Hunt, 1999, 99).

## An Environmental Perspective on Floods

In this context flood policy and practice in North America and Europe are taking on a much wider environmental perspective. This is characterized by a much greater interest in and awareness of the environment in which flooding and its effects take place. Environment is used here in the sense of both the human and the natural environment.

Some of the most interesting developments on the human dimensions side seen to be coming forward in Europe. In a paper in the special flood issue of *Environments* Edmund Penning-Powell (1999) provides insights into the nature and potential of this approach. He reports on some of the results for the EURO flood project which involved researchers from seven countries. Information is provided on attempts to assess and model the flood vulnerability of households (Figure 1). He also reports on: assessing the "social" and intangible effects of flooding; on modeling of flood safety standards notably from an economic standpoint; on the cumulative cost of dike raising in the Netherlands for different climate change scenarios; and on flood forecasting, warning, and response effectiveness based on a policy comparison across five European countries (see Table 2 for the criteria applied).

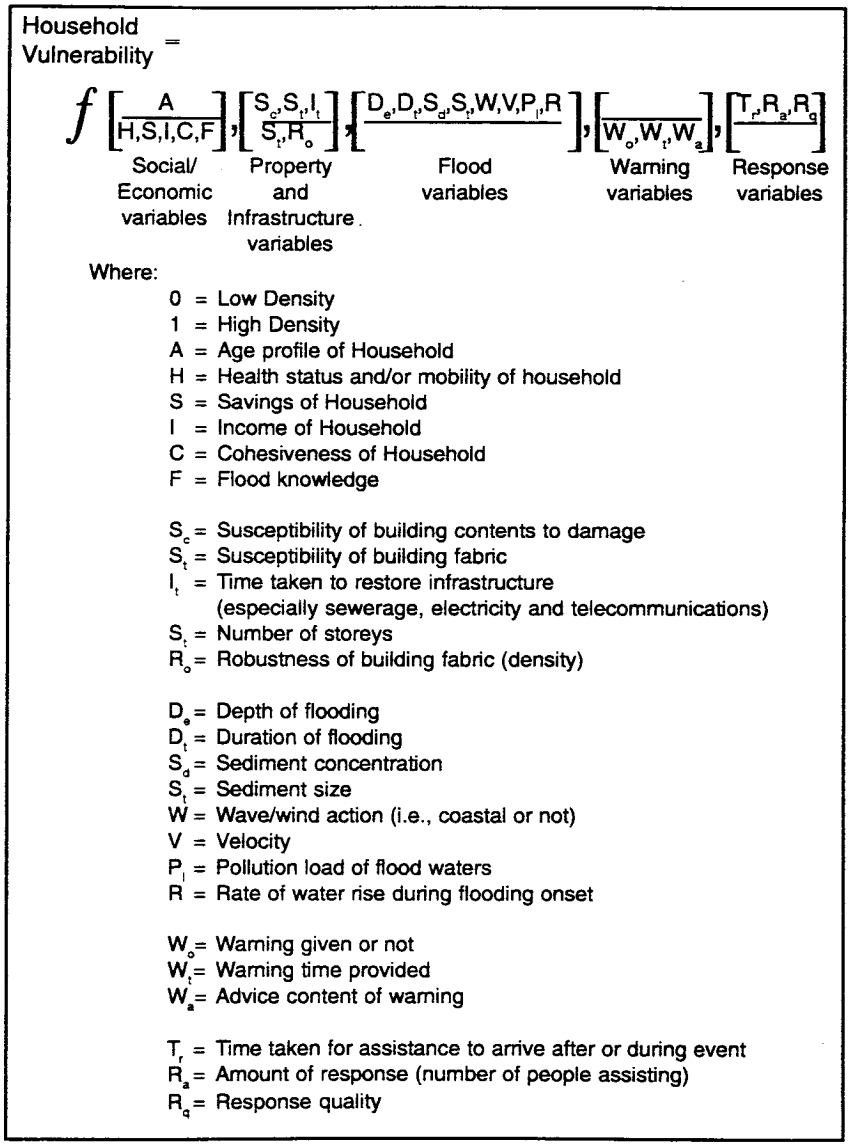


**Figure 1: A model defining flood hazard vulnerability for households.**

Some of the salient characteristics of a natural or ecological approach are presented in the *Environments* special issue on floods, in a paper by Constance Hunt, the Director of the World Wildlife Fund U.S. Freshwater Ecosystem Conservation Program (1999). She explicitly recognizes many of the destructive effects on the natural environment that are associated with structural and non-structural approaches to floods and indicates that *A Twenty-First Century Approach to Managing Floods* should adopt measures that reduce or minimize these effects. She points out that dam constructions, for example, can severely alter riverine environments and aquatic life in several ways.

> *"First, the physical structure of the aquatic environment upstream of the dam is changed from that of a river to that of an ecosystem intermediate between a river and a lake. Second, aquatic habitat downstream of the dam is ecologically separated from the habitat upstream of the dam, causing disruption to fish*

*migration patterns and to the downstream transport of sediment and nutrients. Third, the construction of a reservoir creates a barrier to fish that have evolved to navigate through river ecosystems. The reservoir can prevent fish migration between tributaries upstream of the dam and inhibit fish migration downstream as a result"* (Hunt, 1999, 100).

| Characteristics of criteria | Development stages* 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Flood warning philosophy | Rudimentary | | Intermediate | | Advanced |
| 2. Dominance of forecasting vs warning | Forecast dominant | | Equal | | Equal & improved accuracy |
| 3. Application of technology to FFWRS | Model with manual extrapolation | | Mixture | | Fully automated |
| 4. Geographical coverage | <10% | | <50% | | >50% |
| 5. Laws relating to FFWRS | No laws/ permissive | | Law | | Laws with liability |
| 6. Content of warning messages to public | 'Blanket': general location | | Mixed: location/ timing | | 'Target': severity/ location & timing |
| 7. Methods of disseminating flood warning | General broadcast | | Wardens/ agencies/ police | | Personal phone/fax/ pager |
| 8. Attitudes to freedom of risk/hazard information | Little: request only | | Restricted to general flood-plain | | Open and specific to property |
| 9. Public education about warnings | Minimum | | Some, e.g. colour codes | | Fully informed |
| 10. Knowledge of FFWRS effectiveness | Denial of failure | | Recognise limitations | | Research tested |
| 11. Dissemination of lessons learned | Little | | Partial | | Full |
| 12. Performance targets and monitoring | None | | Key indicators only | | Accuracy/ timely/reliable |
| 13. National standards | Parochial | | National/ regional variations | | National/ international |
| 14. Organisational culture | Independent | | Agency liaison | | Service level agreement with agencies |

* Rating scale: 1: Basic - little development; 3: Improved performance but some failure apparent 5: More advanced performance; failures reduced

**Table 2: Criteria-development matrix used in the analysis of flood forecasting, warning and response systems in five EU Countries**

The construction and operation of dams and other structure can also severely disrupt aquatic ecology by changing the flow characteristics of the river.

*"The ecology of river systems is dependent on a flow regime that is characterized by a number of variables such as the magnitude of discharge, the frequency of occurrence of high and low discharges, the duration of flows of various*

> *magnitudes, the timing or predictability of flows of a defined magnitude, and the rate of change or flashiness…Many riverine species depend on an array of different habitat types that are regularly recreated and by river dynamics. The magnitude and frequency of high and low flows regulate many processes…High flows also clean sediments out of gravel beds, creating spawning habitat; import woody debris to the stream; and inundate floodplain depressions, creating nursery habitat for fish. Low flows provide opportunities for recolonization of floodplain areas for riparian plant species and isolate young fish in floodplain wetlands from mainstream predators. The timing and duration of flood events exert selective pressure on riverine environments, and many species are specifically adapted to prolonged and frequent flooding. The natural timing of high or low stream flows also provides environmental cues for initiating life-cycle transitions such as spawning, egg hatching, rearing, movement onto the floodplain for feeding or reproduction, and upstream/downstream migrations.*
> *Levees disrupt aquatic ecology by separating the river from its floodplain. River and floodplain ecological functions are interdependent – the river fertilizes the floodplain by depositing silt on it during flood events and the floodplain enhances the river by producing riparian vegetation on the fertile silt. The riparian vegetation provides a source of energy to the river, creates fish habitat through the deposition of woody debris, and shades the stream to maintain temperatures suitable for aquatic life. Fish frequently use inundated floodplains as breeding and nursery habitat. When floods recede, moist soil conditions on the floodplain allow the generation of herbaceous vegetation that provides food for waterfowl and shorebirds. The loss of channel-floodplain habitat and the disruption of periodic river-floodplain connections can trigger the decline of both aquatic and terrestrial biodiversity…"*(Hunt, 1999, 100-101).

Hunt also notes that in addition to increasing use of non-structural measures such as land use regulation, flood-proofing, and insurance, more stress is being placed on relocation of towns and facilities away from the floodplains. The first relocation of an entire town in the U.S. took place in the mid-1970's. After several costly floods in the 20th century, Soldier's Grove on the Kickapoo River in Wisconsin rejected a $3.5 million dam and levee construction response, and asked for relocation assistance. The reasons included environmental opposition to the dam, uncertainty about the reliability of the levee, and the costs of construction and maintenance of the levee, "which exceeded the value of the property on the floodplain and the town's entire annual tax collection, respectively" (Hunt, 1999, 102).

The relocation response has gathered momentum following the great Mississippi floods of 1993. Prior to this, federal disaster assistance programs emphasized, "putting the landscape together the way it was before the flood". As a result of the 1993 flooding, victims pressed for more flexible assistance programs to relocate their homes and businesses outside the floodplain. "A number of federal agencies co-operated and about twenty percent of the structures damaged during the floods were removed form the floodplain, including the majority of several small towns" (Hunt, 1999, 103)

## A New Combined Approach

According to Hunt, the emerging approach now in the U.S. is "to combine small scale structural and non-structural measures with restoration of the hydrologic features of the river channel, catchment, and floodplain" (Hunt, 1999, 103). A central goal is to reconnect the river channel with the floodplain. Flood-prone property is removed and restoration of vegetation and natural ecosystems undertaken with a number of objectives in mind. These include direct reduction of flood damages to property; a larger floodplain to accommodate the river; lowering flood stages and damages; slowing of flood flows by natural vegetation; filtering of pollutants and improvements in water quality; and restoration of wetlands, wildlife habitats; biodiversity, recreational, and other benefits. Hunt provides a number of examples of hydrologic restoration and the blend of structural, non-structural and hydrologic or ecological approaches in several areas in the U.S. (Hunt, 1999, 106-107).

> *"In the case of Napa, California, she draws attention to the incorporation of the concept of adaptive management, an approach which is seen as particularly valuable where outcomes are difficult to predict and may be controversial. In adaptive management, projects are viewed "as a sequence of experimental designs and the results of each experiment being used in a learning process to improve subsequent designs. Monitoring, assessment, feedback, and adjustments are integral parts of the resources management process. Thus, it is vital to the concept of adaptive management that resource managers maintain flexibility to respond to changing environmental conditions, social conditions, of social preferences in the system.*
> *The Napa project incorporates this concept in its project monitoring and maintenance strategy. The Napa County Flood Control and Water Conservation District will employ a model to stimulate the project's expected performance under optimum conditions, including sedimentation and erosion rates and locations as well as vegetative establishment. The model will serve as the standard against with the long-tern performance of the flood protection measures is evaluated. Actual conditions will be determined through the annual monitoring of the river cross-sections at 20 locations. The maintenance program will respond to the discrepancies between the actual operation of the project and the ideal operation as predicted by the model by implementing management measures to correct problems"* (Hunt, 1999, 108-109).

A relatively full treatment of the adaptive management approach is given in Sendzimir et al (1999). One of the challenges of this approach is that it can be pursued by managers in ways that separate them, as experts, from the public. The tendency to proceed with decisions without careful consultation with the public has led to some costly decisions in the past. This tendency is exacerbated by the crisis atmosphere that often is associated with flood response. The U.S. Corps of Engineers, for example, has tended to proceed in this fashion in the past and has encountered problems and conflicts by not consulting the public carefully about its costly engineering responses from an early stage.

In the 1980's and 1990's, therefore,

> *"…the Corps began to involve the public much earlier in many water resource projects and to serve as a facilitator and provider of technical assistance to interdisciplinary planning processes. While planning processes that involve extensive public participation are often lengthier and more expensive than planning processes driven by a single agency, the additional costs may be more than compensated for by a reduction in political and legal opposition to the project during the implementation phase. Project mangers also find that the communities that live near a river have a thorough understanding of the characteristics of the river system, as well as the social context into which the project must fit. The incorporation of local knowledge can decrease the costs and increase the benefits of project planning. Public participation also gives river basin communities a stake in the project, so that they are more likely to help with project implementation and maintenance"* (Hunt, 1999, 110- 111).

To the foregoing reasons for greater public participation must also be added the need to work for equity. This has not been referred to specifically earlier in this paper but most readers will recognize that many responses to floods and other hazards can result in decisions that fall unevenly on different people. Some bear a disproportunate share of the costs, especially the social costs. Greater public involvement is likely to lead to greater recognition of these and to more equitable planning.

## A Civic Approach

Such considerations have led to the suggestion that a civic approach is essential in planning, managing, and making decisions on flood and other hazard responses (Lawrence and Nelson, 1999). This suggestion is based largely upon detailed work on floods in the Great Lakes region of Canada and the U.S. during the last three decades. In this context,

> *"The civics approach arises largely from recognition of the limitations of the corporate or rational planning model. The rational planning model often is driven by government officials. It proceeds in a top-down manner, seeking control of the situation. Management goals and objectives are set, usually after some consultation with other agencies and with the public. Responses are selected from a range of theoretical choices. Responses are implemented and monitored and any necessary adaptations theoretically are made. This is basically the approach that has been use in dealing with the Lake Erie and Great Lakes floods. It has worked imperfectly in the sense that damages to property continue to reoccur – and increase – in flood prone areas at a relatively high cost to the individuals and communities affected and to society as a whole. The civics approach is more interactive, adaptive and inclusive than the corporate or rational approach. The civics approach is in the spirit of adaptive management…and the mixed scanning approach…The civics approach moves beyond management by a lead agency or group of agencies into ongoing*

*decision-making by the governments, private groups and individuals involved. In this sense civics essentially refers to attempts to bring various government agencies, private groups and individuals together to address issues co-operatively in terms of a broad social learning approach. The civics approach can be described in terms of seven basic interactive processes: understanding; communicating; assessing; planning; implementing; monitoring; and adapting"* (Lawrence and Nelson, 1999, 14-15).

Time and space do not allow for a full discussion of these seven basic elements of the civic approach here. Suffice to say that these basic elements differ from the models or frameworks generally put forward to describe rational or corporate planning or adaptive management. (see Figures 2 and 3)

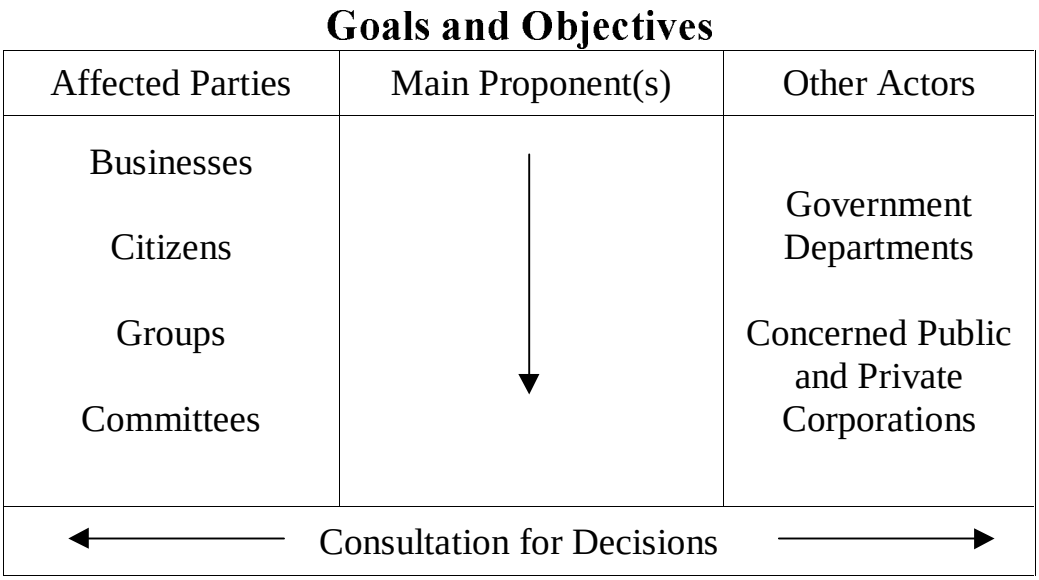


**Figure 2: A General Outline of the Rational or Corporate Model**

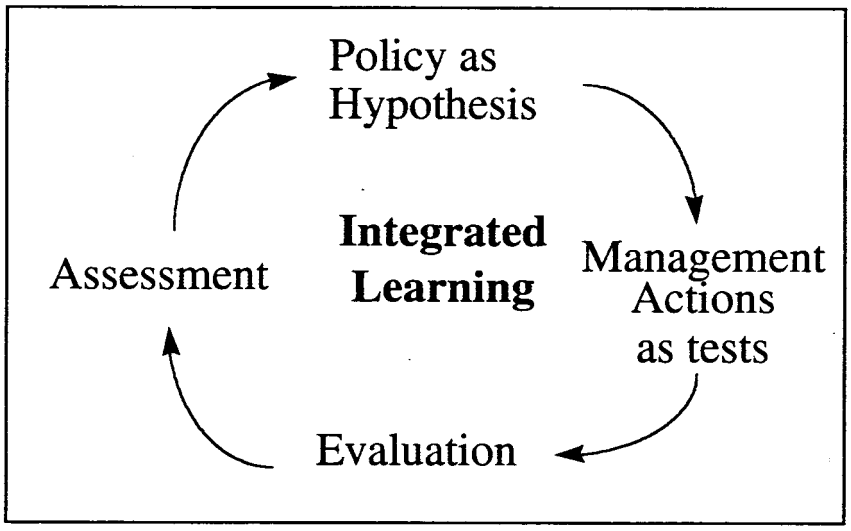


**Figure 3: Key Ingredients Contributing to Structured Learning in the AEAM Process**

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|---|---|
| *UNDERSTANDING* | Broadly informing; comprehensive and pluralist; selective in terms of significance, assessment and action; focusing on preparedness for decision. |
| *COMMUNICATING* | Understanding and using varied means and media; personal and group communication skills; technical understanding and skills; inter-group or cross-cultural understanding and skills. |
| *ASSESSING* | Understanding of and ability to evaluate and select on the basis of principles and standards, pluralist in orientation; awareness of various kinds of social, economic and environmental assessment; understanding of trade-offs; importance of understanding and assessing institutions both as resources and as obstacles to desired change. |
| *PLANNING OR VISIONING* | Ability to think systematically and interactively about time and change; historical as well as a futuristic perspective; understanding of time in both natural (geologic, biologic), and human (historic) senses; a human ecological perspective. |
| *EMPLEMENTING* | Understanding how to decide and act; ideas and models of cooperation and coordination; integrating the technical and socio-economic, the scientific and the humanistic; understanding and use of bridging institutions, of demonstration, of a research and experimental approach, of mixed scanning and transactive planning*. |
| *MONITORING* | Generally following or tracking issues and current events; understanding and use of auditing and follow-up procedures as part of all aspects of civics; understanding of different kinds of monitoring and the pluralist nature of monitoring; regular, periodic, and technical monitoring and assessment. |
| *ADAPTING* | Understanding that continuous adjustments to turbulent and changing circumstances are part of the civics model; objectives and activities frequently change among individuals, groups and nations in a dynamic world; capacity to foresee and adapt; evolutionary, interactive, competitive and accommodating; tolerance for ambiguity.<br><br>*(Etzioni, 1967; Friedmann, 1973) |

**Figure 4: Basic Processes in the Civics Approach**

A general outline of the civic approach is shown in Figure 4 and Figure 5 and these can be compared with the management model or approach in Figure 6. In the civics approach all the basic elements or processes in the model are ideally envisioned as at work

| | |
|---|---|
| *WORLD VIEW* | Comprehensive, holistic, cross sectoral, multidisciplinary, systematic and eclectic, thinking in terms of spectra more than specialties, viz. ecology, human ecology, heritage (both natural and cultural, dynamic and living), environmentalism in the broad human and natural sense, deep ecology; bio-regionalism, whole economy, community. |
| *GOALS* | Sustainability; maintenance and enhancement of economy, society and environment, economy and environment as opposite sides of same coin, meeting basic human needs, multi-culturalism, equity, informed choice. |
| *MEANS* | Mutual learning, use of local or indigenous knowledge as well as science, trans-disciplinary, scholarship, critique, dialogue, integration. |
| *MECHANISM* | Pluralist, government, corporation, citizen, public and private cooperation, self-reliance and voluntarism. |
| *PLANNING APPROACH* | Transactive, participatory, interactive, adaptive, integrative, mixed scanning*. |
| *IMPLEMENTATION PROCESSES* | Preparation for understanding and participation, learning (demonstration, experiment), monitoring, assessment, implementation, adaptation. |
| *CRITERIA FOR JUDGING SUCCESS* | Meeting basic needs, level and kind of involvement, equity, level and kind of social skills and aptitudes, a strong sense of heritage and civics. |
| *POSSIBLE SITUATION* | Difficult to foresee, possibly stronger informal economy to meet basic needs, stronger communities, but perhaps more competition among communities and countries, difficulty in achieving sustainability, problems of overwork and "burn-out" through multiple calls for a civics approach from many sectors, difficulties posed by growth in population and resource consumption, possible balance among various government levels and private groups in maintaining and enhancing environment, economy and society, problems of so-called Third and Fourth Worlds or multiculturalism. |
| | *(Etzioni, 1967; Friedmann, 1973) |

**Figure 5: The Civics Model**

continuously in the minds of all the actors involved in flood and hazard decisions. In this way all the actors and/or affected parties have access to the information that they ideally

| | |
|---|---|
| *WORLD VIEW* | Specialized, sectoral, disciplinary, systematic, viz. geology, vegetation, wildlife, economy, society, culture, resources, environment, development. |
| *GOALS* | Progress, economic and technical development, wealth, leisure, a universal or global economy and social system, nation building, and international cooperation. |
| *MEANS* | Science, technology, education, technical and other training, separation of objective and subjective elements of world. |
| *MECHANISM* | Management, namely command and control with consultation and participation and compensation to affected parties, driven by government funding. |
| *PLANNING APPROACH* | Rational, setting goals, identifying alternatives and selection of best alternative, research by experts, professionalism, cybernetic, tempered by "satisficing" and the like, public participation, coordination among agencies and groups. |
| *IMPLEMENTATION PROCESSES* | Governments and corporations, through systems involving identification of mandates, roles, responsibilities, authority, funding. |
| *CRITERIA FOR JUDGING SUCCESS* | Efficiency, effectiveness, growth, technical progress. |
| ***CURRENT SITUATION*** | Disarray, some successes, some failures, in terms of goals, criteria and other factors. Often inefficient (eg. long time periods and costs for assessment and implementation), fragmented view of world, struggle for holism and comprehensiveness, desire to understand connections and interrelationships (for example between natural and cultural heritage), economic difficulties and inequities locally, nationally and internationally, failure of government to deliver through funding and other traditional means, literacy and learning failures, voluntarism, call for strong community role, movement of government from rational command and control model to one of facilitating grassroots or community approaches. |

**Figure 6: The Civics Management Model**

need to participate effectively, efficiently, and equitably in planning, management, and decision-making.

At the root then, a civic approach to floods moves beyond the concept of management to explicitly recognize and plan for the role of people in hazard planning and decision-

making through a broad participatory or political process. Indeed flood and hazard policy should be a much larger item on the public agenda than currently, especially given the major decision-making challenges posed by climate change. The significance of flood policies is strongly brought out by John Barry in his remarkable Rising Tide; The Great Mississippi Flood of 1927 and How It Changed America. The decision to open the levee to save New Orleans may have led to the loss of power by the southern elite, the rise of the small farmer and worker, the election of the populist Huey Long as governor and even the eventual election of Herbert Hoover as President of the U.S.

We sorely need and could benefit greatly from such histories of hazards and other environmental events. Humanist and broadly civic perspectives on floods are much needed as guides to fuller understanding and more acceptable planning, managing, and decision-making.

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