Environment and Water Resources Management: The Need for a New Holistic Approach

ASIT K. BISWAS[1] & HABIB N. EL-HABR[2]

[1]*President, International Society for Ecological Modelling, 76 Woodstock Close, Oxford OX2 8DD, UK;* [2]*United Nations Environment Programme, PO Box 30552 Nairobi, Kenya*

ABSTRACT *The present approach to environmental assessment of water resources development is seriously flawed and unsatisfactory. While no one will argue against the importance of carrying out environmental assessment, the real question remains how this assessment can be carried out properly and efficiently for the benefit of society as a whole. This paper outlines some of the major problems associated with the environmental assessment techniques used at present, and argues that until and unless these shortcomings are recognized, improvements are likely to be limited in the future.*

Introduction

Interest in the environmental impacts of water resources development has increasingly become an important consideration since the late 1960s. Generally, as in all other environmental areas, the interest of the general public in this issue peaked around 1972–73 and then gradually started to decline steadily for nearly the next decade and a half. The overall interest in the environment in general, and water resources in particular, was rekindled again in the late 1980s. The environment at present has become the key political issue in many major national fora, especially in most developed countries and a few select developing countries. Equally, it now occupies a central place in the agenda of many recent international fora. While it is likely that the public, and thus political, interest in the environment will ebb and flow with time, it is equally clear that a certain threshold of interest is likely to be maintained permanently. The days when engineers could design, construct and operate major water development projects, without explicit consideration of social and environmental factors, is now history in most countries. In others, a certain amount of lip-service to environmental conservation is being given, but it is highly likely that formal and real consideration of environmental factors in such countries will become a reality in the near future.

This, however, does not mean that engineers completely neglected the environmental impacts of water development projects in the past, but simply that they considered only certain specific impacts such as the development of salinity and waterlogging due to poor irrigation management practices, and unsatisfac-

tory resettlement of people who were forced to move because of the inundation caused by newly constructed reservoirs. A comprehensive and integrated environmental and social impacts analysis was not carried out.

It should further be noted that this situation was not unique to the field of water resources development. No comprehensive environmental and social impact of any type of major project was carried out anywhere in the world during the pre-1965 era. The techniques for environmental impact assessment (EIA) were developed only during the post-1965 era, and in fact the term EIA itself first gained widespread use at that time.

While interest in the environmental and social aspects of water development is unquestionably a positive development, and in our view a step in the right direction, we would argue that the following three critical issues reduce the effectiveness of impact analyses as they are carried out at present. These are:

(i) limited frameworks used for environmental assessment;
(ii) absence of any integrative methodology; and
(iii) lack of adequate knowledge.

This, however, should not be construed to mean that these are the only major issues that are worth considering, since there are other important considerations as well, but all these issues simply cannot be discussed here because of lack of space.

Limited Frameworks Used for Environmental Assessment

The various frameworks that have been used for environmental impact assessment have changed only in some minor ways during the past two decades. While such techniques were acceptable and even laudable in the 1970s, they are certainly now out of date. Significant changes and modifications are essential if they are to meet the complex needs and challenges of the 1990s and beyond. Yet, most unfortunately, our profession is continuing to use them without asking any serious questions about their effectiveness. It appears that we have generally accepted them as the only available alternative. We are not even asking the right questions, and hence the real long-term solution is nowhere in sight.

There are three fundamental problems with the techniques used currently for environmental impact assessment. First, at the macro level, the linkages between EIA and the social and economic aspects of water development are not clear. They are fuzzy at best. Second, while considerable expertise has been developed on the application of EIA at the project level, commensurate progress at policy and programme levels simply has not been made. We just do not know how to carry out environmental assessments of policy and programmes, except in a very general fashion (Biswas, 1991).

Third, it is indeed a curious irony that we have spent the last two decades discussing and promoting what is *not* sustainable water development rather than what it is. We have almost totally concentrated our thrust on those aspects that cannot be sustained. By trying to define sustainable water development by *only* the factors that contribute to unsustainability, clearly we have focused our entire attention on just one part of the equation, and have completely ignored the other, which could possibly be as important as the negative issues, if not more so. The whole focus of sustainable water development, as we deal with this subject at present, now concentrates on what it is not, and then tries to

ameliorate the potential negative effects. We do not take a holistic approach to this issue, which should first consider what *is* sustainable water development. Instead we are hung up exclusively on 'how' to reduce negative impacts. We must admit that, as scientists, we find it very difficult to accept the present highly skewed approaches to environmental impact assessment.

It is worth noting that, even though it is axiomatic that any significant development project would have many impacts, the word 'impact' in the context of EIA has developed *primarily* negative connotations. While any large development project, irrespective of its nature, will have both positive (otherwise why build them?) and negative impacts, all current analyses of environmental and social impacts generally consider *only* adverse impacts and their potential amelioration.

To a certain extent this overwhelming emphasis on the negative aspect of all major development projects can be rationally explained. During the 1960s and earlier, project analyses primarily consisted of technical and economic considerations; environmental and social issues were mostly not seriously analysed. Because of this general neglect, and some very visible but adverse impacts of certain development projects on both society and the environment, a movement gradually developed in the West for environmental conservation. Within a very short period, environmental protection became an important item on the political agenda in the late 1960s in some developed countries, primarily through the activities of environmental pressure groups and non-governmental organizations.

Not surprisingly this attitude and perception of environmental protection was reflected in the United Nations Conference on the Human Environment held in Stockholm in 1972. A retrospective analysis of the Stockholm Action Plan, as approved by all the UN member countries, clearly indicates its negative approach to environmental management: stop all pollution stemming from any development activity, stop exhausting non-renewable resources, and stop using renewable resources faster than their generation. The emphasis thus was primarily on adverse impacts of development: positive aspects did not receive much attention.

Accordingly, environmental impact analysis, which was developed and made mandatory in many developed countries during this period, was exclusively concerned with the identification and amelioration of negative impacts; positive impacts were mostly ignored. Because of this inauspicious and incorrect beginning, the term 'impact' has continued to have almost exclusively negative connotations. This unfortunate situation has not changed over the past 20 years.

Specifically, in the area of large-scale water development, another factor of this early environmental period has had a major and continuing impact on our general thinking. This was the publication of a series of articles in the popular media by the well-known journalist, Claire Sterling, on the adverse social and environment impacts of the Aswan Dam. Her well-written but not necessarily accurate commentaries caught the imagination of the general public, including most scientists. This dam suited the times of a 'small is beautiful' era very well for three important reasons.

- It was a large dam whose completion in 1968 coincided with the newly emerging environmental movement, which had started to flex its muscles.
- For political reasons, well-documented elsewhere, the West declined to

assist Egypt in constructing this dam. It was finally constructed with the assistance of the 'Evil Empire', the Soviet Union, and thus became an immediate and easy target for western criticisms.
- In the then prevailing climate, it was much easier to severely criticize a new dam in a far-off land than one's own country.

Sterling's concentration on the negative environmental impacts of the Aswan Dam found a very receptive audience, who were already semi-convinced that all the large development projects were disasters. Her discussions reinforced the biases, and helped to make the Aswan Dam a *cause célèbre* among environmentalists as a shining example of a bad project. The perception that the environmental and social costs of the Aswan Dam significantly outweighed its benefits did not change because Egyptian scientists and the Government generally did not produce objective and comprehensive analyses of its total environmental impacts, both positive and negative, which were widely available to western scientists. To the extent that the Government did do so, the general reaction outside Egypt was "what else would you expect from the Government that built it?"

Thus, the Aswan Dam quickly became a symbol of everything that is wrong with a major dam. Unfortunately this view is still widely held, and most international publications available on this issue do not provide a reliable and objective discussion of the real benefits and costs of this much-maligned dam. Recent reviews by one of the authors (AKB) of the various research work done on the environmental impacts of the Aswan Dam over the past two decades clearly indicate that many myths now surround this dam, which are generally accepted as facts. This is because these myths have been repeated so many times that they have come to be viewed as truths! In reality, however, the Aswan has been a remarkably successful dam, without which Egypt would undoubtedly have been in dire economic straits. It has unquestionably contributed to some adverse environmental impacts. However, the real point is no longer whether the dam should have been built, since without it Egypt would now be facing a continuing catastrophe, but rather what steps should have been taken to maximize the positive environmental impacts and minimize the negative ones (Biswas, 1992).

In retrospect, such developments had one major beneficial impact. It was made clear to the engineering profession, which dominates the water development field, that there are other important issues in addition to the techno-economic analyses which need to be considered to maximize human welfare. Accordingly, environmental impact assessment, which was neglected prior to this period, increasingly became acceptable as an established procedure.

Absence of Integrative Methodology

EIA methodologies have continued to consider only certain selected aspects of water development projects: an integrative approach has basically been missing.

While one can cite many instances of this narrow and restricted approach, let us discuss only one aspect here as an example: the health impacts of irrigation projects.

An objective and comprehensive review of the existing literature in this field would indicate that the main, and mostly the *only* issue considered, is vector-

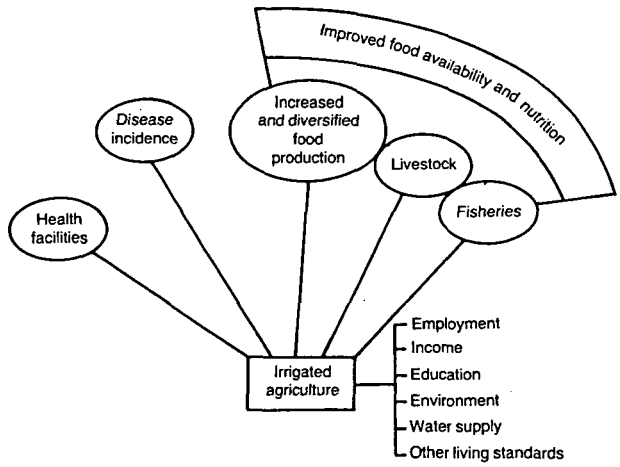

Figure 1. Interrelationships between irrigated agriculture and health.

borne diseases like schistosomiasis and malaria. Irrespective of the reliability of the oft-quoted evidence for increases in water-borne diseases due to construction of irrigation projects, an issue that will be discussed later, we would argue that our present approach is not only simplistic but also somewhat erroneous for the following reasons.

Viewed in any fashion, irrigation has to be considered to be an integral component of rural development. As irrigation practices spread, agricultural production increases as well. With higher per capita food availability and more diversified crop production, food and nutrition levels of the local population also increase. Creation of new employment opportunities due to intensification of agricultural and economic activities in the project areas improves the financial status of many landless labourers. The nutritional status of rural people is further improved by the availability of animal protein through increased livestock holdings and the development of inland fisheries in the newly created reservoirs.

In addition, the health of the rural populations is further enhanced because of improvements in education, health and transportation facilities and the lifestyle of women. These interrelationships are shown diagrammatically in Figure 1. Current EIAs, however, do not consider health impacts of irrigation in an integrative manner: only the negative impacts are analysed. This clearly cannot result in an objective and full impact assessment.

The way present EIAs are carried out has also affected monitoring and evaluation of irrigation projects. For example, not a single multilateral or bilateral aid agency currently carries out project evaluation in a holistic manner. This does not mean that if one broadens one's mind such an integrative evaluation cannot be undertaken. The facts are clearly on the ground for any objective and perceptive evaluator to find: sadly they see but do not observe them.

It is our contention that at our present state of knowledge we can carry out reliable and integrative environmental impact analyses, as well as evaluations of irrigation projects. For example, the evaluation carried out for a major interna-

tional agency for the Bhima Project in India (Biswas, 1987) is a good example of how such studies can be conducted. Such an analysis, however, is generally a rare exception rather than a rule.

Let us outline here just two types of major benefits which were observed at the Bhima Project, which to our knowledge have never been attributed to an irrigation project.

The first is in terms of female education. The report observed the following:

> One point made by several landless labourers was that, before irrigation, they had to move from one place to another searching for jobs. Thus, they could educate only one son, who was left initially with relatives, and in a few cases in hostels. Daughters invariably moved with parents from place to place, and thus were never sent to school.
>
> With the introduction of irrigation, employment opportunities near the villages have increased significantly. Now they stay in one village and find work within the village itself or neighbouring areas. Because of this economic stability, for the first time they are sending their daughters to school.

We are not aware of a single EIA or any other evaluation of an irrigation project that has even cursorily considered female education as an important benefit of year-round irrigation.

Second, the Bhima evaluation further indicated that the patterns of biomass fuel utilization within the project area changed very markedly with the introduction of irrigation. Percentages of people purchasing fuelwood, or the total amount of fuelwood purchased per family, or both, in irrigated areas were significantly less than in non-irrigated areas for three reasons:

(i) higher cropping intensity as well as yields increased availability of agricultural residues, which are being used for cooking;
(ii) increased livestock holding in irrigated areas produced more dung than ever before; and
(iii) increases in employment opportunities and incomes encouraged people to move away from biomass to other forms of energy.

The reasons are diagrammatically shown in Figure 2.

This development has contributed to three major environmental and social benefits:

- reduction in pressure on the forests in the neighbouring areas;
- decline in time spent by women and children collecting fuelwood; and
- money saved by not buying as much fuelwood as before was used for other productive purposes (Biswas, 1990). And yet no EIA of irrigation projects has identified this type of benefit.

Lack of Adequate Knowledge

There are many areas where adequate technical knowledge simply does not exist. Equally there are areas where 'conventional' knowledge can at best be dubious and at worst totally erroneous.

There are also many areas where we are not even asking the right questions. For example, the two most widespread and important vector-borne diseases are probably malaria and schistosomiasis, but we do not know to what extent a

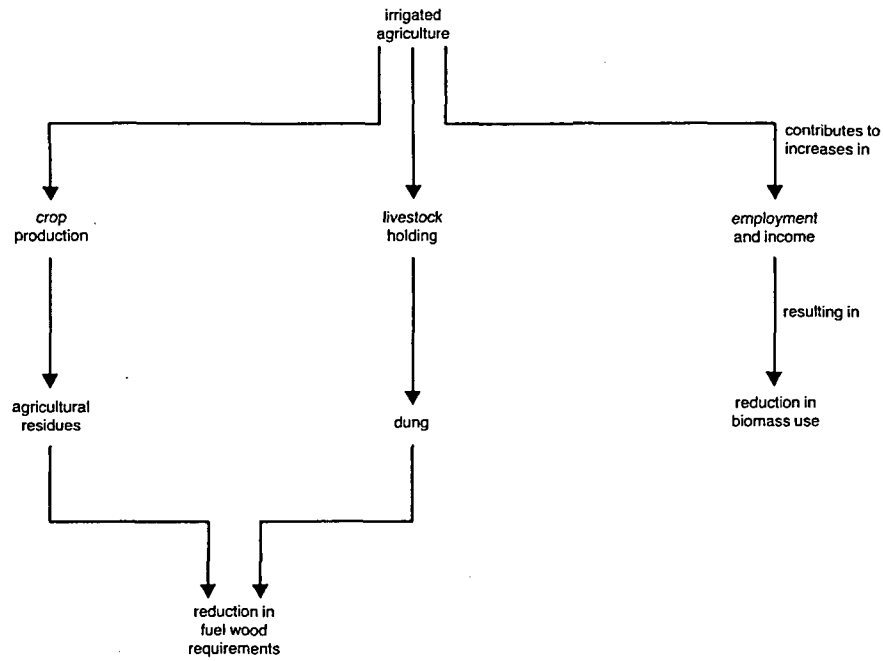

Figure 2. Impact of irrigated agriculture on biomass use.

water development project *per se* may increase their incidence. The problem is further complicated by the case-specificness of the answers.

An exhaustive study by the Indian Malaria Research Centre has indicated that the resurgence of malaria occurred independently of the Green Revolution. There is, however, no question that irrigation, agricultural practices, rice cultivation and migration of agricultural labour have an important bearing on the mosquito vector fauna and malaria transmission (Sharma, 1987). The linkages are not clear, and there is no evidence to indicate a one-to-one relationship between irrigation development and additional incidences of malaria.

Figure 3 shows the district-by-district average annual parasite rate (API) between 1982 and 1984 on a rice acreage map of India. The API registers the number of malaria cases per thousand population in one year. It is found that for large parts of the country, with high acreages under paddy, malarial rates are negligible (API < 0.5) or extremely low (API < 2). There are some rice-growing areas where the incidence of malaria is moderate (API 2 to < 10) or high (API > 10).

There does not appear to be any specific relationship between the area under rice cultivation and API: other parameters appear to govern disease transmission.

There are other complex issues that need to be considered for malaria. A study of two villages in the Kano plains of Kenya, one a newly established village within the 800-ha Ahero rice irrigation scheme and another older village nearby in a non-irrigated area with traditional mixed agriculture, showed remarkable differences in terms of different mosquito species. In the new village 65% of

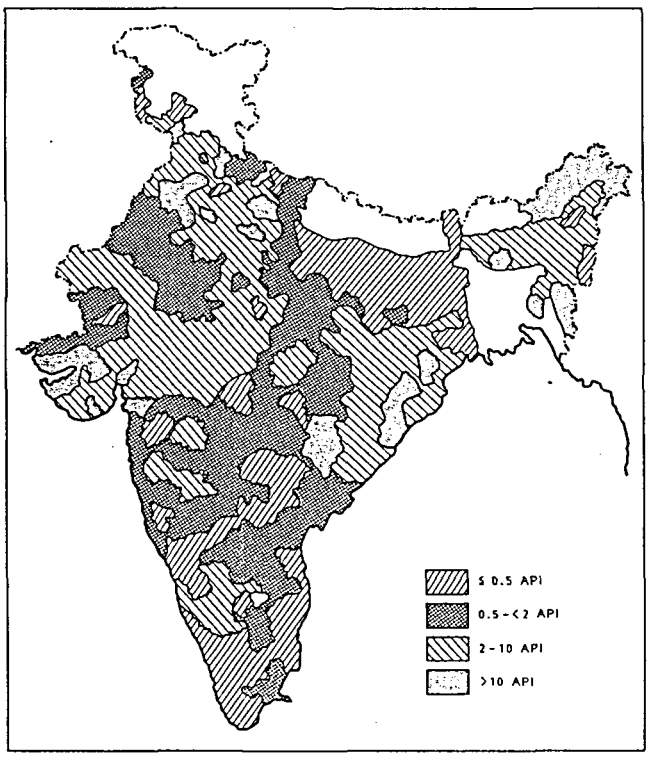

Figure 3. The relationship between area under rice cultivation and average API, 1982–84.

Source: Sharma, 1987.

mosquito bites were from the *Anopheles Gambiae* complex (the principal vectors of malaria in tropical Africa), 28% were of *Mansonia* species (vectors of lymphatic filariasis and Rift Valley fever) and 5% were of the *Culex quinquefasciatus* variety (another vector of lymphatic filariasis). In contrast, 99% of the mosquitoes in the older village belonged to *Mansonia* species and less than 1% were *Anopheles Gambiae*. Thus irrigation can change the transmission patterns of mosquito-borne diseases. This is an especially important consideration for tropical Africa, where most of the global total of more than one million deaths due to malaria now occur (Biswas, 1986).

There is also the issue of stratification. Evaluation of the Bhima command area development indicates that malaria appears to be attacking women more than men (Biswas, 1987). How widespread this stratification is, in India or elsewhere, is unknown since this type of question is not being asked at present, let alone answered.

If schistosomiasis is considered, there is no doubt that the presence of an irrigation system in a developing country, with extended shorelines of reservoirs and banks of canals, contributes to a better habitat for snails than existed before construction. However, extensive studies in Egypt and South Asia now clearly indicate that maximum infection is occurring *not* during the irrigation phase but during domestic interactions with the canals during normal hygienic practices due to lack of basic facilities. Increasing the provision of piped water or tubewells in rural areas, sanitation facilities and health education are reducing

schistosomiasis incidence to such an extent that this disease is unlikely to be considered endemic in Egypt by the year 2000 for the first time since the Pharaonic era.

Another major problem we face on how best to consider vector-borne diseases within the context of irrigation projects is the absence of an adequate number of scientifically rigorous studies. The subject is replete with poor and conflicting information, the repetition of data that have seldom been critically examined, and the elaboration of personal biases. To a certain extent international organizations have contributed, albeit not deliberately, to this sad situation. For example, the World Health Organization estimate that globally some 200 million people are infected with schistosomiasis has remained remarkably constant since at least 1969. UNEP has incorrectly said in the past that schistosomiasis has been completely eradicated in China. Recent publications from the Food and Agriculturel Organization (FAO) have erroneously stated that water development significantly increases onchocerciasis, whereas all the available evidence indicates the opposite. In 1987 FAO once again repeated examples of increases in schistosomiasis resulting from water development projects based on poor and somewhat debatable data first published in 1978. A major problem in this area is the uncritical acceptance and repetition of published information, irrespective of its quality. As these types of dubious data have been published time and time again, they have gradually gained 'respectability'.

Concluding Remarks

The main thrust of our argument in this paper is the unsatisfactory state of our current practices for environmental impact assessments and overall evaluations of water development projects. While no sane person will argue that environmental assessment is not necessary, the challenge that water and environmental experts are facing in the 1990s is how best to carry out EIA holistically and effectively. Until and unless we realize that our present practices are inadequate and unsatisfactory, we can only make limited progress in the future.

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