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RESEARCH ARTICLE

SURFACE WATER CONSERVATION IN SUB-SAHARAN AFRICA: AIMS, ACHIEVEMENTS AND CHALLENGES

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Abstract

Water is one of the essential factors for civilization, and also among the most important items in the new world order. In semi-arid areas, water scarcity is the greatest challenge and is an important driving force in the process affecting the landscape and has become one of the most serious environmental problem attracted much attention worldwide. The aim of the present study was to evaluate the applicability of water conservation methods, their positive impacts and theirfurther challenges in Sub-Saharan Africa. To meet this objective data were collected from published papers dedicated to water conservation in Sub Saharan Africa. Many studies have shown, successfully implement ed water conservation practices. In this order, some water conservation methodshave been developed, appliedand improved over time in several countries. Indeed, it has been demonstrated that water conservation is crucial for agriculture, economical benefits, and environmental mitigation in sub-Saharan Africa. In thisregards, water harvesting and conservation initiatives have been seen as a useful tool for agricultural production, soil protection and biodiversity conservatio n. However, most of water conservation methods were not realized due to multiple challenges including poverty, lack of education, climate change and others. For example, due to the high cost, many water conservation initiatives could not be applied by local populations. To successfully reverse this trend, interventions must be rethought. Therefore, more suitable and less expensive technologies must be considered.

Introduction:-

Water quality is an important parameter in drinking water supply, agriculture, fish production, recreation and other purposes for which the water was impounded (Mustapha, 2008; Wallis, 2011; Toudjani et al., 2017). Water is one of the essential factors for civilization, and also among the most important items in the new world order. Safe and freely available water is a vital and indispensable resource for humans and their livestock (Dusabe et al., 2019).

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Improved water supply and sanitation, and better management of water resources, can increase countries' economic growth and contribute significantly to poverty reduction (Zhao et al., 2013; Dusabe et al., 2019). All major human migrations and the birth of towns and communities have been closely correlated with the search for, and the settlement around, naturally irrigated areas and valleys adequately supplied with water. River basins are the natural entities in which freshwater appears, the ultimate source of nearly all water used and nowadays also the receptors of most wastewater. River basins play a pivotal role not only in the water cycle, but also in nearly all other life cycles as a crucial source of bio-diversity (Jaspers, 2013). Anthropogenic influences, such as agricultural activities, can degrade surface water quality and make it unsuitable for drinking, sustainable agricultural use, and sustaining biodiversity (Kartikasari et al., 2013; Hellar-Kihampa et al., 2013; Selemani et al., 2018). While the expansion from small-scale rain-fed farming to medium- and large-scale irrigation farming has contributed to global food security, it has often been associated with land and water problems (Mateo-Sagasta, 2017).

Why surface water conservation in sub-Saharan Africa? -

In recent decades, human population in sub-Saharan Africa has been growing steadily, increasing demands for water, food and various services resulted in natural resources degradation pressure on water resources (Toudjani &Awet, 2019). This situation requires urgent solutions among which surface water harvesting and conservation. Water harvesting and conservation initiatives have been developed to face increasing erosion, land degradation, water pollution, runoff water loss, evaporation, mismanagement of natural resources due to anthropogenic pressure and climate change, and maximize agricultural production (Wildemeersch et al., 2012; Nyamekye et al., 2018; Traoré et al., 2020; Ahuchaogu et al., 2022). Water conservation is all practicesincluding strategies, policies and programs of improving water use efficiency, environmental protection and improving the efficiency of industry, housing, utilities, and agriculture (Ahuchaogu et al., 2022). Watershed managementis a planks of a consensus on how water should be managed. The assumptions on scale, boundaries, appropriate institutions and procedures underlying this model are, however, not as self-evident as they seem. Rather, they are the outcome of socio-political choices. By presenting these choices as natural, the dominant water discourse works to depoliticize important issues of scale and voice (Wester & Warner, 2002).

Success of surface water harvesting and conservation of surface water in sub-Saharan Africa: -

From the documentary, it appears that several techniques of water conservation practices including zaipits (mall holes are dug at a spacing of about 1 m whichcatch runoff during rainstorms), half-moons (semi-circular wide-open basins constructing face the slope where flowing rainwater to collect runoff water), benches (series of level strips running across the slope at vertical intervals, supported by steep banks), micro-dams (small water storage structures to collect water during the rainy season for irrigation and others uses), grass strips (Planted grass in dense strips along the contour), earth bunds (earth embankments through slopes to slow down the speed of runoff, increase its infiltration and control soil erosion), and stone bunds (stone lines along the contour to slow down the speed of runoff, to enhance its infiltration and reduce soil erosion) have been developed in manyareas of sub-Saharan Africa(Ahuchaogu et al., 2022,Kaboré&Reij, 2004; Lacombe et al., 2008; Abebe& Bekele, 2014; Haoua et al., 2025).

Conservation of water has several agronomic, environmental, and economical benefits (Ahuchaogu et al., 2022). Proven benefits from water conservation, include increase water availability, soil fertility and, thereby, increase in agricultural productivityand irrigation, fish production, ecological services, flora and fauna settlement, expense of grazing lands and bush land, and decreased runoff (Kiéma et al., 2007; 2008, Haoua et al., 2025). The success of waterconservation was the effectiveness of the implementation approaches including the participation of the local community in the form of a contribution. Water management techniques, improved cropping systems, and improved crop varieties may improve resilience by reducing the impact of extreme weather events and thus improve the ability of farmers to bounce-back from shock (Traoré et al., 2020). In the last decades, many studies have been conducted in Africa, reporting the effectiveness of water conservation (Nyssen et al., 2009; Haregeweyn et al., 2012; Taye et al., 2013;

Nyamekye et al., 2018), such as on regenerating vegetation, rehabilitating the soil (Descheemaeker, 2006) and reducing sediment yield (Nyssen et al., 2009), but also stating difficulties in implementing water conservation, as done for Ethiopia (Amsalu et al., 2006; Tefera &Sterk, 2010).Wildemeersch et al. (2012) reported that the synergistic effect of the water-harvesting practices and the supply of manure show promising potential to rehabilitate and to increase the agronomic efficiency of marginal land in Niger. In Burkina Faso, SWCM have largely resulted in an increase in agricultural productivity and improvement in food security (Nyamekye et al., 2018). The use of

surface flooding in conjunction with groundwater resources has augmented the production of dry season farming considerably in Nigeria (Ahuchaogu et al., 2022). A significant increase in soil water due to the water conservation method (WCM) treatments was measured in in Burkina Faso (Traoré et al., 2020). Water conservation techniques represent viable interventions for farmers seeking to improve their incomes and food security while conserving natural resources and building a more resilient ecologically-sound form of agriculture (Oakland Institute & AFSA, 2020).

Constraints of surface water conservation initiatives in sub-Saharan Africa: -

Several water conservation initiatives were successfully implemented in sub-Saharan Africa. However, most of these initiatives could not easily be implemented because of some challenges such as extreme weather, water evaporation, migration, poverty, lack of education and planning, andlow technological level (Toudjani &Awet, 2019). In in this part of the world surface water evaporation is one of the main challenges for water harvesting due to climate change resulting in extreme weather. Implementing of water conservation is a labor demanding process, especially in regions, such as sub-Saharan Africa, where such activities are greatly dependent on local workforce. However, in search of job, and better life many people in the rural areas mover to urban areas, subsequently leading to lack of workforce (Toudjani &Awet, 2019).

Moreover, due to the high cost, some water conservation practices could not be applied by local populations. For example, Ahuchaogu et al. Ahuchaogu et al. (2022) noted that in Nigeria, reinforced concrete waterways are more efficient but have not been widely adopted by smallholder farmers due to their high cost. In this order, the use of local materials at chosen dam sites effectively saves cost whilst achieving the desired result (Ahuchaogu et al., 2022). Water degradation and derived effects are getting more importance worldwide. This is partially due to a lack of appropriate identification and evaluation of the degradation processes and of the relations cause-effects of water scarcity each specific situation, and the generalized use of empirical approaches to select water conservation practices (Pla, 2002).

Conclusion:-

Nowadays, water conservation practices are necessary to adapt to water scarcity and climate change in sub-saharan Africa.It appears that in sub-Saharan Africa, water conservation is crucial for agriculture and environmental mitigation. However, most of water conservation methods are difficult to implementdue to multiple challenges including poverty, lack of education and technology, climate change and others. To successfully reverse this trend, it has been recommended in the literature to rethink the type of water conservationinitiatives. Therefore, more suitable and less expensive technologies must be considered. In addition, substantial remuneration must be allocated to the local workforce during the execution of these activities in order to retain populations and reduce migration to urban areas.

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