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Ecohydrology for Ethiopia – regulation of water biota interactions for sustainable water resources and ecosystem services for societies

Maciej Zalewski^{1,2}, Yohannes Zerihun Negussie³, Magdalena Urbaniak^{1,2*}

¹ International Institute of Polish Academy of Sciences European Regional Centre for Ecohydrology, Tylna 3, 90-364 Lodz, Poland

² Department of Applied Ecology, University of Lodz, Banacha 12/16, 90-237 Lodz, Poland

³ Ministry of Water and Energy of Ethiopia, Haile G/Silassie Road, P.O. Box 5744 and 5673, Addis Ababa, Ethiopia

*E-mail: m.urbaniak@unesco.lodz.pl

Abstract

This article introduces the rationale and the brief review of the content of the selected papers from the International Symposium “Ecohydrology for sustainable water ecosystems and society in Ethiopia” held on 18th-21st of November 2009 in Addis Ababa, Ethiopia” organized by the European Regional Centre for Ecohydrology under the auspices of UNESCO and the Ministry of Water and Energy of Ethiopia, financed by Ministry of Foreign Affairs of the Republic of Poland – within the Polish Aid Programme. The major criterion of papers selection, above scientific quality, was the perspective of use of the information and knowledge provided in their content to improve the sustainability of water, ecosystems and society, for further development of the wisdom and competences applying the theory of Ecohydrology – one of the priorities of the International Hydrological Programme of UNESCO – as a framework.

Key words: problem solving science, Ecohydrology principles, IWRM.

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Ecohydrological status of Lake Tana – a shallow highland lake in the Blue Nile (Abbay) basin in Ethiopia: review

Etfa Emama Ligdi¹, Mohssine El Kahloun², Patrick Meire³

¹ Water Resources and Watershed Management; R&D Coordination Department, Ministry of Water Resources, MoWR, P.O. Box: 28182, Addis Ababa, Ethiopia, e-mail: etafa_emama@yahoo.com; ee.ligdi@ethionet.et

² University of Antwerp “CDE”, Department of Biology, Ecosystem Management Research Group, Universiteitsplein 1; BE-2610 Antwerp (Wilrijk), Belgium, e-mail: Mohssine.elkahloun@ua.ac.be

³ University of Antwerp, Belgium, e-mail: patrick.meire@ua.ac.be

Abstract

This paper is based on a country report for Ethiopia prepared as a part of the ecohydrology component of IHP-UNESCO’s FRIEND/Nile-phase II Project. It reviews past and current research in the Lake Tana sub-basin around the lake. The objective of the study was to determine the ecohydrological status of the Lake as a tool for integrated water resource management in improving the sustainability of the quantity and quality of freshwater resources in the Nile basin. The preliminary results show that reduced lake water level with its annual fluctuations and seasonal floods associated with high flows are becoming amplified and frequent, and the total average annual sediment load of the four major tributaries shows an increasing trend. Source pollution from urban waste and rural agriculture, and degradation of biota in the catchment are the two main environmental threats for the lake ecosystem. Knowledge gaps were identified and future research needs were recommended along with suggestion of some potential phytotechnologies to be applied in the study area.

Key words: FRIEND/Nile II, ecosystem functions, lake level fluctuations, point source pollution, sediment loads, knowledge gap.

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Improving management of shoreline and riparian wetland ecosystems: the case of Lake Tana catchment

Ayalew Wondie

Department of Fisheries, Wetlands and Wildlife Management, College of Agriculture and Environmental Sciences, P.O. Box. 872, Bahir Dar University, Bahir Dar, Ethiopia,
e-mail: ayaleww2001@yahoo.com

Abstract

This review paper presents the results of many years' research and field observations on ecological status of the catchment of Lake Tana in relation to the socioeconomic issues. There are a number of wetlands in Lake Tana region such as shore areas, head springs, permanent and temporary floodplains (riverine and manmade) which serve as crop production, fisheries, sand mining, wetland products harvesting, etc. Population pressure and poverty have led to more intrusive activities, which have damaged the overall natural resources. Poor management practices further restricted the basic ecological services they provide (for example climate control, nutrient retention, drinking water provision, flood protection, etc.). The most outstanding threats of the shoreline and riparian wetlands stability are agriculture, industrial pollution, drainage activities and overharvesting of wetland resources. Management strategies should comprise both biophysical and socioeconomic aspects with emphasis on issues like adoption of watershed/ecosystem approach at policy level, integration of income generation in conservation activities, sharing of responsibility/benefits among local stakeholders, institutional strengthening for environmentally and socioeconomically sustainable development of lakes.

Key words: ecological services, buffer zone, threats, habitat alteration, mitigation measures.

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Landscape management practices for maintenance and enhancement of ecosystem services in a countryside

Andrzej Kędziora

Institute of Agricultural and Forest Environment, Polish Academy of Sciences, Bukowska 19,
60-809 Poznań, Poland, e-mail: kedan@man.poznan.pl

Abstract

The paper presents a review of research on functioning of agricultural landscape, mainly on protection of ecosystem services, carried out by the Institute for Agricultural and Forest Environment, Polish Academy of Sciences in Turew in the period of 1970-2009. The paper concentrates on water balance and water pollution control and the protection of biodiversity in an agricultural landscape. The results of the researches show that the best way for maintenance ecosystem services is development of landscape complexity. Introduction of non-productive elements like shelterbelts, strips of meadows, small ponds allows for improvement of water balance, reduction of groundwater pollution even by 90% and enhancement of biodiversity.

Key words: shelterbelts, landscape structure, water resources, biodiversity.

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A review of the water crisis in Tanzania's protected areas, with emphasis on the Katuma River–Lake Rukwa ecosystem

Manase Elisa¹, John Ignase Gara¹, Eric Wolanski²

¹ Katavi National Park, Tanzania National Parks, P.O.Box 89, Mpanda-Rukwa, Tanzania,
e-mail: elisam27@yahoo.com

² Australian Centre for Tropical Freshwater Research, James Cook University,
Townsville, Q. 4811, Australia, and
Australian Institute of Marine Science, Townsville, Q. 4810, Australia,
e-mail: eric.wolanski@jcu.edu.au

Abstract

Several cases of the developing water crisis in semi-arid regions of Tanzania are described. Some cases have transboundary causes. These include Lake Victoria and the riparian population as a result of hydroelectricity developments in Uganda, the Serengeti ecosystem threatened by deforestation of the Mau forest and irrigation in Kenya, and several national parks threatened by irrigation projects within Tanzania. Some of these developments are given national priorities like in case of the Great Ruaha River. Other irrigation projects are driven by the local population to combat poverty. Most of these developments are in breach of state laws because there is no consideration of minimal environmental flows and all have profound negative impacts on people and wildlife downstream. The paper describes the previously unreported case of irrigation in the upper Katuma River that flows into Lake Rukwa, which lead to poverty increase, environmental degradation and a decrease in ecosystem services provision downstream. Governance at the watershed scale in a framework compatible with ecohydrology principles is needed. Such solutions are proposed.

Key words: irrigation, environmental flow, East African wildlife, governance, ecohydrology, sustainable development.

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Water and nutrient inputs in rainfall into natural and managed forest ecosystems in south-eastern highlands of Ethiopia

Yeshanew Ashagrie*, Wolfgang Zech

Institute of Soil Science and Soil Geography, University of Bayreuth, D-95440 Bayreuth, Germany

* E-mail: yeshanew@hotmail.com

Abstract

The input of rain water to the forest floor and the composition of rainfall and throughfall water were monitored between October 2001 and September 2002 in a natural and two plantation (*Eucalyptus globulus* and *Cupressus lusitanica*) forests at Munesa, southeastern highlands of Ethiopia. The proportions of throughfall to annual incident rainfall that passed through the different forest canopies were 53% under *Cupressus* and the natural forest and 82% under *Eucalyptus*. Annual nutrients deposition by rainfall varied from 0.08 kg ha⁻¹ yr⁻¹ for Mg to 3.79 kg ha⁻¹ yr⁻¹ for Na. Wash-off of materials deposited on the canopy surface and leaching of intracellular solutes from the canopy resulted in an enrichment of throughfall fluxes in K, Mg, Ca and Cl relative to rainfall and varied among forest types, being highest under natural and *Eucalyptus* forests and lowest under *Cupressus*. Sodium, NO₃-N, NH₄-N, SO₄-S and PO₄-P fluxes in throughfall were depleted relative to rainfall, but the magnitude of net depletion was different for the different elements; highest for Na (3.87 kg ha⁻¹ yr⁻¹) followed by NH₄-N (2.85 kg ha⁻¹ yr⁻¹) and lowest for PO₄-P (0.42 kg ha⁻¹ yr⁻¹). The amount of canopy uptake and leaching were generally low in the dry season and increased sharply towards the wet season.

Key words: *Cupressus*, *Eucalyptus*, Ethiopia, throughfall, rainfall.

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Dynamics of dissolved nutrients in forest floor leachates: comparison of a natural forest ecosystem with monoculture tree species plantations in south-east Ethiopia

Yeshanew Ashagrie*, Wolfgang Zech

Institute of Soil Science and Soil Geography, University of Bayreuth, D-95440 Bayreuth, Germany

* E-mail: yeshanew@hotmail.com

Abstract

The dynamics of nutrients in water passing through the forest floors of two plantation forests (*Cupressus lusitanica* and *Eucalyptus globulus*) and an adjacent natural forest were monitored over a one year period at Munesa, Ethiopia. The results showed that, in all forest types, after K, Ca and Cl were the most abundant nutrients leached from the forest floor to the mineral soil. The concentration of NO₃-N in the natural forest was about 10 times higher than that of NH₄-N, but 8 and 3 times higher than that of NH₄-N under *Eucalyptus* and *Cupressus*, respectively. No significant differences in concentrations of most of the nutrients were observed among forest types, but magnesium and NO₃-N were significantly higher under the natural forest and *Eucalyptus* than under *Cupressus*. Except for NH₄-N, which was depleted in relation to throughfall in the natural forest, the concentrations of all other nutrients were enriched in litter leachate in relation to both rainfall and throughfall. However, with the exceptions of NO₃-N in all forest types, Ca under *Cupressus* and PO₄-P under *Cupressus* and *Eucalyptus*, all measured nutrient fluxes from the forest floor to the mineral soil decreased in relation to throughfall fluxes. Generally, the results show that despite the differences in tree species composition among the forest types the organic layer acted as a sink for most of the nutrients coming via throughfall.

Key words: *Cupressus*, *Eucalyptus*, forest floor leachate, Ethiopia.

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SWAT based runoff and sediment yield modelling: a case study of the Gumera watershed in the Blue Nile basin

Meqaunint Tenaw Asres¹, Seleshi B. Awulachew²

¹ Ministry of Water Resource, P.O. Box 15497, Addis Ababa, e-mail: mequanntt@yahoo.com

² International Water Management Institute, P.O. Box 5689, Addis Ababa, Ethiopia, e-mail: s.bekele@cgiar.org

Abstract

Land degradation caused by soil erosion (sheet and rill erosion) and soil fertility decline is a serious threat in the Ethiopian highlands, especially in the Gumara watershed. In this study the SWAT (Soil and Water Assessment Tool) model was applied to the Gumara watershed to predict sediment yield and runoff, to establish the spatial distribution of sediment yield and to test the potential of watershed management measures to reduce sediment loadings from hotspot areas. The model was calibrated using five years of flow and sediment records and validated using data for the next three years. Out of 30 SWAT sub-basins, 18 sub-watersheds (72%) were identified as erosion prone areas contributing to a mean annual sediment load ranging from 11 to 22 t ha⁻¹ yr⁻¹. The model was used to evaluate the potential of vegetation filter strips of various widths to reduce sediment production from critical micro watersheds. The installation of vegetation filter strips on vulnerable land was shown to result in a 58 to 74% reduction in sediment yield for strip widths of 5 m and 10 m respectively.

Key words: land degradation, soil erosion, sediment yield, SWAT, critical sub watersheds, vegetation filter strips.

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Indiscriminate devegetation under improper farming system: a root cause for surface and underground water and food crisis in Ethiopia

Dechasa Jiru

Forestry Research Centre P.O. Box 30708, Addis Ababa, Ethiopia, e-mail: dechasa_j@yahoo.com

Abstract

Deforestation has caused surface and underground water imbalance in the hydrologic cycle followed by subsequent food, feed and wood productivity crisis. This paper reviews the role of traditional farming systems in wet and dry agroecology. It further compares it with existing improper farming practice, which productivity is examined from agroecology based climatic and edaphic perspective. Experiments were carried out to determine the amount of rainfall intercepted by dominant trees on farm, namely by *Cordia africana*, *Afrocarpus falcatus*, *Millettia ferruginea*, *Juniperus procera*, *Syzygium guineense*, *Olea europaea* subsp. *cuspidata*, *Acacia albida*, *Albizia gummifera* and *Moringa stenopetala*. Deep rooted trees planted on farms are found to be sources of feed, food and moisture conservers, that sustain and boost production in moisture scarce agriculture. Under irrigation they are found to be good for salinity protection and marginal land reclamation. Soil infiltration data from secondary sources were examined for cultivated area, wood land and open overgrazed pasture in central Rift Valley. The relative infiltration rates are highest for grasslands. This research work is intended to initiate interdisciplinary networking approach in water and natural resource conservation, proper land use potential development and environmental sustainability.

Key words: farming system, deforestation, on-farm trees, interception, infiltration, water balance crisis.

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The water resource implications of planned development in the Lake Tana catchment, Ethiopia

Tadesse Alemayehu^{1*}, Matthew McCartney², Seifu Kebede³

¹ Environmental Science Program, Addis Ababa University, P.O. Box 20763 (home), Addis Ababa, Ethiopia, e-mail: tade.alex@gmail.com

² International Water Management Institute, P.O. Box 5689, Addis Ababa, Ethiopia, e-mail: m.mccartney@cgiar.org

³ Department of Earth Science, Addis Ababa University, P.O. Box 1176, Addis Ababa, Ethiopia, e-mail: skebede@geol.aau.edu.et

* Corresponding Author

Abstract

The water resources of the Lake Tana catchment are largely untapped. Currently, water resource development is being promoted to stimulate economic growth. This study utilized the WEAP model to determine the likely impact of a number of possible development scenarios on lake water levels. For each scenario, the model was used to simulate water demand in three sectors (i.e. irrigation, hydropower and downstream environmental flows) over a 36-year period of varying flow and rainfall. The simulation results revealed that if all the planned development occurs on average 2198 GWh⁻¹ power could be generated and 677 Mm³ y⁻¹ of water supplied to irrigation schemes. However, the mean annual water level of the lake would be lowered by 0.44 meters. As well as adverse ecological impacts this would have significant implications for shipping and the livelihoods of local people.

Key words: Ethiopia, Lake Tana, water level, water resources development, WEAP model, water demand.

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Integrating aquaculture with traditional farming system: socioeconomic assessment in the Amhara Region, Ethiopia

Berihun Tefera Adugna*, Goraw Goshu**

College of Agriculture and Environmental Sciences, Bahir Dar University, P.O. Box 1701,
Bahir Dar, Ethiopia, e-mails: *berihunadugna@yahoo.com; **gorawha@yahoo.com

Abstract

Semi-intensive aquaculture practice started in 2005 in the Amhara region of Ethiopia. An evaluation survey was undertaken in September 2009. Beneficiaries, key informants and various groups were interviewed. Constructed aquaculture ponds were different in source of water, structure, age, original purpose, level of integration and the type of fish stocked. Farming households integrated aquaculture with different production subsystems and increased the flow of nutrients. At the same time they gained different benefits. However, the practice has been also constrained by various challenges. Farmers' research extension group approach, provision of gillnets, appropriate fish species and mono-sex culture, capacity building of the research and extension system, and proper follow up are the recommendations for integrated aquaculture expansion.

Key words: semi-intensive, subsystem integration, fish stocking.

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Spatial and temporal distribution of commercially important fish species of Lake Tana, Ethiopia

Goraw Goshu^{1*}, Dereje Tewabe², Berihun Tefera Adugna¹

¹ Bahir Dar University, College of Agriculture and Environmental Sciences, P.O. BOX 1701, Bahir Dar, Ethiopia, e-mail: gorawha@yahoo.com

² Amhara Regional Agricultural Research Institute, Bahir Dar, Ethiopia P.O. Box 794, Bahir Dar, Ethiopia

* corresponding author

Abstract

The distribution of Lake Tana fish species was studied from January 2000 to December 2003. Samples were collected monthly using gill-nets of 60, 80, 100, 120 and 140 mm stretched mesh size. *Labeobarbus* spp., *Oreochromis niloticus*, *Claris gariepinus* and *Varicorhinus beso* are commercially important fish species and form 77%, 13%, 9% and 1% of the pooled experimental fish catch. There was significant variability among years and sampling sites encompassing both temporal and spatial aspects. Population densities of *Labeobarbus* spp. and *V. beso* were significantly declining, in contrast, the abundance of *O. niloticus* and *C. gariepinus* did not change. The most likely explanations for the decline in *Labeobarbus* spp. are the increase of the commercial gill-net fishery targeting their spawning aggregations in the river mouths, use of poisonous plant materials and the increasing trend of the disconnectivity and channelisation of rivers. The results stress the need for urgent development of a management plan focusing on ensuring river connectivity, fishing effort and gear restrictions, and control in the river mouths and major tributaries during the breeding seasons.

Key words: tropical lake, species composition, *Labeobarbus*, *Oreochromis niloticus*, *Clarias gariepinus* and *Varicorhinus beso*.

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Stocking based fishery enhancement programmes in Ethiopia

Yared Tigabu

National Fishery and Aquatic Resources Research Center, Sebeta, P.O. Box 8339,
Addis Ababa, Ethiopia, e-mail: Yared1900@yahoo.com

Abstract

Fishery and aquaculture play an enormous role in reducing poverty and alleviating food insecurity at household level. The first fish stocking program in Ethiopia was reported as early as 1925. Indigenous *Oreochromis niloticus*, *Tilapia zilli*, *Clarias gariepinus* and non-native *Cyprinus carpio*, *Carassius carassius*, *Carassius auratus*, *Ctenopharyngodon idella* and *Salmo trutta* fish species were used for stocking. Even though most of the fishery enhancement programs are low-cost operations, they often seem to be very efficient actions. Fish harvested in the reservoirs Fincha and Amerti in Oromia region, lakes Haik and Ardibo in Amhara region and Hashengie in Tigray region, enhanced by stocking, contribute up to 15% of the annual fish production of the country. Thus fisheries programs challenging the growing protein-rich food demand should be considered as a necessary and valuable aspect of management strategy in all waters, independently from its major operational goal like hydropower or irrigation.

Key words: common carp *Cyprinus carpio*, fish introduction, impact, reservoirs, tilapia *Oreochromis niloticus*, *Tilapia zilli*.

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Mathematical modelling as a tool for predicting the intensity of eutrophication symptoms based on zooplankton and fish density

Adrianna Wojtal-Frankiewicz¹, Piotr Frankiewicz^{1,2}

¹ Department of Applied Ecology, University of Lodz, 12/16 Banacha Str., 90-237 Lodz, Poland, e-mail: adwoj@biol.uni.lodz.pl

² The International Institute of the Polish Academy of Sciences, European Regional Centre for Ecohydrology under the auspices of UNESCO, ul. Tylna 3, PL 90-364 Lodz, Poland

Abstract

In temperate zones, algae biomass may be efficiently controlled by *Daphnia* sp., which is the most significant grazer among filter-feeding zooplankton. *Daphnia* population dynamics depends mostly on the trophic state of the ecosystem, which determines both fish community structure and food quality and availability. Relatively invariable water inflow to a reservoir with small amplitudes supports balanced biotic interactions. Here, we present simulations using the DALIS model that well characterised behaviour in a temperate ecosystem under stable abiotic conditions. The model results allowed us to predict the extent to which predation by fish would disturb the dynamics of *Daphnia* under different food conditions. Therefore, mathematical modelling may be an important tool for establishing appropriate recovery strategies in eutrophic water bodies. Although the model in this study characterised temperate zone conditions, its application to tropical lakes, where the dynamics of zooplankton and fish are substantially different, is discussed.

Key words: *Daphnia*, top-down, temperate and tropical freshwaters, cyanobacteria

Blooms.

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Environmental impact of coffee processing effluent on the ecological integrity of rivers found in Gomma woreda of Jimma zone, Ethiopia

Yared Kassahun Kebede^{1*}, Tesfu Kebede², Fassil Assefa³, Aklilu Amsalu⁴

¹ Soil and Water Management Research Division, Ethiopian Institute of Agricultural Research, P.O. Box 28019, Addis Ababa, Ethiopia, email: jaredkassahun@yahoo.com

² Soil and Water Management Research Division, Ethiopian Institute of Agricultural Research, P.O. Box 192, Jimma, Ethiopia, email: tesfuhk@yahoo.com

³ Biology Department, Addis Ababa University, P.O. Box 1176, Addis Ababa, Ethiopia, e-mail: asefafasil2003@yahoo.com

⁴ Geography and Environmental Studies Department, Addis Ababa University; P.O. Box 150223, Addis Ababa, Ethiopia, e-mail: muksitay@yahoo.com

* Corresponding Author

Abstract

The physico-chemical parameters of coffee effluent consists of very high amount of BOD (2200 mg dm⁻³), TDS (1810 mg dm⁻³), NO₃ (26.4 mg dm⁻³), NH₄⁺ (12.6 mg dm⁻³), low pH (4.3) and zero DO values. Despite the reduction of these values by dilution effect of river water, BOD values as high as 1900 mg dm⁻³ and 1700 mg dm⁻³ were found at the downstream sites of Bore and Fite rivers. For biological assemblage study, 6047 macroinvertebrates representing 27 different taxa were identified from riffle sampling sites. The average Shannon and equitability indices and total EPT taxa were reduced at the downstream sites. The habitat score of the study sites was in the range of 27% (very poor) up to 84% (excellent).

Key words: Coffee effluent, environmental impact, Gomma, macroinvertebrates.

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A pilot study on anthropogenic faecal pollution impact in Bahir Dar Gulf of Lake Tana, Northern Ethiopia

**Goraw Goshu¹, Denis Byamukama², Mohammed Manafi³, Alexander K.T. Kirschner³,
Andreas H. Farnleitner⁴**

¹ Bahir Dar University, College of Agriculture and Environmental Sciences, P.O. BOX 1701,
Bahir Dar, Ethiopia, e-mail: gorawha@yahoo.com

² Department of Biochemistry, Makerere University, Uganda

³ Institute for Applied Immunology and Hygiene, Medical University of Vienna, Austria

⁴ Institute for Chemical Engineering, Environmental Microbiology and Molecular Ecology,
Vienna University of Technology, Austria, e-mail: a.farnleitner@aon.at

Abstract

The anthropogenic effect on faecal and chemical pollution at Bahir Dar Gulf of Lake Tana, Ethiopia was investigated in the period of October 2006 to February 2007. Faecal and physicochemical pollution levels were significantly increased and clearly discernible in the Bahir Dar Gulf locations as compared to presumptively anthropogenic uninfluenced reference locations near the outlet of the Blue Nile River of Lake Tana. One directly sewage influenced lake site at Bahir Dar Gulf was found to be excessively faecally polluted. The total pooled data set from the study for faecal coliforms, *Escherichia coli* and *Clostridium perfringens* spores ranged from not detectable (n.d.) to log 6.2 CFU, n.d. to log 6.1 CFU and n.d. to log 1.7 CFU per 100 ml, respectively. A high variation was also observable for the physicochemical parameters including the spectral absorption coefficient at 254 nm, ammonia, nitrite, nitrate, total dissolved solids, total suspended solids and pH values. Although the data have to be considered preliminary, it strongly points to the need for systematic water quality monitoring of Lake Tana and its potential impact sources. This is all the more important as the lake is the largest freshwater body in the country serving a multipurpose role and being identified as a growth corridor of the country.

Key words: microbial pollution, water chemistry, tropical surface water quality, anthropogenic influence, faecal indicators.

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Living with environmental health risks – the case of Addis Ababa

Elias Mazhindu¹, Trynos Gumbo², Tendayi Gondo³

¹ Ethiopian Civil Service College, P.O. Box 5648 Addis Ababa, Ethiopia,
e-mail: elias.mazhindu58@gmail.com

² Ethiopian Civil Service College, P.O. Box 5648 Addis Ababa, Ethiopia,
e-mail: tgumbo2@gmail.com

³ Department of Urban and Regional Planning, University of Venda, P Bag x5050,
Thohoyandou 0950, South Africa, e-mail: gondotee@gmail.com

Abstract

The rapid population growth of Addis Ababa poses the city with many environmental challenges. The current fragmented approach to sanitation and poor waste management has brought serious environmental and health problems. The study deployed purposive and stratified cluster sampling techniques in diagnosing the institutional arrangements for waste management through personal interviews and focus group discussions with stakeholder agencies and households in the slum and residential areas of the city. The threats to groundwater and riverine systems were most proliferated in the central, most densely populated areas of the city, that are poorly served with sanitary facilities. The study concluded that possible improvements may include legitimization of the informal system, community participation and possibly partial privatization. Such an integrated approach seems to be the best option and could well hold the key to the effective and sustainable waste management system in rapidly growing cities such as Addis Ababa.

Key words: environment, pollution, sanitation, disposal, waste management.

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Spatial analysis of solid waste induced ecological hot spots in Ethiopia: where ecohydrologists should begin?

Tendayi Gondo¹, Trynos Gumbo², Elias Mazhindu², Emaculate Ingwani², Raymond Makhanda²

¹ Department of Urban and Regional Planning, University of Venda, Private Bag X5050, Ethiopia, e-mail: gondotee@gmail.com

² Urban Management Masters Programme, Ethiopian Civil Service College, P.O. Box 5648, Addis Ababa, Ethiopia.

Abstract

The significance of solid waste management in ecohydrology research is obvious given the potential threat that solid waste poses on the intrinsic services of water purification, particularly in areas of high temperatures and precipitation levels. Improper waste disposal systems have adverse repercussions on environmental sanitation and impede water quality management efforts. The potential risk to water and soil pollution is surmountable in the areas where waste collection and disposal efforts are constrained. We used a GIS based meso-scale approach to identify solid waste ecological hot spots. Results indicate that solid waste hot spots are characterised by poor solid waste management, high temperatures, and high rainfall and are likely to compromise the ecohydrological processes of both surface and underground water systems. The most affected river basins are found in south and north-western parts of Ethiopia. Climate change is likely to worsen the situation in the areas where precipitation and temperature levels are expected to rise. We recommend that ecohydrologists prioritize such areas for improved water resource management.

Key words: ecosystem, climate, water quality, policy, waste management.

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Assessment of soil erosion processes and farmer perception of land conservation in Debre Mewi watershed near Lake Tana, Ethiopia

Assefa D. Zegeye¹, Tammo S. Steenhuis^{2,3}, Robert W. Blake^{2,4}, Selamyihun Kidnau⁵, Amy S. Collick^{2,3}, Farzad Dadgari⁵

¹ Adet Agricultural Research Center, ARARI, P.O. Box 1326, Bahir Dar, Ethiopia,
e-mail: adz6@cornell.edu

² Master's Program in Integrated Watershed Management and Hydrology, Cornell University
at Bahir Dar University, Bahir Dar, Ethiopia, e-mail: asc38@cornell.edu

³ Department of Biological and Environmental Engineering, Cornell University, Ithaca,
NY 14853, USA, e-mail: tss1@cornell.edu,

⁴ Center for Latin American and Caribbean Studies, 300 International Center, Michigan
State University, East Lansing, MI 48824, USA , e-mail: rwblake@msu.edu

⁵ SWHISA, Bahir Dar, Ethiopia, e-mails: selamyihun@yahoo.com, fdadgari@sympatico.ca

Abstract

Erosion is of great concern in the Ethiopian highlands. The objective of this study was to determine the soil erosion rates under actual farming conditions by measuring the dimensions and number of rills in 15 agricultural fields in the Debre Mewi watershed near Lake Tana, and to understand farmers' attitudes towards land conservation through personal interviews with one-third of the watershed households. The annual rill erosion rate was 8 to 32 t ha⁻¹. Greatest rates of erosion occurred at planting early in the season but became negligible in August. Major factors influencing land conservation decisions were the demand of labor and lack of technical support for implementing new conservation measures from experts.

Key words: Rill erosion, soil loss, farmer perception, soil and water conservation.

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Morphological analysis of Sher River basin using GIS for identification of erosion-prone areas

Dhananjay Suresh Deshmukh¹, Umesh Chandra Chaube², Sanjay Tignath³, Sangharsh Kumar Tripathi⁴

¹ Department of Water Resources & Environmental Engineering, Jimma University, Jimma, Ethiopia, e-mail: dsdesh@gmail.com

^{2,4} Department of Water Resources Development and Management, IIT Roorkee, Roorkee – 247667, Uttarakhand, India

³ Department of Geology and Geohydrology, Govt. Autonomous Science College, Jabalpur – 486001, M.P., India

Abstract

The morphological analysis has been used to identify the erosion-prone sites in the Sher river basin which is one of the sub-basins of the greater Narmada basin, Madhya Pradesh, India. The Sher river basin has been divided into the forty five sub-basins of fourth order and fourteen sub-basin areas representing fifth, sixth and seventh order streams. The various morphological parameters have been derived for Sher river basin and its derived sub-basins to describe their topographical conditions, drainage patterns and their probable response to the runoff. The erosional risk prone map for the study area has been prepared using Texture-Slope Index and the erosional scale of the basin has been prepared using the same index. The derived erosional scale has been arranged into '0' to '100' numerical scale in which the base values '0' and '100' denote the least and the highest erosion prone areas respectively. Comparative study of the sub-basins has been carried out by use of developed erosional scale. Classified erosional hazard map has been categorized into low, medium, high and very high sediment erosion. The classified map of erosional hazard may be useful to suggest various soil water conservation measures for water resources development and management.

Key words: morphological analysis, erosion, Texture-Slope Index.

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Impact of water harvesting ponds on household incomes and rural livelihoods in Minjar Shenkora district of Ethiopia

Akalu Teshome¹, Enyew Adgo², Bancy Mati³

¹ Amhara Agricultural Research Institute, P.O. Box +527, Bahir Dar, Ethiopia,
e-mail: akalu_firew@yahoo.com

² Bahir Dar University, P.O. Box 1289, Bahir Dar, Ethiopia,
e-mail: enyewadgo@gmail.com

³ Improved Management of Agricultural Water in Eastern & Southern Africa (IMAWESA)
P.O. Box 39063-00623 Nairobi, Kenya, e-mail: b.mati@cgiar.org

Abstract

This paper presents the findings of the socio-economic impact of household-level water harvesting technology. Before water harvesting was introduced, onions were not grown in the area due to lack of seedlings. Thus onion seedlings were grown on 100 m² plots using water from the ponds in the dry season, then sold or planted under rainfed conditions during the rainy season. The results obtained show that the average net income from onion seedlings was 155 US\$ per 100 m² plot, while those from bulb onions grown rainfed in the field was 1848 US\$ per ha, making the contribution to farmer incomes by onions alone about 2003 US\$ per year which is higher than from rainfed teff and wheat combined.

Key words: Socio-economic assessment, onions seedlings, net incomes, rainfed agriculture, water harvesting.

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A preliminary survey of the ecohydrological management challenges faced by Lake Gudera, Sekela woreda, West Gojjam, Ethiopia

Miheret Endalew¹, Goraw Goshu², Wondie Zelalem¹

¹ Amhara Regional Agricultural Research Institute, Bahir Dar Fish and Other Aquatic Life Research Center, P.O. BOX, 794. Bahir Dar, Ethiopia, e-mail: miheretendalew@yahoo.com

² BahirDar University, College of Agriculture and Environmental Sciences, P.O. Box 1701, Bahir Dar, Ethiopia, e-mail: gorawha@yahoo.com

Abstract

Lake Gudera, a highland lake, is highly degraded by agricultural activity, but still serves the local community for irrigation and livestock watering. Preliminary investigations indicated chemical composition of NO₃ (0.7 mg dm⁻³), turbidity (26 NTU) and conductivity (78 μs cm⁻¹) with poor floristic and faunistic composition. The Community Elders explained that the wetland encroachment started in 1986/1987, was aggravated in 2002/2003 and now had resulted in 25% littoral zone macrophyte loss. Wetlands had been converted for agriculture, leaving reduced filtering capacity of the lake which impacted on the ecosystem services. Now there are growing calls for sustainable management for the various values and functions, involving different stakeholders to alleviate negatively impacting factors.

Key words: biodiversity, degraded, ecosystem, open access, watershed, wetlands.

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Fishing activities in Gendwuha, Guang, Shinfa and Ayima rivers in Tekeze and Abbay basins, Ethiopia: preliminary study

Dereje Tewabe¹, Abebe Getahun², Eshete Dejen¹

¹ Amhara Regional Agricultural Research Institute (ARARI), Bahirdar Fisheries and Other Aquatic Life Research Center, P.O.Box 794, Bahir-Dar, Ethiopia, e-mail: drjetewabe@yahoo.com

² Addis Ababa University, Department of Biology, P.O. Box 1176, Addis Ababa, Ethiopia

Abstract

We sampled fishes of the rivers Gendwuha, Guang, Shinfa, and Ayima with 6, 8, 10, 12 and 14 cm stretched mesh gillnet, monofilament of different mesh sizes, hook and line, fykenet and castnet. During October 2007 through January 2008 in both dry and wet seasons. 27 fish species were identified from the four rivers represented by the families: Centropomidae, Cichlidae, Bagridae, Schilbeidae, Clariidae, Mochokidae, Malapteruridae, Osteoglossidae, Mormyridae, Characidae, Citharinidae and Cyprinidae. Species richness was slightly highest in the rivers Shinfa and Ayima - 20 species each, whereas 16 and 18 species were identified from Gendwuha and Guang rivers, respectively. Most destructive fishing methods used in the region include plant poisons and chemicals (Malathion) which are nonselective and dangerous for all biota. Action towards awareness creation in this respect should be urgently undertaken before extinction of species.

Key words: ichthyofauna, diversity, guraba, *Milletia ferruginea*, relative abundance, physical water parameters.

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The general information about the impact of water hyacinth on Aba Samuel Dam, Addis Ababa, Ethiopia: implications for ecohydrologists

Emaculate Ingwani¹, Trynos Gumbo², Tendayi Gondo³

¹ Ethiopian Civil Service College, P.O. Box 5648, Addis Ababa, Ethiopia,
e-mail: macuhungwe@yahoo.com

² Ethiopian Civil Service College, P.O. Box 5648, Addis Ababa Ethiopia,
e-mail: tgumbo2@gmail.com

³ Department of Urban and Regional Planning, University of Venda, P Bag x5050,
Thohoyandou 0950, South Africa, e-mail: gondotee@gmail.com

Abstract

The water hyacinth, *Eichhornia crassipes*, has been widely recognized as the worst aquatic weed the world over and of increasing importance in Africa, Ethiopia inclusive. The aim of the research was to highlight the devastating impact of the water hyacinth on aquatic life and human activities on Aba Samuel Dam and to underline prospects of its beneficial use. Delphi technique and on-site observations were used. Eutrophication was found to be the main cause of the proliferation of the plant. However, a majority of its potential uses were identified. The absence of a distinct Ministry of Environment is retarding the efforts in fighting causes of water hyacinth spreading. Community awareness has also been identified as a vital component in eradication of water hyacinth. This research is of significant relevance to environmentalists and ecohydrologists in formulating appropriate strategies and policies for hampering proliferation of the weed.

Key words: water quality, ecohydrology, sustainability, aquatic weeds, eutrophication, invasive species.

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RNA/DNA ratio as an indicator of the impact of long-term accumulative contamination for the assessment of river degradation – a pilot study.

Joanna Mankiewicz-Boczek^{1,2*}, Zbigniew Kaczkowski², Maja Godowska¹, Maciej Zalewski^{1,2}

¹International Institute PAS – European Regional Centre for Ecohydrology
under auspices of UNESCO, 3 Tylna Str., 90-364 Łódź, Poland,

* e-mail: j.mankiewicz@erce.unesco.lodz.pl

²Department of Applied Ecology, University of Łódź, 12/16 Banacha Str.,
90-237 Łódź, Poland

Abstract

To improve our understanding of the hierarchy of human induced modifications of the natural environment, with particular regard to the controlling strength of the habitat or chemical impacts, it was found to be appropriate to employ indicators at a molecular level. This paper examines the potential use of the analysis of the RNA/DNA ratio for the evaluation of the ecological status of two rivers of Central Poland. The study confirmed that analysis of the RNA/DNA ratio has the potential to be a sensitive indicator of river degradation. It is also a useful screening method for the evaluation of the impact of prolonged sub-lethal contamination of freshwater ecosystems dominated by tolerant fish species such as the perch, *Perca fluviatilis* L.

Key words: nucleic acid, *Perca fluviatilis* L., water quality, ecohydrology.

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Application of permeable reactive barrier for reduction of nitrogen load in the agricultural areas – preliminary results

Agnieszka Bednarek^{1*}, Małgorzata Stolarska^{1/2}, Marek Ubraniak², Maciej Zalewski^{1/2}

¹ University of Lodz, Department of Applied Ecology, Banacha Str. 12/16, 90-237 Lodz, Poland

² International Institute of PAS, European Regional Centre for Ecohydrology u/a of UNESCO, Tylna Str. 3, 90-364 Lodz, Poland

* e-mail: agnik@biol.uni.lodz.pl

Abstract

Demographic and socioeconomic pressures resulted in increase of agricultural production, which in turn led to increase in nitrate pollution to groundwater. Biotechnologies create an opportunity to boost the efficiency of groundwater treatment at the ecosystem scale. The aim of the study was to build an underground denitrifying barrier around the manure storing place composed of organic material and to monitor its effectiveness. It was constructed by burying pine sawdust mixes with soil perpendicular to groundwater flow. The preliminary groundwater monitoring gave the average concentration of N_{tot} equal to 704 mg dm^{-3} , $\text{NO}_3\text{-N}$ equal to 228 mg dm^{-3} and $\text{NH}_4\text{-N}$ to 347 mg dm^{-3} . Preliminary results showed nearly 90% reduction of all forms of nitrogen. The applied technology seems to be an inexpensive tool for diminishing nitrate loads into surface waters and for achieving good ecological status of the entire catchment, as required by the Water Framework Directive.

Key words: biotechnology, denitrification, protection of groundwater, ecohydrology, system solution.

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Ecohydrological systemic solutions for reduction of siltation, eutrophication and dioxin-induced toxicity. The pilot study of the Asella BioFarm Park lake, Ethiopia

Maciej Zalewski^{1,2}, Magdalena Urbaniak^{1,2*}, Yohannes Zerihun Negussie³

¹ International Institute of Polish Academy of Sciences European Regional Centre for Ecohydrology, Tylna 3, 90-364 Lodz, Poland, *e-mail: m.urbaniak@unesco.lodz.pl

² Department of Applied Ecology, University of Lodz, Banacha 12/16, 90-237 Lodz, Poland

³ Ministry of Water and Energy of Ethiopia, Haile G/Silassie Road, P.O. Box 5744 and 5673, Addis Ababa, Ethiopia

Abstract

This study introduced the spatial pattern of PCDD, PCDF and dl-PCB concentration in the sediments of Ethiopian small river-lake system. Among the analyzed samples the highest contamination was observed in the lake littoral (222.11 ng kg⁻¹ d.w.). The lowest concentration was noted at the outflow from the lake (26.65 ng kg⁻¹ d.w.). The WHO-TEQ concentrations showed decreasing trend along the river-lake system with highest value in the inflow (2.32 ng TEQ kg⁻¹ d.w.) and the lowest at the outflow (0.55 ng TEQ kg⁻¹ d.w.). The concentration of PCDD, PCDF and dl-PCB in the lake causes diseases among local population and prevents of use of water resources except from the outflow. Moreover the lake persistence and its ecosystem services provided for the local community were endangered by erosion of land and nutrient load from pastoral landscape, which could generate toxic algal blooms. For reversing the lake pollution the ecohydrological systemic solutions which integrated methodology to prevent all those threats to sustainable water and ecosystems was designed and implemented.

Key words: PCDD, PCDF, dl-PCB, water quality, toxic algal blooms, ecosystem services.

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