

3. Health and Environmental Aspects

BACKGROUND AND JUSTIFICATION

Development of water resources for agriculture impacts on human health and the environment in multiple, varied and complex ways. Often yields in irrigated agriculture are higher than in rain fed agriculture making more food or income available to farmers. This may lead to better nutrition and so increase resistance to disease or increased income may be spent on improved health care. Changes in the environment caused through agricultural water development can have both positive and negative implications for health. For example, increased availability of water, even of relatively low quality, can greatly reduce water-washed diseases. Conversely by providing breeding sites for disease vectors, such as *Anopheles* mosquitoes and snails, there may be an increase in water-related diseases, such as malaria and schistosomiasis (Boelee, 2003).

Agricultural water development also causes social changes that impact on health. For example, seasonal labourers can bring infectious and non-communicable diseases to an area. Today, SSA is bearing the brunt of the HIV/AIDS crisis (approximately 75% of the 42 million people living with the disease are in Africa) and many rural communities, now and in the future, have to deal with consequences of the epidemic. Since, it often strikes during the most productive years (i.e., ages 15 to 49) HIV/AIDS has severe implications for the availability of agricultural labour. However, good nutrition is recognized as being key to helping people fight HIV/AIDS related infections and food security, enhanced through agricultural water development, can make an important contribution to alleviating the devastating impact of HIV/AIDS.

Agricultural water development can have a significant impact on livestock-keeping with associated health and environment implications. In many irrigation systems livestock not only benefit from the easing of water supply constraints, but may also be major consumers of crop residues. Livestock keeping may be a positive benefit to health, not just through contribution to improved nutrition and wealth, but also indirectly through processes such as zoonophylaxis (i.e., reduction in malaria prevalence caused by mosquitoes being attracted to cattle in preference to people). It can also make significant contributions to environmental protection, particularly in mixed farming systems where there are appropriate balances of crops and animals. On the other hand, livestock grazing may have undesirable environmental and health implications. For example, watering at wells and along the edges of water bodies such as reservoirs leads to removal of vegetation, increased sedimentation, water pollution through feces and urine, contamination of domestic water with zoonotic parasites and may create environments more favourable for insects that transmit diseases. The impact of livestock often extends over large areas, even when the water development is relatively small.

In many cases the negative impacts of agricultural water development may be mitigated and the positive impacts enhanced through careful design and management. Measures for environmental control are primarily focused on approaches that prevent negative impacts through improved scheme design. For example, by designing systems which simultaneously reduce the chances of soil erosion and avoid the characteristics that favour the development of habitat suitable for disease vectors. In some cases investments in improved management of existing systems may lead to significant improvements in health and the environment.

For administrative purposes the livestock module of the investments project is included within the Health and Environment (H & E) component. The livestock module will include an evaluation of the H & E implications of modifying livestock management as a result of investments in agricultural water. However, it will not be limited to inputs to this component alone. Contributions of the livestock module to other components are presented in the relevant sections of this report and a full description of the livestock component is given in Section 4.

OBJECTIVES AND SCOPE

Clearly, an understanding of H & E implications of investments in agricultural water development is a prerequisite to deciding when and where investments are most appropriate and for improving design and management. The objective of this component of the investment study is to contribute to a better understanding of:

- the environmental and health implications (positive and negative) of different forms of agricultural water development in SSA, and
- the opportunities for mitigating negative impacts and promoting positive impacts.

This component will utilize findings from the CGIARs Systemwide Initiative on Malaria and Agriculture (SIMA) that is coordinated by IWMI and is investigating water and land practices across a range of crops and ecosystems to determine the farming activities that encourage and discourage, the breeding of malaria vector mosquitoes. It will also incorporate findings from existing IWMI programs, including research relating to: i) the risks and benefits derived from the use of waste-water in irrigation; ii) approaches to reduce malaria in paddy cultivation; and iii) the health impacts associated with rainwater harvesting and small-scale water storage. In addition it will utilize results obtained from a wide range of ILRI projects as well as other CGIAR and non-CGIAR studies.

METHODOLOGY

This study will provide evidence-based recommendations geared to informing decision-making about investments in agricultural water development. For the H & E component to fulfil this objective it is necessary to provide insights that can be generalized and from which patterns or trends for particular types of agricultural water development scheme² can be derived. This is a complicated task for a number of reasons:

- All schemes are unique. The magnitude and nature of H & E impacts depend on the juxtaposition of a wide range of biophysical and socio-economic factors and complex interactions between the design of the scheme and the way that it is operated.
- Schemes do not occur in isolation (either in space or time) and it is often difficult to isolate the impact of the scheme from other factors causing change.
- Small incremental changes are difficult to measure and may go unnoticed.
- Neither the costs nor the benefits of schemes are evenly distributed amongst different social groups and stakeholders.
- H & E impacts of a scheme may occur a great distance from where it is implemented.

² In this component of the project the word “scheme” is used to encompass not only traditional or formal irrigation systems but also non-traditional, informal, investments such as small-scale development (e.g., treadle pumps and collector wells, etc.).

In order to develop generic findings and enable recommendations to be made a systematic approach to data collection and evaluation is required. To this end the H & E study will be based on the following four elements:

- a classification of investment types (i.e., a typology of schemes)
- a classification of agroecological regions/agricultural production systems
- a conceptual framework to evaluate the impacts of schemes and in which the linkages between environment and health are made as explicit as possible.
- quantitative information that can be linked directly to the type of scheme and/or the agroecological region/agricultural production system in which the scheme is located.

Scheme Typology

In common with many complex systems, agricultural water schemes have numerous characteristics that can be used as the basis of classification and a wide range of typologies has been developed (e.g., by FAO). For use in this component a preliminary typology has been devised based on attributes that it is anticipated will have the greatest influence on H & E impacts:

- scheme size: large (> 1000 ha), medium (200-1,000 ha), small (10-200 ha) and micro (< 10 ha)
- water source: surface water or groundwater
- form of water application: flood/furrow, sprinkler or drip

The typology developed differs from that used in the Cost component of the study, but is considered more appropriate for H & E assessment. Nonetheless there are recognized limitations with the typology as it stands at present. Because of these limitations it is proposed to collect information on as wide a range of scheme attributes as possible to enable modification of the classification typology following analyses of the data.

Definition of agro-ecological regions/agricultural production systems

Climate exerts the most significant control over biophysical processes and hence the nature of agricultural production systems. It is also a significant factor in determining the nature of H & E impacts associated with different types of agricultural water development. Impacts may be magnified or mitigated depending on the geographical location of a scheme and the prevailing climate. Hence, climate provides a basis for attempts to generalise the impact of agricultural water development on health and the environment. The primary basis of the ILRI livestock production system classification is three different agro-ecological zones based on climate (i.e., humid/subhumid, arid/semi-arid and temperate/tropical highland). For this study it is proposed to use these three classes in conjunction with the associated ILRI production systems typology (Thornton *et al.*, 2002).

Conceptual Framework

The conceptual framework for this component of the study was outlined in the TOR. In brief, it recognises that the well-being of individuals and communities is determined by a wide range of economic, social and environmental factors as well as by heredity and health care. Any change to physical or social environment will have impacts on health. Consequently any agricultural water development will have health impacts (Figure 3.1). Health is improved by poverty reduction, increased food security, distributional equity, community empowerment and improved environmental quality. Negative health impacts are associated with increases in communicable diseases (i.e., vector borne, zoonoses, gastro-intestinal, geohelminths), increase in non-communicable diseases as well as more subtle manifestations (e.g.,

psychosocial disorders such as alcoholism) linked with social impacts. As far as possible this study will identify both positive and negative impacts as well as the direct and indirect impacts.

Quantitative Indicators

For comparison and generalisation it is necessary to obtain quantitative information and indicators that show changes from periods before and after the implementation of a scheme and which are verifiably attributable to the scheme. A range of possible indicators has been identified, relating to health and environmental impacts. It is anticipated that this information will be obtained from the literature as well as for specific case studies (see method) from scheme planning and development reports, clinic records, department of health records, department of agriculture surveys and field tour reports, records from other government ministries (e.g., department of water resources) and from post scheme evaluation documents.

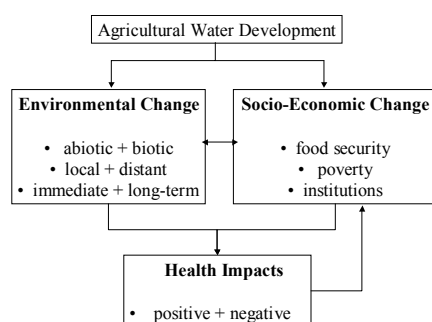


Figure 3.1: Influence of Agricultural Water Development on Human Health

ACTIVITIES

This study will collect and collate the best available quantitative information relating to different types of agricultural water investment. The first phase of the H & E component will comprise a review of literature, including “grey” literature. It is intended to seek information from a range of institutions including donors (i.e., banks and national development organizations), international and national agencies (e.g., UN agencies, consulting firms, government departments and river basin authorities) and NGOs. The review will be conducted to obtain both baseline (i.e., generic findings pertaining to different scheme types in different agro-ecological zones) and scheme-specific H & E information. As far as possible the study will draw on original data sources. Reports that provide only qualitative information on impacts or are based on an authors’ opinion alone will not be used.

A database of scheme H & E impacts will be established. For each scheme the intention is to collect information in systematic manner that will facilitate the development of generic findings and will enable trends and patterns to be determined in relation to scheme type and agro-ecological zones/agricultural production system. To facilitate this process a standard data sheet/checklist will be completed for each scheme investigated. Analyses of the data collected, possibly using SPSS, will establish the balance of scientific evidence for specific impacts.

On the basis of the findings obtained from the literature review, “gaps” in knowledge will be identified and case studies will be selected for in-depth reviews that will be conducted to fill these gaps. Gaps may be associated with a specific type of scheme or a particular agro-

ecological zone/production system. For the case studies, information will be collected in greater detail, but it is anticipated that the same approach will be adopted. It is not intended to use the checklist as a field questionnaire, but it will be used to guide the information that will be sought from each of the case studies investigated.

SYNERGIES

The agriculture and livestock work (Section 4) is managed as a sub-component of the H & E study; clearly, there are significant synergies in these areas. This component will draw on work undertaken in a number of IWMI research projects in SSA, notably the studies on the health impacts of small-dams, the Systemwide Initiative on Malaria in Agriculture (SIMA), and the potential risks and benefits of recycling waste for peri-urban agriculture. The H & E component will also work closely with other components of the collaborative program. Subject to the availability of relevant data, the following analyses will be undertaken:

- An evaluation of the cost of environmental impact and health impact assessments, as well as measures implemented to mitigate negative affects. It is hoped that this will provide insight into the proportional cost of these activities in relation to the total cost of irrigation schemes in sub-Saharan Africa. Clearly this will be directly relevant to the *irrigation cost* component of the study.
- An evaluation of the extent to which the performance of schemes may have been downgraded as a result of the “technical failure” to foresee negative H & E impacts (e.g., through salination of soil). This will be directly relevant to the *planning and implementation* component of the study.
- An evaluation of differences between the public and private sectors in the scale of investments in H & E impact assessments and consequent mitigation measures. It is anticipated that this will inform the *private sector* participation component on the need, or not, to regulate the private sector in relation to H & E issues.

To ensure further synergies, as far as is practicable, the case studies selected will be the same as those chosen for other project components.

OUTPUTS

It is intended that project findings will inform and influence donors and investors in decision making related to the appropriateness of different types of agricultural water investment in different regions of sub-Saharan Africa. As such the project outputs, which will be as practicable and as specific as possible given available information, will be useful for policy and strategy planning as well as project development.

Specifically outputs from this component will be:

- A database, developed from available literature and comprising quantitative information, which it is anticipated will provide a benchmark of aggregated knowledge on the H & E impacts of investments in agricultural water.
- A publication on the inter-linkages between environmental and health impacts of agricultural water development in a representative set of agricultural production systems across sub-Saharan Africa. This will include evaluation of environmental and health impacts of livestock keeping within the context of agricultural water development.

- Recommendations on how to mitigate negative environmental and health impacts of agricultural practices (including livestock keeping) whilst simultaneously enhancing the benefits of agricultural water development in sub-Saharan Africa.