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Distribution and composition of benthic macroinvertebrates functional feeding groups and ecosystem attributes under different land use patterns in Kipsinende River, Kenya

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Abstract
Functional feeding groups in tropical rivers helps in understanding organic matter processing, energy flow, trophic relationship and management activities. This study aimed to describe the general distribution and composition of benthic macroinvertebrates functional feeding groups and ecosystem attributes under different land use in Kipsinende River. A total of 20,040 macroinvertebrates individuals belonging to five feeding groups (FFGs) were collected. The dominance was as follows; predators (54.4%), collector- gatherer (28.6%), collector- filterer (11.7%), scraper (3.6%) and shredders (1.8%), respectively. Predators were the dominant group (81.18%) in agricultural land use and least (11.02%) in forested site. However, collector- gatherer (57.53%), scraper (11.9%) and shredders (4.16%) were dominant in forested site. All zones were strongly heterotrophic, non-performing and presence of plentiful loading of fine particulate organic matter. Thus, it is important that watershed management practices and further research be done to limit the ecosystem damage on the surrounding of the river.

Keywords: Functional feeding group, ecosystem attributes, land use and Kipsinende River

Introduction
Functional feeding groups (FFGs) are a classification approach, based on morphological mechanisms and behavioural characteristics of macroinvertebrates to acquire food rather than their taxonomic group and also used as a tool for evaluating environmental conditions and variables (Merritt & Cummins, 2006; Cummins, 2016) [1, 2]. The presence of different composition of functional feeding groups (FFGs), of macroinvertebrate communities has essential implications for ecosystem functioning (Uwadiae, 2010) [3]. Currently, in most parts of the world, land use change, particularly loss of riparian vegetation, and other human activities have resulted in loss of diversity, composition and major shifts in the structural and functional organization of macroinvertebrates in rivers (Jinggut *et al*., 2012; Sensolo *et al*., 2012; Allan *et al*., 2015) [4, 5, 6] . When natural riparian vegetation is removed for agricultural and other purposes the water temperature, nutrient concentration and sediment input tend to increase in the river and causing negative effects to the ecological integrity of aquatic ecosystems or leads to non-relatively stable food dynamics in functional feedings groups will result reflecting stress environment (Blevins *et al.*, 2013) [7] **.** Benthic macroinvertebrate species composition is a function of the trophic status as a number of individual increases with an increase in organic enrichment. Whereas, the number of species seems to reduce or increase in response to the quantity of available nutrients (Cummins *et al*., 2005) [8].

Macroinvertebrates functional feeding groups serve as useful surrogates for ecosystem attributes and they reflect the status of the environment. This approach uses the relative abundance of various functional group of invertebrates as indicators of ecosystem conditions. For example, the relative importance of autotrophy to heterotrophy as the basis for the aquatic food chain in the rivers (Cummins *et al*., 2005; Merritt and Cummins, 2006; Ramírez and Gutiérrez-Fonseca, 2014) [8, 1, 9]. The ecosystem attributes are difficult and time- consuming to measure directly because of the need to integrate measures over a season and spatial heterogeneity.

On the other hand, it is also difficult to apply in tropical rivers and streams due to limited information on the functional composition of macroinvertebrate communities (Boyero *et al*., 2009) [10]. Therefore, knowledge about the functional composition of invertebrates in tropical streams/rivers is important to understand organic matter processing, energy flow, and trophic relationship and management activities needed to minimize the impairment of ecosystem functioning (Boyero *et al*., 2011a; Fereira *et al*., 2012) [11, 12] .The objective of this study was to describe the general distribution and composition of benthic macroinvertebrates functional feeding groups and ecosystem attributes with different land use in Kipsinende River, Kenya. Based on the river continuum concept, (RCC) and other literature like (Brasils *et al*., 2014) [13]. It was hypothesized that 1) There is a longitudinal zonation of macro invertebrate functional feeding groups (FFG) along with the profile of a river due to the presence of the differential distribution of energy inputs and matter transfers. 2) Riparian conditions and availability of leaf litter play important roles in the distribution and abundance of macro invertebrates especially the shredders. 3) The ratios of the various FFGs can be used as surrogates for ecosystem attributes to assess the ecological condition of the rivers.

Material and Methods

Description of Study Area

This study was carried out in Kipsinende River and its tributaries Yatiene and Kipkwen (Figure.1). The River starts from Elgeyo Marakwet County and flows through the Kaptagat forest to Uasin Gishu County. Kipsinende River is a tributary to Nzoia River which flows into Lake Victoria. The area has mean annual rainfall of 1200mm and an average temperature of 18 ºC during the wet season with maximum 28 ºC during the dry season and minimum of 7 ºC during the coldest season (Masese *et al*., 2009) [14]. This river flows in one direction and is impacted by different land use activities and serves various domestic purpose, local and institutional activities such as drinking, bathing, laundry, washing of vehicles, motorbikes, for cattle drinking and to some extent irrigation purposes.

Table 1: Description of sampling site along Kipsinende River.

Site	Assigned	Site description/characterises
Site 1	KA	The site was located at the Yatiene stream which was at latitudes N 00°23.005´ and longitudes of E 035°34.144´. The land use was agricultural and some human activities like cutting down trees for charcoal burning, agriculture and cattle rearing. A Substrate in the run biotope sampled was composed of cobbles, stones and gravel, but in the pool sand, silt and detrital material were the common ones.
Site 2	KA	Located at Kipkwen stream at latitudes N 00°22.117´ and longitudes of E 035°33.574´. This station was surrounded with swamps and it is a mixed land use type. crop farming, cattle rearing and washing were the dominant human activities
Site 3	KC	This site was located where two streams (Yatiene and Kipkwen) meet each other below Kapkenda bridge at latitudes N 00°23.184´ and longitudes of E 035°33.023´. The main anthropogenic activities were agriculture, Grazing and pumping of the water. Bedrocks, stones and cobble were the frequent substrates.
Site 4	KD	Site 4 was taken where the River entered to the Kaptagat forest at latitudes N 00°23.598´ and longitudes of E 035°32.416´. The substrate composition in the riffle consisted of bedrock and in a run, stones and gravel. While, pools had clay, sand, silt and to some extent detrital material. Gazing and agricultural activities were observed
Site 5	KE	This site was found Where the river exited from the Kaptagat forest near Kaptagat girls' school at latitudes N 0025°.589´ and longitudes of E 035°27.865´. The land use type was almost a forested area and the human disturbance was minimum (almost noon)
Site 6	KF	Site 6 was located around the Kaptagat bridge in the main road at latitudes N 0025°.606´ and longitudes of E 035°28.659. The sampling was carried out above the bridge. Anthropogenic disturbances in this station composed of agricultural activities, rearing of cattle and washing of clothes and cars. The substrates were consisted of bedrocks, boulders sandy and detritus material.

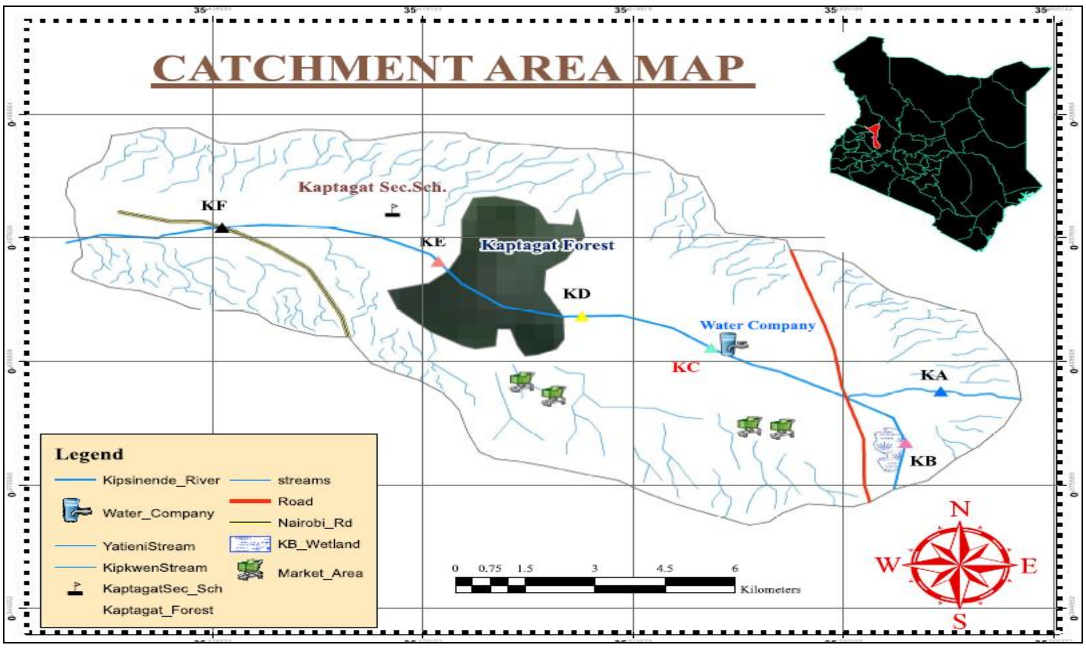

Fig 1: Showing sampling site in Kipsinende River, Kenya

Sample collection and Processing

Samples were collected from (November 2019 to March 2020) during the wet season because of unpredictable climate change. Before field sampling started, a reconnaissance survey was carried out in order to obtained a representative sampling site. Sampling sites were selected randomly to avoid biases and covering all catchments to determine the effect of land use and human disturbances on the River ecosystem based on the factor of accessibility, physical proximity, habitat diversity and riparian land use. Each sampling site was marked using a Geographical Positioning System (GPS) to make sure that samples were collected from the same points at each subsequent sampling period. Quantitative triplicate samples were collected from various stream orders and four microhabitats (runs, riffles, pools and marginal vegetation) and other substrates. Each microhabitat organism was collected separately. Visible organisms were removed with forceps from the substrate and put into the specimen bottles and preserved with 4% formalin in the field. The specimen bottles were labelled two times inside and outside the container for better and reliable information. In the laboratory, samples were washed through a 300 µm mesh size sieve, using tap water and sorted in a white plastic tray. After sorting, identifying and enumerating, lastly grouping each organism in functional feeding groups (FFG) categories based on appropriate identification key and various literature respectively.

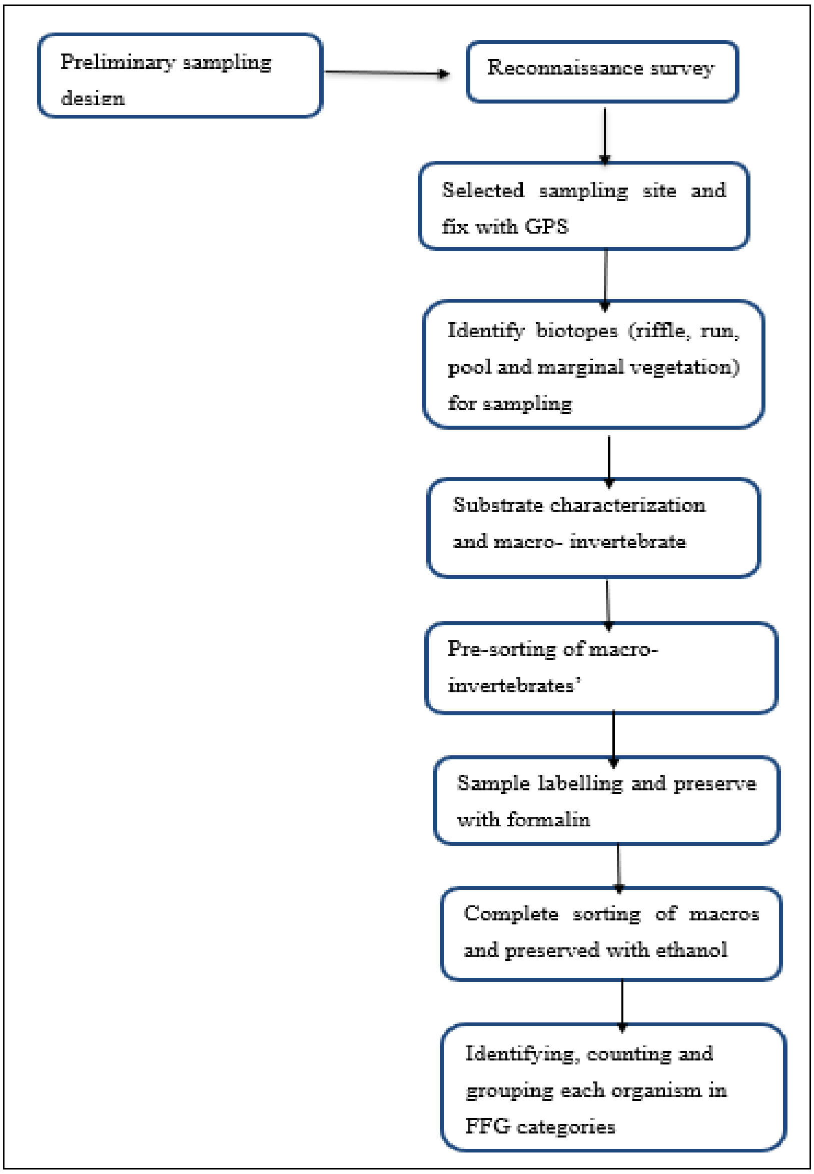

Fig 2: Flow diagram of sampling procedure for conducting functional feeding groups (ffgs) in study sites

Data analysis

The categories of functional feeding groups were carried out at each family level based on (Merritt & Cummins, 2006; Baptista *et al*., 2006; Merritt *et al.*, 2008 and Merritt *et al*., 2014) [1, 15, 16, 17] as indicated (appendix1). The relative contribution of each functional feeding group to the benthic macroinvertebrate's community was calculated on the basis of numerical abundance. On the other hand, the ecosystem attributes were calculated by the ratio of functional feeding groups of macroinvertebrates at each site. Cluster analysis was used to know the relationship between land use pattern and macroinvertebrate functional feeding groups .The analysis was performed using PAST software (Version 3.21) and Ms-excel.

Benthic macroinvertebrates grouped into five functional feeding groups (shredders, scrapers, collector-gatherers, collector-filterers, predators). Group of functional feeding and their source of food described in (Table-1**)**

Table 1: Group of functional feeding and their source of food modified from (Merritt & Cummins, 2006; Merritt *et al.*, 2008 and Merritt *et al.*, 2014) [1, 16, 17] CPOM= coarse particulate organic matter, FPOM=fine particulate organic matter.

Functional groups	Particle size feeding ways	Dominated food source	Particle size (mm)
Shredders	Chewing litter or vascular plant tissue	CPOM-decomposing From vascular plant	>1.0
Filtering	Suspension feeders (filter particles from the water)	FPOM-decomposing detrital particles like algae	0.01-1.0
Gathering	Deposit feeders (ingest sediment loose particles)	FPOM-decomposing detrital particles like faeces	0.05-1.0
Scrapers	Graz rock, wood, stems	Periphyton attached and non-filamentous algae	0.01-1.0
Predators	Capture and engulf prey (ingest body fluids)	Prey living organisms	>0.5

Table 2: Examples of functional feeding group ratios serving as surrogates for stream ecosystem attributes Modified from (Merritt & Cummins, 2006; Merritt *et al.*, 2008) [1, 16].

Ecosystem attributes	Represented by	Functional Feeding Groups for attributes	The suggested threshold from previous studies
Ratio of autotrophic to heterotrophic	P/R	The ratio of scrapers to (shredders+ total collectors)	Autotrophic system ≥ 0.75
coarse particulate organic matter (CPOM) to fine particulate organic matter (FPOM) index	CPOM/FPOM	The ratio of shredders to total collectors	Expected linkage between riparian vegetation and shredders Fall-winter shredder populations > 0.50 Spring-summer shredder populations > 0.25
FPOM in transport (Suspended) to FPOM in storage (Deposited in Benthos)	TFPOM/ BFPOM	Filtering collectors to Gathering collectors	Expected quantity and quality (i.e. sufficient to support suspension feeders) of FPOM in transport > 0.25
Habitat (channel stability)	Stable habitat	The ratio of (scrapers +filterers) to (shredders+ gatherer)	Adequate stable substrates > 0.50
Top-down predator control to prey	P/P	The ratio of predator to prey (total all groups)	Expected predator-prey balance = 0.10 – 0.20

Results and Discussion

Functional Feeding Group of macroinvertebrates

In this study, a total of 20,040 macroinvertebrate individuals belonging to 13 orders and 48 families were identified (appendix1). The dominant taxonomic groups in Kipsinende River were Diptera (51%), followed by Ephemeroptera (27%) and Trichoptera (6%). This study also showed that there was a high diversity of FFGs in Kipsinende River including: gathering-collectors, filtering collectors, predators, shredders and scrapers. Similar, finding carried out by (Boyero *et al.*, 2011; Brasils *et al*., 2014; Masese *et al*., 2014) [18, 13, 19] stated that many tropical rivers had high diversity feeding groups. The result has shown that the percentage of functional feeding groups in River Kipsinende dominated by predators (n=10,892, relative abundance 54.4%), collector- gatherer (n=5727, 28.6%) collector- filterer (n=2350, 11.7%), respectively (Table-3 and appendix-1). On the other hand, the abundance of shredders feeding group was the least (n=352, 1.8%). Spatially, as indicated in (Table-3) the highest predator's composition (81.18%) was observed in the agricultural area (site KA) and the lowest (11.02) was in the forested area (station KE). The difference in predators between sites could be due to the availability of prey in each site and the presence /absence of riparian vegetation. However, some predators for example, Odonata use vegetation as a hunting ground for food (prey) and resting positions especially for the less mobile species (Koneri *et al.*, 2017) [20]. In agreement to the river continuum concept the abundance of predator may depend on prey availability and in turn predator abundance also affects prey populations. Similarly, according to Favretto *et al*., (2014) [21] reported that the predator functional group can be found with high abundance in anthropic environments. The highest percentage of collector- gatherer (57.53%), scraper (11.90%) and shredders (4.16%) were recorded in the forest area (site KE). Whereas, the lowest percentage for both gatherer (12.6%) and shredders (0.79%) were observed in site KA and for scraper (0.28%) was in site KD. Gatherers feeding on small particles accumulated on the stream bottom. These fine particles are generated from the decomposition of organic matter by shredders. Hence, the abundance of gatherers determining by the presence of shredders. The scraper feeder was highest in forested site (KE) and lowest in agricultural area. This might be due to the low periphyton productivity, lacking of macrophyte as food resource because of greater depth and increased turbidity's in agricultural area since scraper grazes the macrophyte that attached to the bed rock, stones and vegetation (Oliveira *et al*., 2010) [22]**.** Similar findings reported by Barbee, (2005) [23] stated that the densities of scrapers are determined by the presence /absence of algal biomass and production. Families of Heptagenildae, Scirtidae and Elmidae were the common scraper in the river during this study period. Even though shredders relative abundance was the least in all sites. However, in terms of spatial distribution like the scraper's, had the highest relative abundance recorded in a forested area (site KE) and lowest in agricultural area (site KA). This is because shredders feed on course organic matter (CPOM) from pieces of living or dead plant material including leaves and woods by breaking down into smaller parts. These smaller particles are also used as source food for other organisms such as collector feeders. Probably variations might also be due to the magnitude of temperature and the availability of riparian vegetation or canopy cover as well as the land use differences on each site. Hence as mentioned above shredders are intimately related to the riparian vegetation, because of their reliance on allochthonous feeding resources and as well contribute much in the degradation of leaf materials dropping into aquatic systems from overhanging vegetation. Similar observation was made by (Boyero *et al.*, 2011; Brasil *et al.*, 2014; Masese *et al.*, 2014) [18, 13, 19]. Deforestation and temperature have a negative effect on shredder as this reduces or eliminates their main source of food and also various land use types use has a significant influence on the functional organization of macroinvertebrate communities with shredder diversity and abundance higher in forest streams (Masese *et al*., 2012) [24]. In the same way, the percentage of collector- filterer varied in the range of 4.72% to 26.7%. The highest percentage (26.7%) was found in site KB and the lowest (4.72%) was in site KA (agricultural area). The source of variation among the site might be because of water velocity and the degree of disturbances. This idea verified by Parker *et al*. (2013) [25] an abundance of filter feeders to the increased encounter of food particles with increased water velocities, in other words the velocity of water aids to facilitate filtration. The common families grouped under filter feeder in the study area included; Hydropsychidae, Philopotamidae, Sphaeriidae and Leptoceridae. Generally, the benthic macroinvertebrates composition and the distribution of functional feeding groups showed variations between the different sampling areas (land use). This is probably related to some environmental variation, anthropogenic activities, distribution of energy inputs, change in river morphology which included variations in channel characteristics (presence of rapids, riffles, plant cover, presence of stable substrates, availability of food and water flow) (Brasil *et al*., 2014; Azhar *et al*., 2015; Merritt *et al*., 2017; Atkinson *et al*., 2018) [13, 26, 28, 27].

Table 3: Indicating compositional functional feeding groups on benthic macroinvertebrates and ecosystem attributes during the study period in River Kipsinende.

Categories	Agricultural		Mixed		Forest	
	KA	KB	KC	KD	KF	KE
% Scrapers	0.71	4.36	1.47	0.28	9.45	11.90
% Filterers	4.72	26.7	10.27	11.92	8.18	15.39
% Gatherers	12.6	46.84	23.28	38.44	20.17	57.53
% Shredders	0.79	1.76	0.98	1.46	3.53	4.16
% Predators	81.18	20.34	64	47.9	58.67	11.02

Cluster analysis performed on the basis of macroinvertebrates functional feeding groups (Figure-3) formed a dendrogram that grouped all the six sampling stations into two clusters. Cluster A consists of a single set and one subsets sites KB and KE. In this set station KB and KE showing similarities between them. Similarly, Cluster B consists of two subsets. The subset-a includes site KA and KC, KF and KD. Whereas, subset-b itself had two subset which include station KC, KF and KD. Thus, under the subset-b station KC, KF and KD showing 100% similarity between them. During this investigation, the highest predators were found dominating in station KA and KC, KF and KD respectively. It has been observed during the study that the land use type at stations KA was mainly agricultural and the remaining stations were mixed land use which include agricultural, forested and grazing of animals. It may be the availability of the population of prey because it being hard to hide themselves. But the reverse is true for collector- gatherers. Similarly, shredders and Scrapers were dominantly found in station KE and the land use type within the catchment area of this stations was forested.

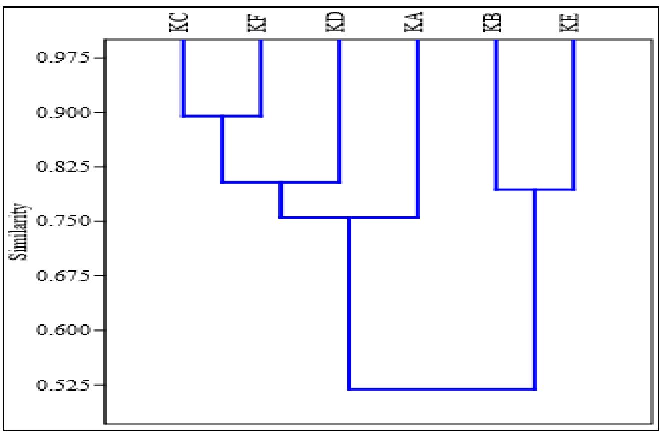

Fig 3: Cluster analysis on the basis of macroinvertebrates functional feeding groups during the study.

Ecosystem attributes

The counted benthic macroinvertebrate functional groups ratios were used for calculating surrogates five ecosystem attributes (P/R, CPOM/FPOM, TFPOM/BFTOM, habitat stability and P/P) by using a summarized protocol (Table-2). The result has shown that the ratio of production to respiration (P/R) varied in the ranges of 0.01 and 0.30. The highest value was observed in site KF and the lowest was in site KD. Thus, according to this numerical value all sampling stations were heterotrophic (P/R<0.75 Table-4). The heterotrophic condition recorded in Kipsinende River showing that the carbon present in these waters is originated from the decomposition of riparian vegetation that enters or falls into the river and fewer algae blooming. This idea verified by Merritt *et al*., (2014) [17] stated that the presence of the heterotrophic condition in the streams indicates carbon in water comes from the decomposition of riparian vegetation. In other words, it never originated from the photosynthetic activity of an autotrophic organism. Secondly, as reported before by Masese *et al*., (2014) [19] the predominance of heterotrophy over autotrophic production could be attributed to extensive pollution by livestock waste that tends to promote high abundance of collectors over scrappers. The riparian area of Kipsinende River was used as grazing area and cattle wastes are common in most sites (personal Field observation). Masese *et al*., (2014) [19] also reported more heterotrophy in a potentially autotrophic river system in the Kenyan highland streams and attributes it to cattle and human waste in the riparian areas of the rivers.

Similarly, as indicated in (Table-4) the ratio of CPOM/FPOM < 0.25 showing that all sites had a non-functioning riparian area which means that the link between shredders and riparian was very poor. The shredders were almost underrepresented. This might be due to the reduction of the riparian forests to supply sufficient litter inputs for instance, woody vegetation and presence of various species of riparian plant yields litter. Removal of indigenous vegetation for agricultural and other purposes depletes the allochthonous resources to a river and hence reduces shredder abundances (Minaya *et al*., 2013) [29]. Agricultural activities like gardening and crop farming are common along Kipsinende River almost all sites except site KE and could be a cause of the non-functional riparian zone. Site KB and KF had adequate stable substrate like bedrocks, boulders, cobbles, debris for provide stable substrates for filter feeding and scrapping hence the high filter FFG frequency obtained in site KB. However, based on the calculated value the remaining site (KA, KC, KD and KE) had lower value than the threshold vale (< 0.5). Therefore, this tells us there wasn't adequate stable habitat for functional feeding groups of macroinvertebrates. The ratio of TFPOM /BFPOM in all sampling sites was greater than the threshold value (>0.25). Thus, River Kipsinende had plentiful loading of fine particulate organic matter for filters. In particular site KB had very heavy suspended loading of fine particulate organic matter (enough food and good quality of FPOM). While, most of the sites except site KE were overburdened with predators and this also contributed to the overall overburden of predators for the entire river. However, in site KE the top down predator control to prey was normal. Odonata, Hemiptera and to some extent Diptera are the common predators during this study. In general, the FFG ratios provided evidence of widespread human influences in River Kipsinende in the form of removal of vegetation, livestock grazing, washing activities, and crop farming. This also indicates the extent to which River Kipsinende ecosystem function has been impaired.

Table 4: Indicating ecosystem attributes based on the ratio of FFG during the investigation period in River Kipsinende.

Ecosystem attributes	Agricultural	Mixed				Forested
	KA	KB	KC	KD	KF	KE
P/R	0.04	0.06	0.04	0.01	0.30	0.15
CPOM/FPOM	0.05	0.02	0.03	0.03	0.12	0.06
Top-down predators	4.31	0.26	1.78	0.92	1.42	0.12
Stable channel index	0.40	0.64	0.48	0.31	0.74	0.44
TFPOM/BFPOM	0.37	0.57	0.44	0.31	0.27	0.41

Conclusion

The FFG ratios obtained in the study offered some pieces of information into the overall functioning of the River Kipsinende system and reflected a shift from autotrophy to heterotrophy which can be attributed to changing land use and clearing of riparian vegetation. Thus, this study concluded that the composition of benthic macroinvertebrates functional feeding groups and ecosystem attributes were affected by the human activities near the river such as agriculture, grazing, deforestation and washing activities which lead to natural habitat quality deterioration and soil erosion. The variation of functional feeding group at different sites can be explained by their food resources available, availability of suitable habitat and presence/ absence of disturbances from the land use pattern, within the catchment area of the sites. Therefore, it is important that feature watershed management practices and further research should be done to limit or reduce the ecosystem damage on River Kipsinende.

Conflict of Interests: The authors declare that there is no any conflict of interests regarding this paper.

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Appendix

Appendix 1: Benthic macroinvertebrate taxa and functional feeding groups in river Kipsinende catchment (based on Merritt *et al.*, 2008; Baptista *et al*. 2006 and Merritt & Cummins, 2006)

Order	Family	Sampling station						Functional Feeding Groups
		KA	KB	KC	KD	KE	KF	
Ephemeroptera	Baetidae	455	1012	1063	1070	535	388	Collector- Gatherer
	Caenidae	40	57	10	16	35	23	Collector- Gatherer
	Ephemerellidae	5	14	0	2	0	0	Collector- Gatherer
	Heptageniidae	31	115	74	8	174	289	Scraper
	Leptophlebiidae	4	0	1	4	10	34	Collector- Gatherer
	Tricorythidae	0	0	0	0	5	3	Collector- Gatherer
Diptera	Simulidae	3510	116	2542	1117	47	1788	Predators
	Tipulidae	3	19	5	2	4	8	Predators
	Chironomidae	63	155	518	103	46	33	Predators
	Ceratopogonidae	0	1	4	1	4	3	Predators
	Tanyderidae	1	4	2	0	1	2	Predators
	Dolichopodiae	0	1	0	0	0	0	Predators
	Chaoboridae	6	14	52	1	0	0	Predators
	Syrphidae	0	0	1	0	0	0	Collector- Gatherer
	Ephydridae	1	0	0	0	0	0	Collector- Gatherer
	Dixidae	0	0	0	1	0	0	Collector- Gatherer
	Musidae	0	0	8	0	0	0	Predators
Trichopetra	Hydropsychidae	25	268	387	267	41	44	collector- Filterer
	Leptoceridae	15	36	4	4	10	3	Collec- Filterer/Ga
	Lepidestomatidae	0	3	2	0	7	0	Shredders
	Pisulidae	0	0	0	2	0	0	Shredders
	Calamocetatidae	0	0	0	0	1	0	Shredders
	Philopotamidae	0	3	0	0	1	0	Collector- Filterer
Hemiptera	Gerridae	11	0	2	14	2	1	Predators

	Hebridae	0	1	0	0	0	0	Predators
	Nepidae	2	1	2	3	1	0	Predators
	Naucoridae	0	0	1	0	0	0	Predators
	Veelidae	1	0	0	0	1	0	Predators
	Mesorehidae	0	0	0	0	0	1	Predators
	Corixidae	2	0	3	0	0	1	Predators
	Notonectidae	0	30	2	1	20	1	Predators
	Hydrometridae	0	0	0	1	0	0	Predators
Coleoptera	Gyrinidae	12	41	14	41	23	4	Predators
	Scirtidae	0	12	0	0	2	5	Scraper
	Elmidae	1	2	0	0	1	3	Colle-Gatherer/scra
	Dytiscidae	0	3	1	2	1	0	Predators
Decapoda	potamonutidae	32	25	0	15	41	102	Shredders
Bivaliva	Sphaeriidae	181	500	127	75	183	211	Collector- Gatherer
	Thiaridae	1	0	0	0	0	0	Shredders
Oligochaeta	Tubifiscidae	67	270	93	14	255	175	Collector- Gatherer
	Lumbricculidae	1	25	0	0	12	13	Collector- Gatherer
Odonata	Gomphidae	12	9	24	31	25	3	Predators
	Lestidae	54	148	41	63	9	6	Predators
	Aeshnidae	1	0	0	0	0	0	Predators
Arhynchobdellida	Hirudinae	6	104	5	5	3	4	Predators
Tricliadida	Planariidae	0	6	0	0	1	0	Shredders
Lepidoptera	Crambidae	0	0	0	23	8	0	Shredders
Araneae	Dictynidae	0	0	0	0	0	1	Shredders
Total	48	4538	2959	5025	2885	1490	3143	

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