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Information System for Watershed Management and Long-Term Sustainability

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Abstract: In recent years, the many economic, social, and environmental advantages of land-based resources have become more critical. Hence, sustainable source of energy production systems need effective and efficient implementation of these resources. Many believe that watershed management, which is essentially the application of land resource management systems, is the best strategy for protecting and sustaining the planet's precious natural resources and raising the standard of life for people everywhere. Management and conservation of renewable and nonrenewable natural resources in upland regions is commonly regarded to best be achieved via integrated watershed management with involvement of all necessary key players.

Keywords: social and environmental, multiple economic, Integrated watershed management

Introduction

Humans drastically altered watersheds' hydrologic function when they cut down vast swaths of forest in the nineteenth and early twentieth centuries. Frequent downstream floods led to an upsurge in fatalities and property destruction. Due to changes in the biotic and hydrologic components of natural drainages (watersheds), siltation of developed lowlands occurred at an unprecedented scale [1].

Managing a catchment's soil, plants, and water for conservation purposes is the essence of watershed management. Maintaining sufficient water, soil, food, and fiber production requires careful management of the drainage's land and people resources[2]. For regions as small as a few hectares or as vast as whole river basins, effective management calls for a comprehensive strategy that takes all of these factors into account. The term "watershed management" refers to the practice of coordinating efforts to conserve natural resources within a certain geographical area[3]. From a conceptual standpoint, identifying and monitoring the components (such as inputs, storage, and outflows) of a management system, such as the hydrologic cycle, is simplified when the limits of that system are established. Land managers, on the other hand, see these topographical divides inside political and administrative borders that often overlay a network of watersheds. While appealing in theory, implementing participatory integrated management of natural resources is challenging. The idealistic integrated approach is hampered by the complexity of huge watersheds, which include many different uses, ownerships, political and social limitations, and biophysical processes. Economic, social, and political factors are often taken into account while managing vast catchments. The participatory integrated paradigm may be most effectively applied to the management of natural resources in headwater basins. Land used for farming, logging, or ranching may be a valuable asset to the local economy. Yet, compared to lower

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altitudes where main production and population centers are situated, uplands' intrinsic physical and biological restrictions generally limit productivity[4-7].

Watershed Management Review and Assessment of Strategies and Approaches

The energy resources of highland regions have been depleting worldwide for decades. Watershed management ideas have been used by concerned nations as well as aid groups since the 1960s in an effort to reverse this trend. As the field of watershed management progresses along the learning curve, new tactics and methods for undertaking intervention projects have emerged. Adjustments and modifications are made to the discipline as needed in response to research findings, lessons were learned, failures and triumphs, periodic reviews, and assessments. Economic and social considerations in watershed management have already been given more emphasis during the last decade. People's involvement is also seen as crucial to the efficient administration of natural resources. As part of an all-encompassing watershed management development strategy, the integrated idea has grown to include community demands and issues. [8-10]

Objectives

The assessment's overarching goal was to encourage the worldwide sharing of data on watershed management's successes and failures and to offer future backing for successful watershed management projects and initiatives. Their goals are as follows:

The goal of this research is to examine, on a worldwide basis, the variety and scope of watershed management successes.;

The primary goal is to identify significant shortcomings in watershed management practices during the years 1990-2000.;

Guidelines for developing future watershed management initiatives and programs.

Major issues that require further investigation and in-depth analysis

include: Multi-institutional methods to operating jointly in watershed management projects; cross-scale biophysical and socio-economic challenges; the dynamics of intensification of use of natural resources; the paths of water, sediment, and nutrients in response to land management[11]. The above points to the necessity for a better organized and effective international assistance effort, as well as for links to be established between national and local governments and civic groups. Central vs decentralized; upstream versus downstream consumers; community organization; water distribution and property rights; all of these are significant concerns, as are questions of governance. The difficulty comes not from trying to understand these problems theoretically but from mustering the political resolve to take action. Conflict resolution is at the heart of watershed management. Hence, poor leadership is a significant barrier[12-15]. Moreover, there is a shortage of process-based ideas and models at a variety of geographical scales. The failure to duplicate achievements stems from a lack of knowledge of the factors that contribute to the success of some but not all large-scale catchment development efforts. Another "weak spot" of watershed management

initiatives is their lack of long-term support from funding and institutional systems. Significant future restrictions include the continuation of current limits. Freshwater scarcity is a growing problem that threatens to exacerbate environmental degradation as water quality as well as flash floods become more pressing concerns in densely populated areas[16-18]. Upstream-downstream conflicts are most pressing in regions where water scarcity prevents the efficient use of land.

The involvement and dedication of crucial players may be increased via better project design and management. The ability and desire of national governments to take action, for example on land tenure and compensation for ecosystem functions of catchments, such as water supply, is a key limiting factor in catchment development. To become the industry standard, you'll need to overcome obstacles like developing context-specific decision support tools and keeping a record of your successes and failures. An opening exists in the growing consensus that watershed management is a crucial tool in the fight against the detrimental effects of global warming and desertification. The necessity of watershed management is also becoming more widely recognized. With data gathered in the 1990s, we can more accurately gauge performance and evaluate methods and approaches in light of actual outcomes. [19]

Impacts of watershed management technologies

Technologies for watershed management have been shown to reduce slope erosion, level up landscapes, provide clean water, and maintain or even enhance agricultural productivity on a local to regional scale. Existing technology can be effectively adapted for usage in most human-inhabited terrestrial areas. Success in watershed management interventions depends heavily on public support and the scope of efforts. Because of economies of scale and the difficulty in forecasting the outcomes of these efforts with sufficient precision, the influence of upland watershed actions on river water quantity, quality, and siltation remains a disputed subject. Unless both human-induced and natural erosion and sedimentation in a watershed are reliably assessed, the debate over upstream impacts on downstream facilities will continue[20]. The same holds true for the hydrologic cycle, water supply, and water quality as a result of land use, all of which can be measured. However, hundreds of millions of dollars are being spent on downstream infrastructure like hydroelectric and/or irrigation dams. Unfortunately, in the past, only a few million dollars were allocated to remediate all of the upland regions that contributed to the downward flooding and erosion of these buildings during watershed management works. Small-scale watershed management initiatives are often ineffective because the upland sections of many catchments are already in poor condition before the dam is built. This is analogous to applying a band-aid to a wound that already has gangrene..

Sustainability and replicability of watershed management technology

Sustainable has a relative meaning when discussing strategies for watershed management. Once the study ended, many of the interventions were maintained at the community, home, and agricultural levels. Years after initiatives stopped in countries like Pakistan, Nepal, Burma, Thailand, India, and the Philippines, woodlots continued to be maintained by local

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governments. Several low-tech and low-cost upland initiatives have been shown to be more durable than high-tech and high-cost ones throughout the development process. Financial and organizational stability/instability are two critical elements in determining the longevity of watershed management efforts.

Some participants in this evaluation agreed that the "tragedy of the commons" is still an issue. In order for interventions on common lands to be long-lasting, political, social, and user rights concerns must be resolved. Most human-inhabited landscapes may use the same or similar technological techniques for managing soil and water resources. These methods are widely used across the globe.

The technical expertise and financial expenditure needed to perform an approach determines to some part the extent to which it can be replicated. For instance, it is possible to implement high-tech, expensive methods of controlling floods and landslides everywhere. Nevertheless, the existing financial and technical resources restrict the size of these operations.

But, if local technical skills are available and people are ready to undertake the activities, reduced, low-cost interventions at the community and farm levels have the potential to be replicated on a big scale. Institutions, finances, and collaboration and coordination among all stakeholders are crucial for upscaling from the site level to the watershed level, the basin level, and finally the region level. When moving from a test plot or showcase site to actual farms and communities, it is crucial to take into account biophysical constraints, financial realities, and the local institutional capability.

Development status of institutional/organizational arrangements, policy and legislative mechanisms

More nations than ever before include watershed management as part of their overall strategy for protecting and preserving their natural resources. It receives greater focus in certain nations than in others. It's been institutionalized in the forestry and agricultural line agencies in the Pacific region of Asia and South America. In some countries, such as Bhutan and the Lao People's Democratic Republic, watershed management is handled by a single expert, while in others, such as Myanmar, Nepal, Honduras, and the Philippines, watershed management is handled by a specialized unit or division. Watershed management institutions in Africa are yet in their formative stages. It is not within the scope of this work to speculate on the causes for this delay. Major challenges include the lack of policy and law that supports community-based watershed management. Governments have been sluggish to act on the need to revise and enact new laws and regulations that increase upland residents' capacity for long-term engagement in conservation efforts aimed at protecting natural resources.

Integrated Watershed Development Programme (IWMP)

With an aim to encompass 55 million hectares of rain fed land by 2027, the Integrated Watershed Development Project (IWMP) has being executed by the Department for Farmland, Ministry of Rural Development as of 2009-10. After China's watershed program, the IWMP is the biggest in the world. The plan calls for reviving depleted soil, plant life, and

water supplies via watershed management projects that restore these natural resources. All 50 states are participating, with funding split 90:10 between the federal and state governments. IWMP's results include less soil runoff, more regrown vegetation, more collected rainwater, and a higher water table. This makes it possible for people living in the watershed region to engage in sustainable livelihoods including multi-cropping and the development of new agro-based businesses.

Other Initiatives Taken:

The Central Government has funded the Haryali watershed development project to help the rural populace better manage water resources for human consumption, agriculture, fisheries, and reforestation..

The Project is being executed by Gram Panchayats with people's participation.

Neeru-People in Andhra Pradesh's Meeru (Water and You) initiative and Rajasthan's Arvary Pani Sansad have been working together to build water-harvesting structures including percolation containers, dug out ponds (Jihad), check dams, and more..

Water harvesting systems in homes are now mandated in the Indian state of Tamil Nadu.

Water collection systems are an essential part of any construction design.

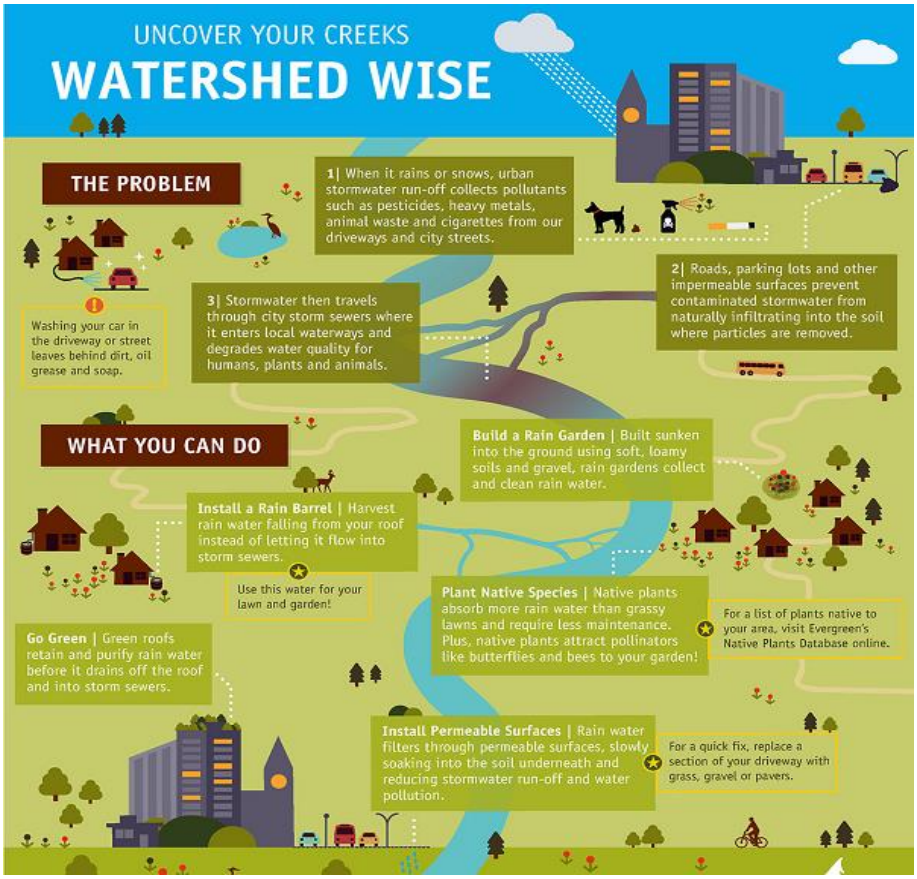

Figure1. Effective Implementation Integrated Watershed Development Programme (IWMP)

Conclusion

Stakeholders involved, government & non-government institutions, and other institutions are all part of the collective activity and community engagement inherent in the consortium model. Multidisciplinary knowledge and expertise are essential for watershed management. The significant effects seen in the watershed may be attributed in large part to the ease of access and timely guidance provided to farmers. As a result, farmers have a greater understanding of their surroundings and know who to go for help when issues emerge. Engineering, forestry, horticulture, livestock breeding, biology, sociology, economics, and marketing expertise are all necessary. The resources and expertise needed are not usually found in a single company. The many watershed projects and interventions may therefore be made more successful via the consortium method, which pools the knowledge of specialists from several fields.

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