

Results of the DAAD Alumni Summer School on Topics of Integrated Watershed

Management at University of Siegen

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Abstract

Managing watersheds is a process, which requires integrated concepts, skills and planning. This is pursued as an ongoing process demanding regular monitoring and evaluation for sustainable utilisation of natural resources. Success in integrated watershed management (IWM) depends on participation of stakeholders and empowerment of local institutions with autonomy at the catchment level to balance demand for water resources. The 2005 DAAD Alumni Summer School on Topics of Integrated Watershed Management, University of Siegen, proposes an approach that addresses issues of equity and implementation of the “user pays principle” at all levels. A practical example is that of stakeholder co-operation in IWM for water supply at the Bigge Dam (Ruhrverband) and the Historical Community Forest Resource Management called “Haubergwirtschaft” at Siegen. In these two sites the attitude of stakeholders towards resources and policies as well as dialogue on water issues is important for the change that has taken place. Human resources development and institutional capacity building are essential in IWM. The East African Region can borrow from the European Union Water Framework Directive (EU, WFD) programme which can serve as a useful reference tool. The Siegen Summer School 2005 recommended institutional harmonization through inter-agency cooperation for efficiency and effectiveness using a participatory approach. Linkages between regional and national level institutions are required in setting up policy and institutional framework as well as sharing of country or regional experiences, best practices, research findings, capacities and

indigenous knowledge in watershed management. The Summer School also recognised the need to transform national water policies to promote water as an instrument of peace. Capacity building in maintenance, monitoring and evaluation of water management systems is required. The International Masters Programme on Integrated Watershed Management that is proposed to be launched at Kenyatta University - Nairobi in September 2005 is geared towards sustainable watershed management.

Introduction

A watershed is an area of land that sheds water to a lake or river. It is a logical way to divide landscapes and ultimately the most appropriate analytical and management units for water quality improvement. Watersheds are the places where everyone relies for water and other natural resources. Understanding them is the first step in protecting the water and other natural resources. The watershed is a dynamic and complex web of resources - soil, water, air, plants, animals and men. Its features depend on its size, boundary, terrain, and soil type. Everyday activities at the watershed can impact these resources, ultimately impacting human well-being and the economic livelihood. To fully understand a watershed, one therefore needs to consider how it is used in terms of land uses and trends, and natural resources use. Cities, homes, roads and factories modify the watershed and affect its natural resources. Farming, recreation, mining, construction and forestry can also significantly affect a watershed leading to other issues such as water availability, livestock grazing, pesticide use or septic systems. It can also lead to significant changes in land use which can affect water quality, air quality, wildlife, soil quality, property values and other natural resources.

In spite of their environmental, economic and socio-cultural importance, most watershed natural resource base has been depleted. Poverty and environmental degradation are widespread in especially upland rural communities in the developing countries of Eastern Africa. Some of the most important factors contributing to this situation include:

- the fragility of upland ecosystems
- inappropriate farming techniques
- population growth leading to a shortage of arable land and low agricultural yields
- disadvantaged market conditions and limited job opportunities
- a lack of infrastructure and services
- a lack of political influence
- top-down conservation policies

These factors highlight the vicious cycle in which upland rural communities are currently trapped. Lack of opportunities for social development leads to the unsustainable exploitation of natural resources, which leads to top-down interventions, which in turn lead to further misuse of resources.

The most critical resources in any watershed are water, land and soil. These need to be nurtured and taken care of properly. If water, land and soil resources are managed properly, rain-fed areas can be as productive as irrigated areas. On the other hand, if water is not managed properly, even with good rainfall, soils are degraded and drinking water becomes unsatisfactory. Such are witnessed at the GTZ South Gondar Project area, Ethiopia; Nzoia river basin and Mt. Elgon Forest Reserve where failed *shamba-system* and fragmented forest plantations are a common feature; Lake Victoria Research Initiative Project, Kenya; Wanale Micro-catchment, Mt. Elgon, Uganda; Water Pollution in Morogoro Municipality; Water Source Protection, Demand & Supply Management for Suwasa, Singida, Tanzania; Hydrological Measurements in Hare Watershed, Southern Ethiopia; Conservation of Lake Naivasha, Kenya; and Lake Jipe water crisis; which were among the examples given by presenters at the Siegen Summer School, 2005.

Since watershed management is a process with people in the watershed as chief functionaries, as they have the most decisive power, stakeholders need to be involved in the planning and implementation process for integrated watershed management. A sound local economy is important and ways to sustain or improve it through successful watershed management should be sort. Effective watershed management planning relies on an effective partnership that includes representatives of all stakeholders that works cooperatively toward a common goal. Conflicts among partners can however influence the effectiveness and fairness of the management plan.

IWM requires a plan, an integrated Watershed Management Plan (IWMP), which is a compilation of many studies conducted within a watershed in a participatory way, including geologic and wetland surveys, socio-economic studies, well water level monitoring, stream gauge data collection, water quality chemistry, bio-assessment surveys, stream corridor evaluations, and Geographic Information System (GIS) database development. The overall goal of the Siegen Summer School 2005 was to formulate a management program that sustains water resource through utilization of best management practices and to highlight those characteristics or critical issues in the watershed that require planning and management for IWM. The watershed planning process as outlined by Warren (1998) involve:

- Getting to know the watershed (determining size, boundaries, soils, terrain and other features; understanding the people, interests, and institutions; and determining how the watershed is used)
- Building local partnerships (identifying and contacting partners or stakeholders; dividing work and responsibility Identifying and managing conflicts; obtaining local funding and other resources)
- Determine priorities for action (assembling maps and data; identifying and documenting problems; determining goals and objectives; evaluating water quality; assessing land use; selecting critical areas for attention)

- Conducting educational programs (identifying and understanding target audiences; developing specific messages combining communication approaches; channels and media)
- Providing landowners with assistance (targeting technical assistance; providing financial assistance; building social support and recognition)
- Ensuring implementation and follow-up (continuing with monitoring and evaluation, providing continued local funding; continuing to inform and involve everyone)

Integrated Watershed Management Plan

Managing watersheds in East Africa calls for development of an Integrated Watershed Management Plan (IWMP), that can provide direction for resource management. IWMP attempt to coordinate existing country, regional, provincial or local authority legislation and policy into a useful background document which: supports and addresses a wide variety of land use issues; identifies key responsibilities of stakeholders; and makes recommendations for the implementation of resource management actions.

Given the broad resource management mandate and areas of jurisdiction of the environmental management authority of each country or the conservation authorities, the bodies take a coordinating role in watershed planning and management. In keeping with their role, each country's environmental management authority need to work in cooperation with watershed municipalities (local authorities), the residents (local communities), the development industry, government organizations (ministries and ministerial departments), non-governmental organizations, special interest groups, and bordering conservation authorities to prepare a IWMP. The IWMP is based on principles that reflect:

- a fair and equitable process involving gender consideration;
- a watershed ecosystem approach to planning and management;
- consultation through open and accessible decision making;
- economic considerations being incorporated into all management sections;

- education;
- innovative technology and proactive resource management;
- landowner rights and privileges;
- streamlining to reduce duplication of services and to increase overall efficiency;
- the protection of water systems through wise use.

As discussed in the Siegen Summer School on Topics of Integrated Watershed Management, and in the context of the papers presented, the participants incorporated issues of both rural and urban concerns including:

- preliminary results of one-year hydrological measurements in Hare watershed;
- an analysis of accessibility and pricing of water supply in rural watersheds;
- an assessment of runoff and soil loss in Wanale micro-catchment;
- challenge and chance for water management;
- challenges facing the conservation of Lake Naivasha;
- community participation in integrated water resources management;
- cross border conflicts;
- digital image analysis and GIS database design of lake Bogoria area;
- energy linkages to watershed management;
- EU-Water Framework Directive - National implementation;
- facilitating cross-border dialogue;
- indigenous knowledge as a tool for water and watershed management;
- institutional set-up for WSM;
- Lake Jipe water crisis
- land law and policy and their effect on water resources;
- modelling soil erosion and vegetation change;
- participatory approach in integrated watershed management;
- potential water use conflicts and interventions;
- practical experience in water source protection as an example of demand and supply management;

- rural electrification – an essential infrastructure for sustainable development;
- towards monitoring and measuring micro-watersheds;
- towards participatory watershed management at the village level;
- water and environment in Tanzania;
- water pollution in Morogoro municipality;
- watershed management – a holistic approach.

Based on the presentations, the logical content of an IWMP as illustrated in Figure 1 would include:

- development, communications, education, and information;
- forest, rangeland, woodlands and wildlife habitat management;
- funding sources;
- natural corridors;
- public conservation and lands management;
- ravine, valley, river, stream and natural corridors management;
- waste water and storm water management (septic systems, septage and sewage);
- water resources, including groundwater and surface water quality and quantity;
- and wetlands, fish habitat and riparian area management.

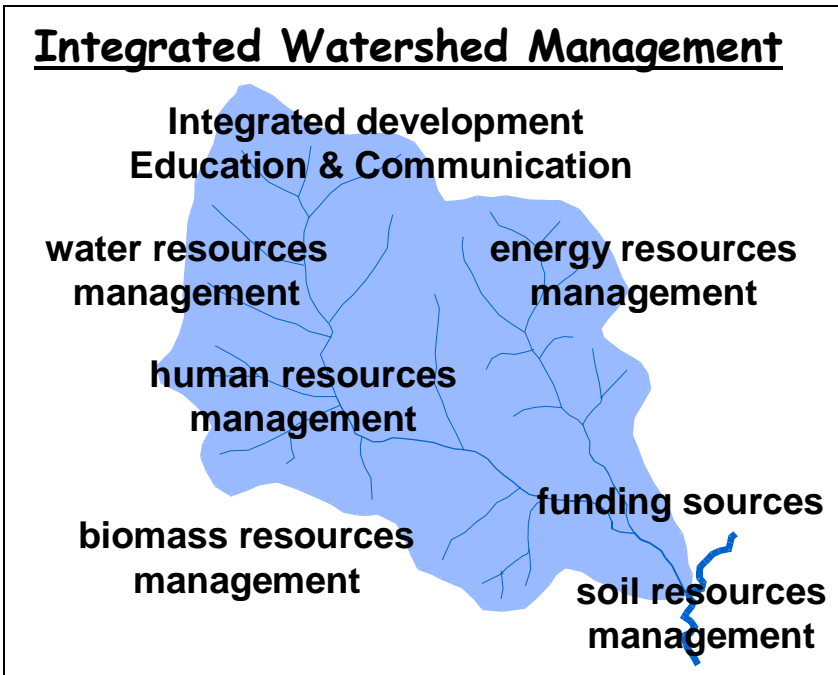


Figure 1: Integrated Watershed Management

Common themes arising from watershed resources and management topics (UNEP, 2004) discussed in IWMP include:

- the preservation, conservation, enhancement, and rehabilitation of natural ecosystems;
- the preservation and improvement of surface water and groundwater quality and quantity (water reforms);
- the utilization of environmentally sound land use practices (land use policy and land reform);
- a need to reduce overlap or duplication of services and programs offered for resource management and a clear identification of who is responsible for what (addressing conflicting government sectoral policies);
- and enhanced communications for resource management issues and solutions (education and development).

In order to address the above issues, the Siegen Summer School 2005 recommended a number of actions for integrated water resources management (IWRM) that point to different orientations involving interventions and research at all levels of intersectoral integration as outlined in Figure 2.

| Degree of intersectoral Integration | | |
|--|---|--|
| <u>Low</u> | <u>Partial</u> | <u>High</u> |
| Mono-sectoral view: focus on water resource (with attention to externalities) | Focus on water & another resource sector (with attention to externalities) | Focus on water & multiple other resources (with attention to externalities) |
| <ul style="list-style-type: none"> ➤ Integrated management of water quantity & water quality aspects in particular water courses ➤ Ensuring the conjunctive use of groundwater & surface water resources | <ul style="list-style-type: none"> ➤ Land & water in irrigation ➤ Waste water reuse in agriculture ➤ Control of minimum flows in rivers for ecosystem protection | <ul style="list-style-type: none"> ➤ Integrated resources management in a watershed ➤ River Basin Management |

Figure 2: Different orientation of IWRM and Research

In general, the recommendations can be grouped into 6 key action areas also recommended by UNEP (2004) and Warren (1998):

Streamlining and coordination: resource management programs and services must be streamlined and coordinated in order to provide an efficient delivery of services.

Partnerships: where there is a need in natural resource management for improved efficiency, shared expertise, better communications,

shared funding, or improved conservation or preservations, partnerships should be considered (Figure 3).

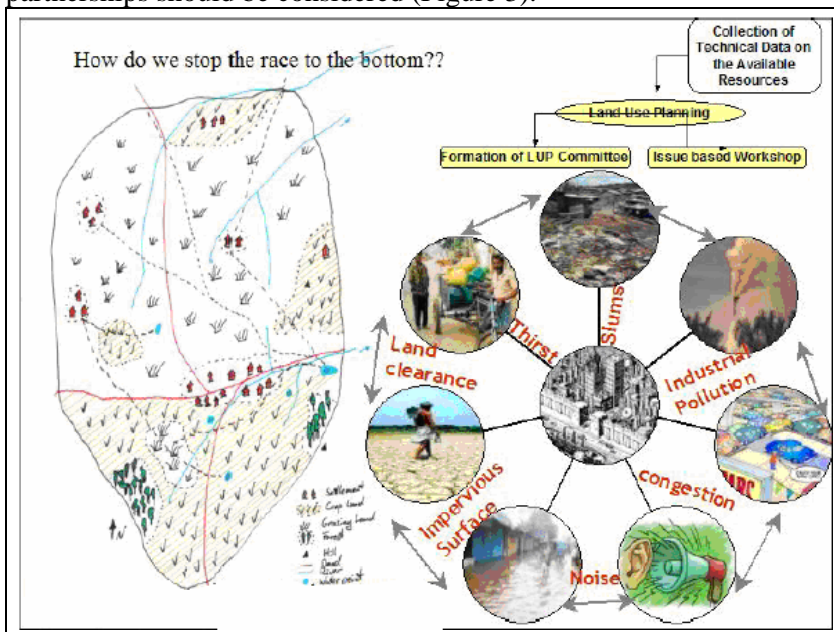


Figure 3: Collection of technical data on available resources

Land stewardship: there needs to be accessible information and support in place to allow watershed residents to become environmental stewards of their land.

Taking responsibility - all stakeholders must recognize their responsibility in natural resource management.

Effective communications: effective communications are a key component of watershed management as they can: improve land use practices; change attitudes; create awareness; and improve relations between watershed stakeholders thus reducing conflicts.

Natural resource policies: natural resource policies should be implemented in a fair and equitable manner, reflecting both the intent of provincial policy and local watershed community conditions.

The goals, objectives, and recommendations of the IWMP can be implemented through land use planning documents, sub-watershed

plans, local agency policies and programs, and land stewardship initiatives. The need for revisions to the IWMP is determined through continuous review by the Planning Team and the full membership of the Country Watershed Planning Team and yearly Planning Team meetings. In addition, monitoring the success and performance of the mechanisms used to achieve the objectives developed in the Plan is through the following indicators (see also Figure 4):

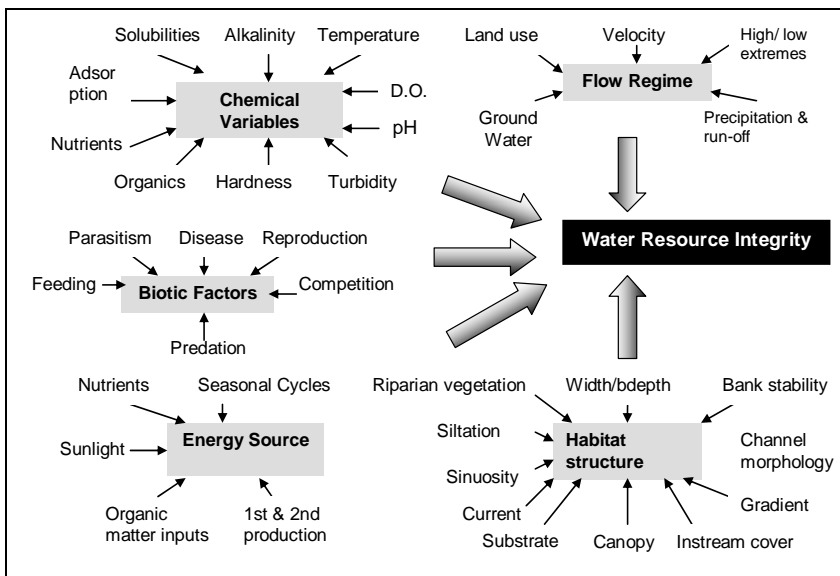


Figure 4: Water quantity and quality sampling

Figure 4 shows that water quality and quantity sampling and monitoring (assessed using pollution sensitive organisms found only in good quality water (group 1 taxa e.g. stonefly, mayfly and water penny); somewhat pollution tolerant organisms found in good or fair quality water (group 2 taxa e.g. dragon fly, damselfly and crayfish); and pollution tolerant organisms found in any quality water (group 3 taxa e.g. aquatic worm, leech and midge fly larva) fish and wildlife trend data

- the Watershed Report Card
- an effectiveness questionnaire circulated to municipalities, Planning Team members, and other stakeholders.

These indicators have been used to monitor the quality of water by the Ruhrverband Community at the Bigge Dam water supply. It is recommended to be used in assessing all the water bodies in European Union Countries through the EU-Water Framework Directive that aims at:

- Promotion of a lasting use of water resources
- Progressive reduction of the priority hazardous substances and putting an end to filling in and setting free priority hazardous substances
- Reduction of the contamination of the groundwater
- Reduction of the effects of floods and droughts
- Protection and improvement of the status of aquatic ecological systems and the groundwater including the land ecological systems that depend directly on the water

Overall, it is the intent of the IWMP to: provide direction for resource management in all the watershed; to coordinate policies and legislation as they apply to land use planning and management; and serve as a guide for the implementation of resource management issues through municipal planning documents. The IWMP does not create any new policy or legislation. Rather, it reflects current policies and legislation. Therefore, the information in the Plan can be used as seen fit by a municipality, local authority, or government agency for guidance when making land use decisions. The municipality or local authority is ultimately responsible for making land use decisions, and the Watershed Plan is one of many sources of information available to assist the decision makers. Monitoring stream/river flow can help determine the critical base flow condition values. Such data are used in the Water Balance Model that involves:

Development and maintenance of gauging stations

- Maintenance of the Rating Curve for the gauging station - the Rating Curve requires annual riverbed profile measurements and periodic stream velocity measurements
- Monitoring Aquifer Levels - Water levels should be measured monthly at 4 to 6 local wells or boreholes. This data is used in groundwater storage and water budget calculations.

- Generation of an upgraded water table map.
- Develop and expand a GIS Database - as more watershed related data becomes available, incorporation of all data into GIS and computer applications becomes necessary.
- Develop and maintain current land use maps and Township Level storm water
- Management Plan - extreme local erosion problems are observed to contain siltation in the streambeds.
- Develop a comprehensive biological inventory

A strategic plan as an integral part of IWMP is reviewed and revised based upon the trends shown from the monitoring and in annual reports thus providing long-range strategies for the entire watershed. There are however challenges (conflicts) and obstacles that prevent positive change on parts of society, the economy, or the environment.

Understanding Watershed Conflicts

For people who want to organize a local partnership to protect their watershed against the numerous conflicts associated with resource use, a guide is required that can help solve some of the watershed management problems. It requires a process of going through building a voluntary partnership and developing a watershed management plan which recognises that the characteristics of each watershed are unique. Regardless of the watershed situation a long-term, integrated perspective based on a systematic, scientific assessment can be used to address the watershed concerns.

Conflict is a natural disagreement resulting from individuals or groups that differ in attitudes, beliefs, values or needs. It can also originate from past rivalries and personality differences. The ingredients of conflict also include *perceptions, feelings, emotions and power*. People for example define and use power as an influence on the number and types of conflicts that occurs and how they manage them. Conflicts can arise when people try to make others change their actions or to gain an unfair advantage. Public conflicts in watershed management efforts and other environmental issues often are rooted in trying to balance environmental protection and economic growth and jobs. This calls for participatory approach in integrated watershed

management involving all issues related to available resource use challenge and scarcity (Figure 5) and a reform process that can transform institutions for better water governance (Figure 6).

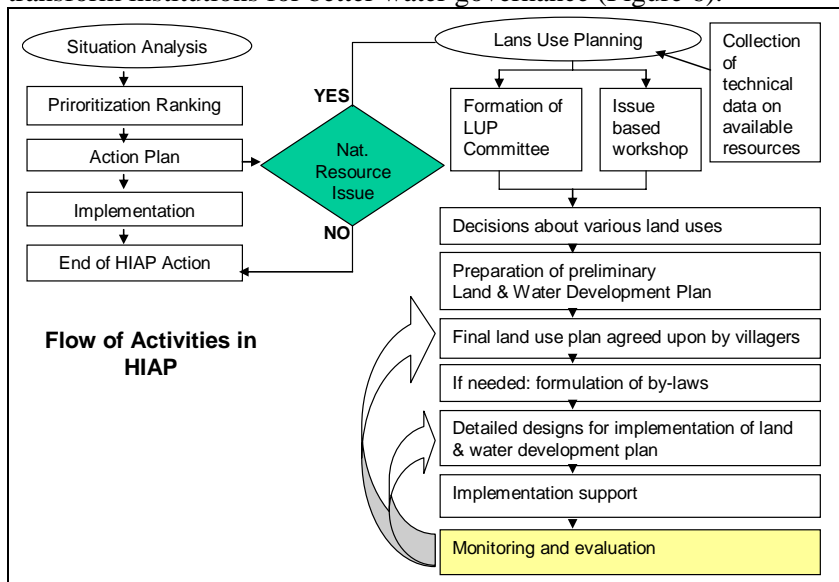


Figure 5: Participatory Approach in Integrated Watershed Management

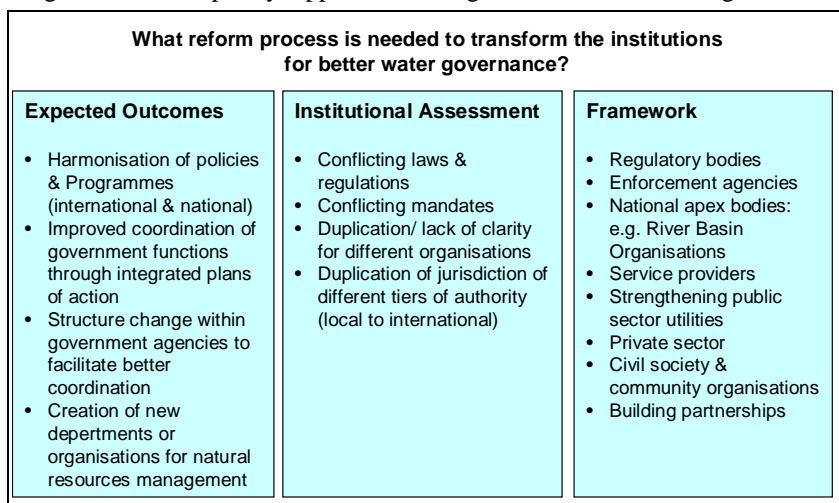


Figure 6: Reform process needed for better governance

Complicating factors in effective watershed management include:

Distribution of costs and benefits (those who benefit may not be the same as those who pay the costs)

- *Perceptions of problems* (people tend to blame others for causing the problem)
- *Speed of clean-up or other actions* (some will want changes to take place more quickly than others)

The first step in managing watershed conflict is to analyze the nature and type of conflict. Once there is a general understanding of the conflict, the groups involved need to analyze and select the most appropriate strategy. It may be necessary to have a neutral facilitator to help move the groups toward consensus:

- by creating collaboration between concerned parties
- through compromise to avoid destructive power struggles
- by avoiding competition for basic rights
- through accommodation which is appropriate when cognise of wrong doing is taken into account
- by avoidance which can be used when confrontation has a high potential for damage or more information is needed.

To set the stage for effective negotiation, the groundwork must be laid involving all stakeholders. The following should occur prior to any negotiation; *initiation, assessment, ground rules and agenda, organization and joint fact-finding*. When negotiating, discussions of interests are openly expressed rather than giving stated positions. Interests include the reasons, needs, concerns and motivations underlying positions on watershed issues. Satisfaction of interests should be the common goal in integrated watershed management.

Conclusion

The incorporation of watershed management objectives into local and national development planning can be accomplished by means of integrated planning at all administrative levels and across political boundaries. Countries often pursue their own national interests in exploiting natural resources, instead of equitably sharing the joint benefits that can accrue from integrated multi-country management.

The focus of sectoral agencies results into overlapping sectoral development plans and often renders implementation ineffective. Also the interests of local governments in planning do not necessarily coincide with planning objectives relating to the broader national interest. The reconciliation of competing interests requires more dialogue-based planning approaches that provide room for negotiation.

The standards of planning across Eastern Africa countries differ significantly, yet each of them provides some opportunities for strengthening more integrated planning at various levels. The analysis and subsequent formulation of an integrated planning approach starts from the basic proposition that due to its natural resource-based character, effective watershed management can only be accomplished if it is integrated into the wider planning systems of the Eastern Africa countries and into their development frameworks. The analysis of the existing planning systems in the Eastern Africa countries, regarding the policy, structure, resources and support for integrated planning can promote watershed management objectives through the strengthening of concrete watershed functions in spatial development strategies. Institutional constraints could be reduced by creating appropriate incentives for mutual coordination under a policy-based and area-based fiscal management framework.

Watershed management efforts generally fail to reconcile the political, economic and social conditions with the ecological and biophysical aspects of an area. They also lack influential and voluntary participation of local and non-governmental interests. The Siegen Summer School, 2005 concluded that integrated watershed management is a decision process that is informed by a combination of biophysical sciences, socio-economic information, and local or indigenous knowledge.

An inventory of watershed resources can be done using Geographic Information Systems (GIS) technology as the best way to show the spatial relationship and inter-relationship of the inventoried resources. Items inventoried include elevation surveys, field boundaries, soils, water habitats, surface water storage facilities, hydrologic drainage patterns and results of aerial photography. Maps prepared using GIS technology are primary tools that are catalysts to individual

landowners discussing issues as a watershed community. They serve identify the inter-relationship of the issues discussed and invoke issues of historical nature. The GIS tools as used for the planning process are critical in having landowners or local communities look beyond property lines to solutions on neighbouring ground. By combining products of engineering software, GIS Maps, and local expertise, decisions are based on factual information and alternatives that help make informed decisions about resources.

The Way Forward

The Siegen Summer School effort assembled Geologists, Planners, Environmentalists, Lawyers, Geographers, Hydrologists, Economists, Engineers, Agriculturalists, Biologists and Conservationists from institutions of higher learning, state, local and private agencies. The effort addressed integrated water issues dealing with integrated watershed management, land use, wetland habitats, irrigation water management, erosion control and flooding, cross border conflicts and intra-basin conflicts over water resources. The meeting provided a communication venue where the participants sort to cooperatively address common watershed problems. In this regard a network – Integrated Watershed Management Network (IWMNet) for networking on watershed management in Eastern Africa was formed. The aim of the Network is to liaise with the International Masters Programme on Integrated Watershed Management to be launched at Kenyatta University - Nairobi (September 2005) to improve teaching, research and extension. The Research Centre for Water and Environment, University of Siegen is collaborating in the development of the said Masters Programme with the following institutions in East Africa:

- Sokoine University of Agriculture, Morogoro, Tanzania (Department of Soil
- Sciences; and Department of Agricultural Engineering)
- Kenyatta University, Nairobi, Kenya (Geography Department)
- Makerere University, Kampala, Uganda (Institute of Environment and Natural Resources; and Institute of Economics)

- Arba Minch University, Ethiopia (AWTI)
- University of Dar Es Salam, Tanzania, (Department of Water Resources Engineering)

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