EFFECTS OF WATER MANAGEMENT ON THE ECOLOGY OF THE AREA

William A. Dick-Peddie[1]/

Water is a continuous, unbroken entity existing in various forms and places and connected by groundwater to surface water, by running water to ocean water, or by the interface of surface water to water vapor. Consequently, there is a "net" or matrix of water under, on, or above the earth's surface with no loss or gain in the total amount.

Variations in composition, location, and inclination of the earth's surfaces result in differential degrees and rates of insolation, conduction, reflection, and re-radiation of solar energy over our planet. These energy differentials are further amplified by the earth's diurnal "spin" and annual "wobble". The interactions of water, solar energy, varied surfaces and the earth's "spin" and "wobble" result in the formation of climates and macro-habitats. Macro-habitats apply to such units as oceans, lakes, mountain masses, and continental plains.

Consequently, where water is, what form it is in, and what is happening to it is highly variable from place to place and time to time.

Climates and macro-habitats are then energy systems. They are often of such great proportions and the energy exchanges are so regular that the systems appear to be static and permanent. In fact the relative stability of these systems has persisted long enough to have allowed the evolution of complex aggregations of living organisms - communities which "fit" into and are an intregal part of each system. Often the degree of specificity and delicacy of the "fit" is such that even a slight perturbation of a single component (biotic or abiotic) will induce gyrations in the rates and directions of energy flow to such a degree that the system will lose its stability.

The study of the nature of these "community fits" in "energy systems" is called Ecology. From this it is obvious that an ecologist is occupationally an integrator and synthesizer. It is equally obvious that he is doomed to failure!!

I would like to suggest to you today that the Ecologists' point of view is the important feature rather than the degree of his success. In fact, perhaps there really is no discipline of "ecology" at all. An Ecologist may have to deal with physiology, morphology, taxonomy, soils, meteorology, history, sociology, and economics.

Today's technology is such that even the huge "climatic" and "macro-habitat" systems could be altered to such an extent that we might consider them destroyed. This technology combined with the geometric increase of our species' mass, make it highly probable that some of these

1/ Head, Biology Department, New Mexico State University

systems will be unintentionally destroyed!

Men have long been aware of their modification, disruption, and destruction of sub-systems. Often these sub-system manipulations have been of great benefit to man, i.e. agriculture, industry, etc. Sometimes not beneficial such as species extinction, soil losses, pollution, etc. However, as man's ability to increase the speed and degree of system modifications continues, there is evidence that uncontrolled energy flow gyrations may be initiated. This could be dangerous!!

Let's look at some indicators of extensive manipulations.

1. Miami's seasonal temperature ranges used to be similar to those of the Keys - moderate, due to the buffering effect of water which gains and looses heat slowly as compared with land. The summer and winter temperature extremes of Miami in the past few years appear to far exceed those of the Keys. The extensive drainage of Southern Florida may well have actually brought about a climate shift for Miami.

2. The "foggy, foggy London" of Sherlock Holmes appears now to have been largely caused by soft coal consumption commensurate with the industrial revolution in England. The smoke tended to reduce insulation and add particulate matter. Both conditions modified the conditions just enough to initiate fog which led to more fog. Recently, London weather has so improved that birds not seen in many years are again nesting in the city!

3. Up until the 1920's major Midwestern rivers only flooded periodically. The Spring thaw filled Pleistocene created sloughs, marshes and potholes. Also the flood-plains of the smaller meandering rivers were filled in the Spring. This local filling and flooding allowed ample time for groundwater recharge and slowed the speed of run-off into the major rivers.

4. With the extensive drainage programs initiated in the 1920's and 30's to increase farm acreages for high cash crops (which quickly became surplus) a rain drop on the land was in a river in a matter of hours, moving at rates making the transport of soil particles easy. Consequently, bad floods now occur annually on most major river systems, delta build-ups of midwestern soils is of concern, water tables are unstable, and the Mississippi migratory water-fowl fly-way has become virtually limited to the Missouri and Mississippi Rivers.

We try to repair mistakes with other vast manipulations and need go no further into that "Dam" business. These are just a few examples of extensive man-made changes which hint of-things-to-come if we are not thoughtful.

The attempt to anticipate the possibility of distant (either in space or time) gyrations in the system caused by a local manipulation,

exemplifies the ecological point of view. This long-range, synthetic, or "over-view" approach becomes increasingly difficult due to the very technological advances which make it necessary. Our knowledge explosion demands narrow specialization. Consider the name of this conference.

We can no longer necessarily assume that it is desirable to induce more precipitation, increase or decrease water run-off, reduce water transpiration, transport water for irrigation, develop water for industry, develop water for recreation, etc. Not only do many of these activities conflict directly but they most certainly could modify systems in complicated and remote ways. Actually conferences such as this, function to prevent such conflicts at least as far as water use is concerned.

Often at this point there is a tendency to reduce all problems to one of "economics". It is always important to know how the term is being used. Does it take into account new or changing value systems? With this in mind let's look at New Mexico.

Should we increase areas under irrigation for crops which have support prices?

Is the complete removal of vegetation along water courses to reduce transpiration losses the best approach in the long run if another type of vegetation such as cottonwood trees might lower water losses and at the same time provide much needed park and recreational areas?

Do we know that even if "rain making" should be successful that we want it? What if it should change the environment to such an extent that new kinds of plant communities might come into being which are highly undesirable for our present economy or value system?

Even if the economic factors were to be satisfied by some environmental manipulation, how about our ability to reverse or redirect the changes caused by this manipulation?

I suggest that there are virtually no operational generalizations which can be made about managing our environment. We really have not even defined the problems, let alone anticipated the long term results of manipulations or the consequences of a future change in our value system. Let's manipulate sparingly and cautiously. We should never make decisions concerning the modification of our environment based upon single or short term motivations.

We are all drawn toward conferences such as this where we can announce our achievements and explain our problems to understanding and sympathetic ears. We also learn a lot and have our enthusiasm renewed.

However, there is probably no system component whose management demands an ecological viewpoint more than does water. Intelligent management of this resource can never be accomplished outside of the context of a

complete system. This means that "water people" must increasingly operate in "non-water people" environments. We can no longer afford the luxury of working entirely within the limited horizons suggested by such terms as watershed management, water pollution, sanitation, meteorology or hydrology.

This observation is possibly more obvious to "water people" than to many of the environmental scientists. This is indicated by the planning and interlocking nature of most of the papers at this conference, but the plight of our environment indicates that we are all still too preoccupied with our individual specialities.

Let's hope that some day soon we are able to title a talk "Water Management is Ecological", rather than, "Effects of Water Management on the Ecology of the Area".