Journal of Science and Development

Volume 2 No. 2, 2014

HAWASSA UNIVERSITY

Journal of Science and Development

Volume 2, No.2 2014

ISSN (Online): 2789-2123; ISSN (Print): 2222-5722

Contents

Journal of Science and Development Vol. 2, No. 2 (2014)

Effects of Land-use on Birds Diversity in and around Lake Zeway, Ethiopia

Girma Mengesha[1*], Yosef Mamo[2], Kefyalew Sahle[4] Chris Elphick[4]and Afework Bekele[5]

1. Hawassa University, School of Wildlife and Ecotourism, PO Box 5/128, Shashemene, Ethiopia. Email: gutgirma@gmail.com
2. Hawassa University, Department of Biology, P.o.box 5. Emial: yosefmam@yahoo.com
3. Hawassa University, School of Natural Resource Management , PO Box 5/128, Shashemene, Ethiopia. Email: kefyalew_sahle@yahoo.com
4. Department of Ecology and Evolutionary Biology, Center for Conservation and Biodiversity, University of Connecticut, 75 North Eagleville Rd.U-3043, Storrs, CT 06269, USA: Email: chris.ephick@uccon.edu
5. Addis Ababa University, Department of Zoological Sciences, PO Box 1176, Addis Ababa. Email: afeworkbekele@hotmail.com

Abstract

Girma Mengesha*, Yosef Mamo, Kefyalew Sahle, Chris Elphick and Afework Bekele Effects of Land-use on Birds Diversity in and around Lake Zeway, Ethiopia.Journal of Science & Development 2(2)2014, 5-22.

Anthropogenic factors can have major impacts on ecosystem functioning and stability, which are often reflected in changes to the biodiversity that includes wildlife. Land-use is a dynamic process that changes in space and time depending on prevailing socio-economic and biophysical conditions. This study aims at investigating anthropogenic effects of land-use on bird species diversity and abundance in and around Lake Zeway. Systematic random sampling techniques at an interval of 4km were used to select sampling blocks. A transect line of 1.65km and a sighting distance of 300m on both sides of a given transect, depending on species and habitat types, were laid along each block to count birds. Satellite images and Environment for Visualizing Image (ENVI) were used to analyze and detect land-use and cover changes in the surrounding areas of the Lake. The study revealed that land-use and cover related to bird community have changed during the analysis period in the area. Relatively low bird species diversity was recorded in blocks with less vegetation cover as compared to blocks with relatively intact vegetation cover. Bird species diversity showed significance difference among different species ($F = 39.326$, $df = 11$, $P < 0.05$). In terms of feeding guild, carnivorous had the highest species richness and diversity, while Piscivorous feeding guild had the least. Diversity of birds community with changes in vegetation cover showed significant difference ($F = 6.613$, $df = 21$, $P < 0.05$). Moreover, abundance of bird species was relatively higher in dense vegetation cover sites and areas with permanent ponds. From the results, it can be concluded that variations in the diversity and abundance of bird species variably affected by land-use and land cover types. The major reason for such change is conversion of land to irrigated agricultures in the surrounding areas of the lake. Thus, urgent conservation measures that could reduce the impact of land-use/cover changes are needed to conserve the bird species at the lake.

Key words: Abundance, birds, diversity, impacts, land-use

*Corresponding author gutgirma@gamil.com

INTRODUCTION

Anthropogenic factors can have major impacts on ecosystem functioning and stability, which are often reflected in changes to biodiversity that includes wildlife. This because abundance and diversity of the ecosystem community are changed. Biological community is an assemblage of populations of two or more different species occupying the same geographical area and characterized by type of species present, species diversity and their relative abundance (Ricklefs and Miller, 2000). Land-use is a dynamic process that changes in space and time depending on prevailing socio-economic and biophysical conditions (Esikuri, 1998); and changes in land-use have strong impacts on biological communities (Brambilla *et al*., 2010). Different literature have noted that changes in surface water as a result of land-use changes, have made a significant impact on local biodiversity like birds, other wildlife species and subsequently erode local economies reliant on those resources (Ayenew, 2001; Sisay, 2003; and Esikuri, 1998). Among wildlife, birds have been more susceptible to and affected by environmental changes such as land-use changes (Kolecek *et al*., 2010). Particularly, alteration of environment of freshwater lakes by land use changes is known to have negative effect on water-bird community structure (Hill-Lukkarinen *et al*., 2011).

Ethiopian Central Rift Valley (ECRV) area is known to have a number of lakes and hydrological features (Jensen *et al*., 2007); and along with their associated watershed areas the lakes are known to harbor millions of resident and migratory water-birds. However, these natural resources have been under threat by unregulated land-use changes happening in the area (Aynew, 2009). The study area, Lake Zeway, is one of such lakes that are under great threat of land-use changes mainly due to extensive and irrigation based agricultural farms surrounding the lake. Changes in land-use associated with the farms in the surrounding areas have known to have negatively affected the Lake's hydrodynamics (Aynew 2009). Large-scale irrigation farms were established in early 1970s in the Lake Zeway's catchment by diverting water from the lake and its two main feeder rivers (Ayenew, 2002). Moreover, large scale commercial plantation forest around the Lake has been established using water for irrigation from the lake (Muzien, 2006). These changes thought to have put the lake and its surrounding bird's habitats under great pressure (Wetland International, 2002). Lake Zeway consists of congregated waterbirds. As a result, the lake is recognized as an Important Bird Area (IBA), and a potential Ramsar site of Ethiopia (EWNHS, 1996; BirdLife International, 2002). It supports over 20,000 numbers of water-birds on a seasonal basis (EWNHS 1996; BirdLife International, 2012). The lake water, its shoreline, riverine woodland and wet grassland habitats also serve as roosting and stop-over sites for a diverse and abundant assemblage of resident and Palearctic migratory bird species (EWNHS, 1996). Although the lake and its associated habitats harbor various species of birds in large numbers, a combination of socio-economic and climatic factors has resulted in the loss of biodiversity of the lake (Abebe, 2003; Legesse *et al*., 2003).

Development schemes, such as pumping of water from Lake Abijata for soda ash extraction and utilization of water from feeder rivers and the lake for irrigation has rapidly reduced water levels of the lake (Ayenew, 2001). This is threatening the lake's viability for suitable nesting/roosting/stopover habitats of birds. Irrigation activities around Lake Zeway also had a considerable effect of increasing soil salinity (Ayenew, 2001). Recently, the problem is aggravated due to uncontrolled pumping of the lake water by private investors for floriculture and horticulture development. As irrigation in this area is a year-round process, its effect on the water level is magnified, especially during times of low precipitation and high evaporation during the months of November or December (Gebemariam and Delebo, 1989). This uncontrolled over-irrigation, if unabated, might bring the same disastrous effects on the fertile plains around the lake. The likely irrigation of this land characterized by shallow groundwater levels might induce large-scale soil salinization either by capillary rise from the shallow groundwater or due to inappropriate irrigation methods (Hengsdijk and Jansen, 2006).

Knowledge about land-use and land cover has become important as the Nation plans to overcome uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, and destruction of important wetlands and loss of fish and wildlife habitat (Anderson *et al*., 1976). However, critical information of the effect of land – use/ -cover on the abundance and diversity of bird species of both resident and migrants in the area are least known and documented. Therefore, this study aimed at understanding the impacts of land-use/land-cove on the bird species diversity and abundance at Lake Zeway and its surroundings

MATERIALS AND METHODS

The study area

Lake Zeway is located some 163 km south from the capital city of Ethiopia, Addis Ababa. It is situated between $07^0$51'- 08^0 07'N latitude and $38^0$43'- $38^0$50'E longitude (Fig. 1). The Lake has an open water surface area of 434 km^2, which makes it the third largest Rift Valley Lake; and has two small Islands of 6.9 km^2 area size together. The islands at the Lake are used as breeding grounds and roosting areas for water-birds, but affected by land-use change impacts. The open and shallow Lake Zeway has catchments of about 6834 km^2, a maximum depth of 9 m, and a corresponding average surface and volume of 485 km^2 and 1.7 km^3 respectively (Legesse *et al.*, 2005). The lake is mostly used for irrigation in the central Rift Valley area. The lake is bordered by swamp, except along the south-eastern and southern margins where the shores are relatively steep.

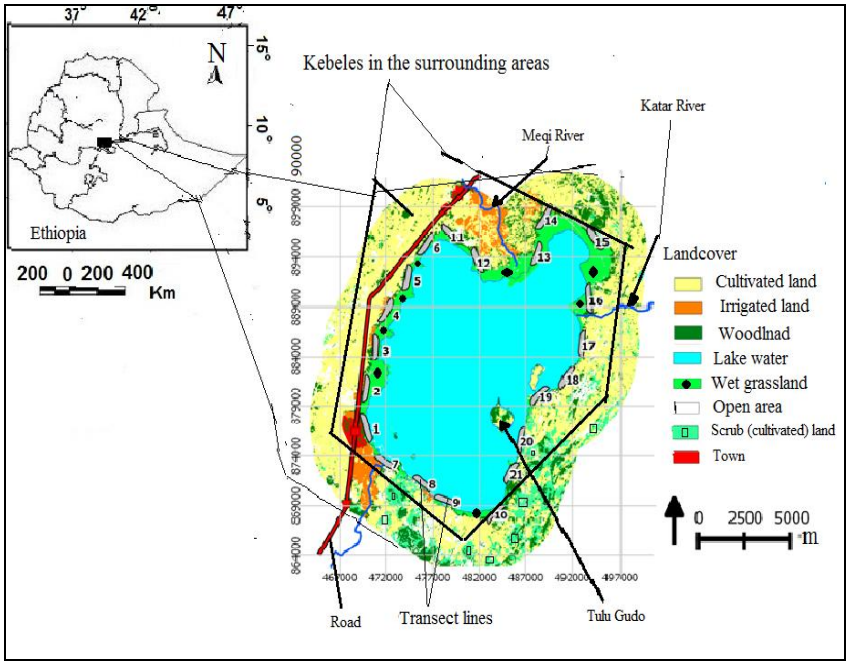


Figure. 1. Map showing location of the study site and the surrounding areas land-use and land-cover types. (Note: - The grid a line with numbers represents transects line selected for the study).

The study was comprised the Lake and areas around it (Figure 1). The altitudinal range of the study area varies between 1636 m asl in the east and 1880 m asl in the south encompassing Mount Aletu, which is a major centre of volcanic activity during the Quaternary period (EWNHS, 1996). Rainfall occurs throughout the year except during the months of November and December. Twenty seven years record in the area showed that the mean annual rainfall and temperature are about 600 mm and 20.6 ^{0}C, respectively. The wettest months are July and August. The short rainy season occurs during March to May. This coincides with a reduction of the Arabian high wind as it moves towards the Indian Ocean causing warm, moist air with a southerly component to flow over most of the country including Lake Zeway area (Norton-Griffiths, 1978).

Bird species count or estimation methods

Bird species in the area was counted and identified using a spotting scope technique that covered a total area of 51.5 km^2 areas of the wetland including shoreline and riverine habitats. The same (51.5 km^2) of the open water was sampled from 434 km^2 to count or estimate bird species. A representative (calculated from each area) area of 10.4 km^2 (2.97 km^2 from the west, 2.97 km^2 from the east, 2.5 km^2 from the north and 1.98 km^2 from the south) that accounted to 20.2% of the wetland habitats

were sampled. Then, a systematic random sampling technique was used and observations were made from the shore of the lake side along a transect line at every 4 km. The length of each of the transect line was 1.65 km and the width 50-150 m along the shoreline (Fig. 1). The sighting distance varied between 50-150 m on either side of the transect depending on the species and habitat types as used by Pomeroy, (1992) in similar situation. In the open area of the lake, a long transect of 29 km and width of 300 m on both sides were sampled to count birds using a boat. Along the lake, boat was slowly (2.5 km/hour) driven to allow counting of birds. At each sampling station, observations of: 1) the presence of colonies, approximate size and species composition; 2) the presence of roosts, their approximate size and species composition; 3) the number and species of flying birds and 4) the number and species of foraging birds (Bibby and Burgess, 1992; Sutherland, 2004) were carried out. The location of observed bird species was recorded using GPS.

Moreover, photographs were taken for further identification of birds and to capture corresponding habitat types. Field identification of birds was aided by binoculars and field guide books (Perol, 1995; Sinclair and Ryan, 2003). Observations were carried out early in the morning (6:00-10:00 a.m.) and late in the afternoon (4:00-6:00 p.m.) when birds known to be active. Additional information were gathered by inquiring indigenous and local people living around to document birds local names and their occurrence range in the area. Secondary raw data on water-bird census done by Birdlife International (BLI) in regular basis were also considered since their censuses have been conducted every year from 1999-2008 except in 2006. observations on the type of land-use/land-cover in each of the blocks and transects and observations concerning government and private irrigation based agricultural activities; that depend on the water of the lake and their impacts on the lake hydrodynamics were carried out. In addition, secondary information from literature was gathered. Information related to the current and previous water points (where water reaches) and the dry and wet seasons water points were also collected using GPS, marks (stages left) and local elders. Local elders were also used to provide land-use history.

Two of the fundamental parameters of biological communities, i.e. the number of species (species diversity) and the number of individuals within each of those species (species richness) (Hamilton, 2005) were assessed in the study area. Both the species richness and diversity were measured for broader understanding of bird species richness and diversity, and to relate these with the impact of land-use/land-cover change and climate variability in and around Lake Zeway. Species richness was measured using Margalef (d= S-1/Log (N)), and species diversity by Shannon-Wiener diversity index ($H'=-\sum pi \ln pi$) and Simpson index = $1-\sum$ (Ni x (Ni-1/N x (N-1) across transects in and around Lake Zeway.

Vegetation covers in the study area were measured on 4 survey plots of 30m x 30m using remote sensing image of, Landsat taken in 2011 and aerial photo as described in Buyantuyeu *et al*. (2007). Field observation data were also used to quantify vegetation cover of each plot.

Identification of habitat in relation to land-use type and bird species richness, diversity and distribution

Along with counting birds, observation point of each species and colonies were marked using GPS. Observation points marked using GPS were imported into Arc View GIS software to make spatial and temporal analysis of distribution, abundance and location of colonies, and to relate these to identify foraging behavior and critical habitats of birds at the study area. Satellite images of the study area of 1986, 2003and 2011 were used to assess land-use and land cover changes. Land-use type was first classified into mapable land-use types. Then, the classified images of 1986, 2003 and 2011 were compared for each of the land-cover types in the surrounding areas and water of the Lake. Consistency was maintained when assessing images within and between by going through three iterations: 1) Desk/laboratory interpretation of images that was cross matched with available vegetation and wetland of the map of the study area, 2) systematic random selection of sites that showed changes in land-cover type and carefully mapping these on topographic maps of the study area, and 3) Field Visit of the sites in order to check for consistency and aid in amending the classification and identification of land-use/land-cover type in the study area.

The location of the current major irrigation scheme was determined and checked that they existed in 2005. It was done using the 2011 and 2005 land cover map supported with field visit in 2011. The analysis focused on the major irrigation sites covering larger areas. The sampled habitat was divided in to two and two analysis models were established taking into consideration the location of the irrigation sites (Fig 2). First, they are of different irrigation types; second the Meki irrigation site is located at the input side whereas the Zeway site is located near to the outlet of the lake, third there are bird habitats located between the two sites which makes difficult to establish a common model for both sites. The hypothesis that the type of land use (in this case the irrigation) affects the diversity of the bird habitats was tested using linear model (lm). The model has the diversity index as response and the distance of the habitat from the major irrigation scheme (Fig. 2). The distance was computed in (Geographic Information Systems) GIS environment from the irrigation site (centroid of the polygon) to each habitat. Similar to the diversity, a model was established for the abundance of the bird habitat in relation to the location of the irrigation sites(Fig2).

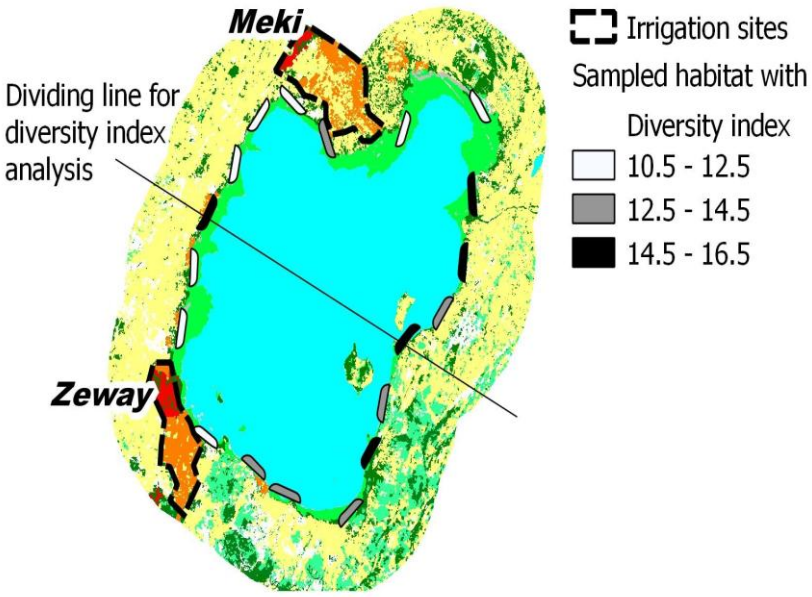


Figure 2. The location of irrigation sites as related to current land use type in the surrounding areas of Lake Zeway

Data Analysis

Bird species diversity and abundance were analyzed using PRIMER 6 statistical software (Clarke and Gurley, 2009). One way ANOVA was used to test variation in bird species diversity and feeding guild and across blocks. For the analysis of land-use/cover changes, Arc View 9 GIS software was used. Moreover, image processing software, ENVI (Environment for Visualizing Image) was used for the analysis of land-use/cover detection.

RESULTS

Bird species diversity

A total of 233 bird species that categorized under 52 families were recorded along the lake shore, riverine woodland and wet grassland habitats of the Lake. Among these 54 were migrants, 8 were threatened and 3 were endemic bird species. The highest bird species diversity were recorded along transect number 4 (western habitat) side and 17 of eastern habitat (Table 1)

Table 1. Species diversity of birds along transect lines in the study area.

Sample	S	N	J'	Fisher-α	H'	1-Lambda'
T1	54	172	0.9118	27.06	3.637	0.9699
T2	64	190	0.9475	33.96	3.94	0.9819
T3	60	147	0.9399	37.72	3.848	0.9793
T4	86	252	0.9396	46.09	4.185	0.9845
T5	59	159	0.9499	34.01	3.873	0.9805
T6	60	164	0.9485	34.02	3.884	0.9808
T7	59	181	0.9535	30.4	3.888	0.9811
T8	72	189	0.9565	42.36	4.091	0.9846
T9	74	222	0.936	38.88	4.029	0.9802
T10	70	196	0.9428	38.88	4.005	0.9818
T11	56	149	0.9541	32.53	3.841	0.9808
T12	71	186	0.9461	42.01	4.033	0.9827
T13	61	155	0.9454	37.11	3.886	0.9807
T14	58	244	0.8777	24.07	3.564	0.9575
T15	63	195	0.9242	32.27	3.829	0.9744
T16	90	254	0.918	49.76	4.131	0.9752
T17	93	265	0.9488	51.05	4.301	0.9856
T18	73	172	0.95	47.81	4.076	0.9833
T19	76	168	0.9499	53.34	4.114	0.9849
T20	68	188	0.9458	38.35	3.991	0.9819
T21	79	184	0.9503	52.37	4.152	0.9851

Note: T **=** transect, S = total number of species, N = Total number of individuals, d = species richness, J = Pielous evenness, H' = Shannon – Weiner index, 1-lambda = Simpson index.

Analysis of variance of the bird species diversity in and around lake Zeway showed significance difference between groups ($F = 39.326$, $df = 12$, $P < 0.05$ (Table 2) i.e. transects grouped below Table 2.

Table 2. Diversity between and within groups of bird species in the study area.

	Sum of squares	df	Mean square	F	P-value
Between Groups	0.254	1	0.254	39.326	0.002*
Within Groups	0.032	5	0.006	-	-
Total	0.287	6	-	-	-

* Significance difference at 0.01
Groups= Ts= Transect (T1-7, T8-11, T11-14 and T15-21)

In terms of feeding guild, carnivorous had the highest species richness and diversity while Piscivorous had the least species diversity (Table 6). The test of variation for diversity among vegetation cover showed significant difference of ($F = 6.613$, $df = 21$, $P<0.05$).

Table 3. Major types of feeding guilds of bird species in the study area.

Feeding guild	S	H'	1-Lambda'	Vegetation cover (%)
Piscivorous	3	0.87	0.5317	15
Omnivorous	4	1.37	0.7468	40
Carnivorous	10	2.96	1.99	70
Insectivorous	4	1.17	0.6636	46
Herbivorous	4	1.32	0.7278	65

Note: - S= Seasons sampled, d= richness, H' Shannon- Wiener diversity index, 1-lambeda = Simpson index

Land use-land cover change

There has been significance changes in land-use and cover in and surrounding areas of the lake during the observed 19 years period (Figs. 2, 3 and 4). During 1986, the surrounding areas close to the lake had less irrigated land except along the north and southwestern parts (Fig.3).

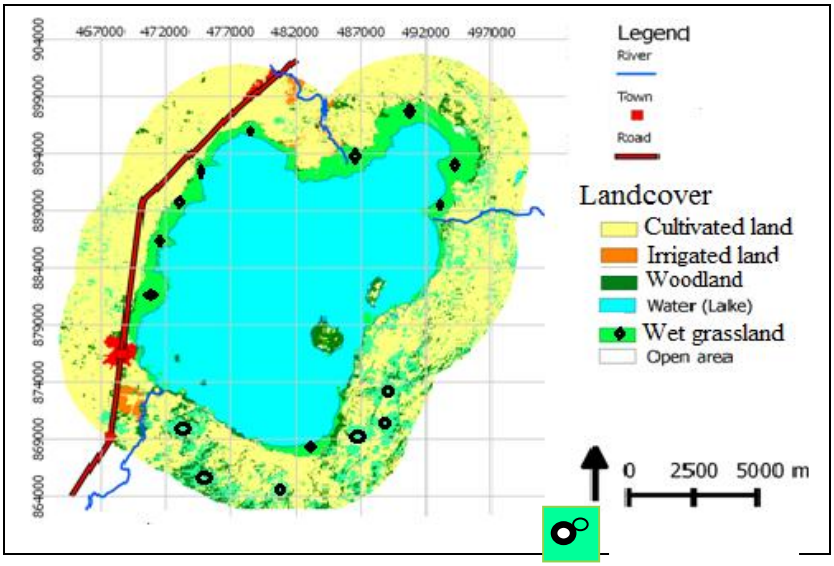


Figure 3. Land-use and cover types of the study area in 1

In the north as shown on the map there was there was small irrigated private farm land. Furthermore, there were intact wet grassland and riverine woodland vegetation in the surrounding areas of the lake during this time. Nonetheless, by 2003, the irrigated land, wet grassland and cultivated large government farm and in the southwest land (in the west) showed a significant increase (Fig. 4). Consequently, there was a decrease in riverine woodland vegetation cover and increase in swamp habitats with scattered grasses.

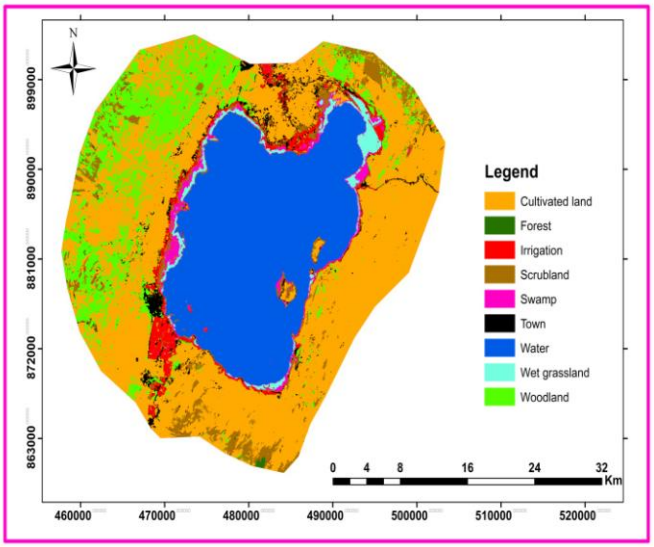


Figure 4. Land-use and cover of the study area in 2003.

The cultivated land in the surrounding area of the lake also increased specifically in eastern part of the lake in 2003 observation as compared to 1986. This increase was happened in the expense of woodland vegetation cover decrease in 2003. In year 2011, there was an increase in the wet grassland in the surrounding area of the lake accompanied with shrinkage in the size of open water (Fig. 5). Between year 2003 and 2011, woodland vegetation cover decreased while cultivated land cover increased, especially in the south, north and eastern side of the lake.

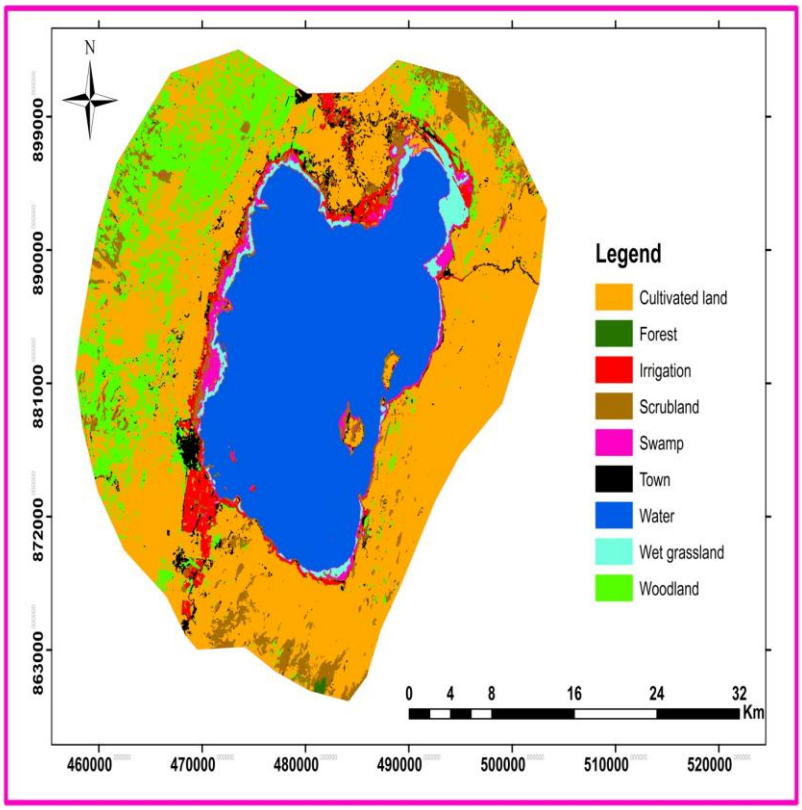


Figure 5. Land-use and cover of the study area in 2011.

The land-use and cover changes detection revealed an increase in rate of cultivated land by6.9% and irrigated land by 32.3% between 2003 and 2011 (Table 3). In the same period, the lake water size was reduced by 4.5%, whereas woodland vegetation decreased by 37.5%, and wet grassland increased by 96.9% (Table 3).

Table 4. Existing Land-use and land cover between 2003 and 2011.

Habitat types (ha)	Yr. 2003	Yr. 2011	Change in surface cover (ha)	Proportion of change (%)
Cultivated land	63163	67523	4360	6.90
Forest	131.0	093.00	38.00	-41.5
Irrigated land	4100	5422	1322	32.3
Scrubland	7560	3823	-3737	-49.4
Swamp	2520	1431	-1090	-43.2
Town	3219	1963	1256	39.0
Lake Water	41010	39153	-1857	-4.5
Wet grassland	2534	4991	2456	96.9
Woodland	17109	10689	-6420	-37.5

According to Shannon-Wiener diversity index (H'), bird species diversity and abundance were significantly different among sample transects (Figs.5 and 6). Very high bird species diversity was recorded on transects 4 of the west and 17 of the eastern side (Fig. 6). Most of the transects on western side had very low to medium bird species diversity (Fig. 6).

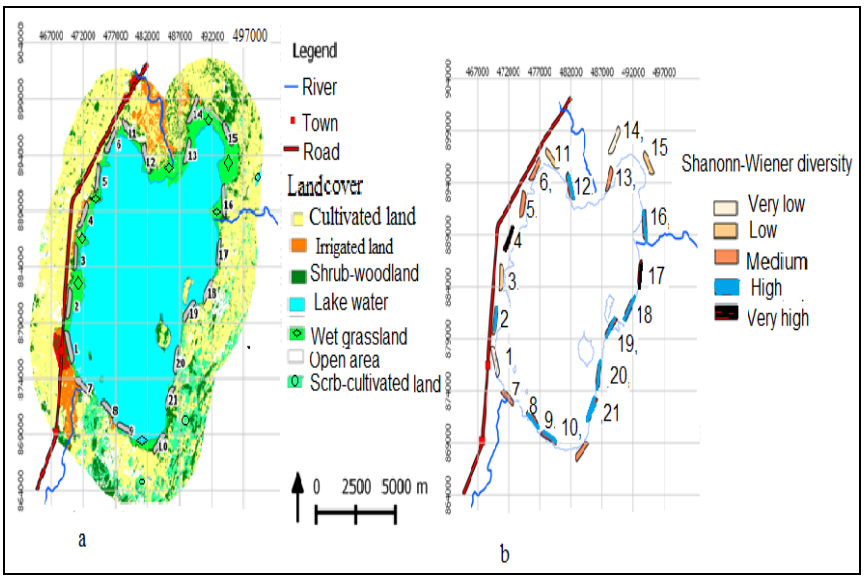


Figure 6 (a & b): Bird species diversity in relation to land-use and cover types of the study area.

When abundance was computed against land-use and cover types, birds abundance were high on transects 4, 14, 16 and 17 but very low on transects 3, 5, 6, 11 and 19 (Fig. 7a and b).

Satellite imagery analysis and observation revealed that large wet grassland pond along transect 4 and 14 and more vegetation cover on transects 16 and 17 were observed.

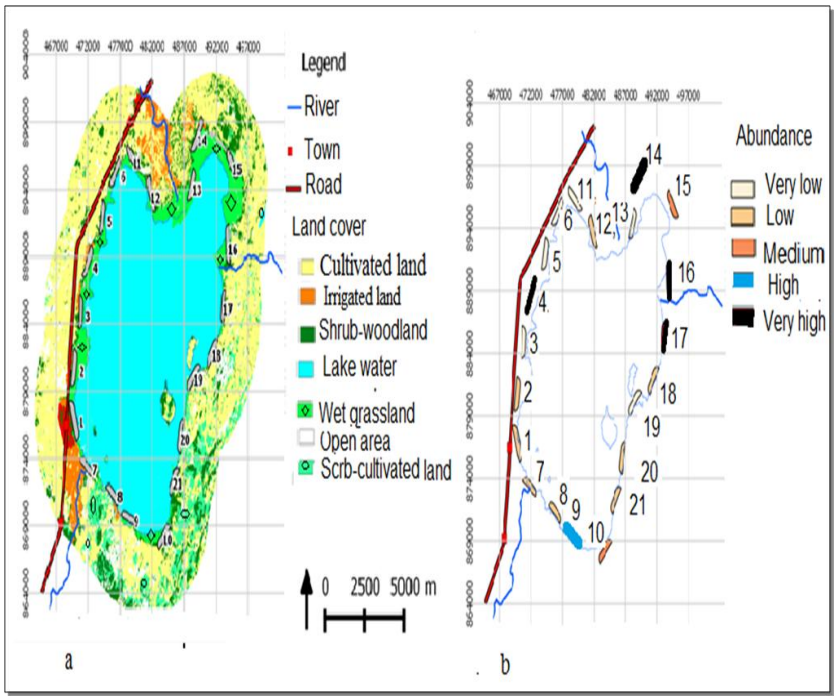


Figure 7 (a & b): Abundance of bird species in relation to land-use and cover types of the study area.

Relationship between Bird and land use

The relationship between land use land cover and bids indicated that the bird species diversity is higher in areas far away from irrigation scheme and decrees in areas close to irrigation and towns (Fig.8).

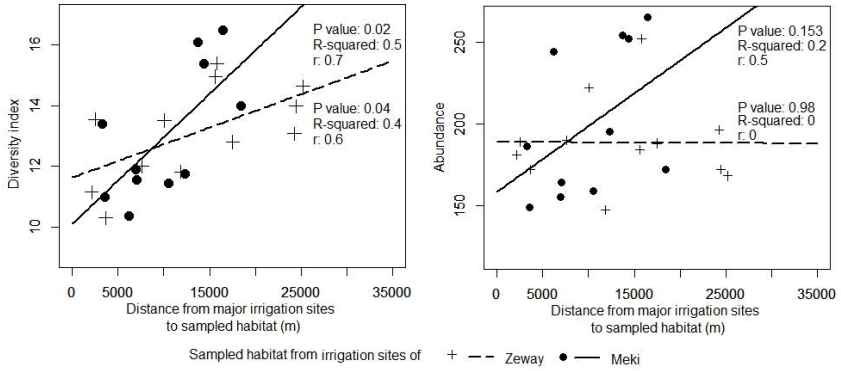


Figure 8. Relationships between bird species diversity (left), abundance (right) and land use in and around Lake Zeway

DISCUSSION

Understanding the composition and abundance patterns of bird species across sites is a central question in community ecology (Guadagnin *et al*., 2005). This study also strives to understand bird species diversity and abundance along the wetland area of Lake Zeway that have experienced diagrammatic land use/cover change during the last two decades. Generally, the study raveled change in land-use/cover around the lake with increase in cultivated and irrigated lands and decrease in forest and woodland vegetation cover. Moreover, the study showed less vegetation cover in the western side of the lake as compared to the east. This is similar to the finding by Hengsdijk and Jansen (2006) that indicated conversion of land covered by woodland vegetation in the eastern side of Lake Zeway to large scale floriculture and horticulture industries.

Biodiversity in wetlands has been affected by; inter alia, changes in land-use and land cover, that stem from anthropogenic factors (Finlayson *et al*., 2006). The result of this study also showed irrigation based agricultural activities have reduced vegetation cover, particularly in the western side of Lake Zeway. These could have led to low bird species diversity and abundance in this side of the lake except in some areas where there is large permanent pond. Thus, the low-medium bird species diversity and abundance in most of transects (areas) might be due to less vegetation cover due to anthropogenic pressures. Therefore, the presence of high bird species diversity and abundance in transect 4 and 17 could be because of the presence of large pond formed by irrigation practices and relatively intact vegetation cover in the 17 of the eastern side. Similar study by Reinkensmeyer *et al*. (2007); also reported high bid species density and diversity in area of more vegetation (plants) covered. The decrease in vegetation cover and significant difference in bird species diversity among the sampled sites may be associated with intensity of land-use/cover changes in the area. Accordingly,

finding by Brambilla *et al*. (2010) showed that bird community structure is negatively affected by changes in land-use and land cover. Waltert *et al*. (2004) also indicated significant decline in bird species diversity with increase in habitat modification. Thus the land-use/ cover change that modified the bird habitat at Lake Zeway might have led to the decline in bird species diversity and abundance of those transects with low records.

The corresponding decline in vegetation cover and diversity of birds in feeding guild at the lake could have also been linked to decline in the vegetation covers indicating significance of intact vegetation cover for the existence of diverse feeding guild in the area. The significant high vegetation cover for foraging guilds of birds was also shown by Liordos (2010). The decrease in size of the lake while irrigated land increased could also be contributed to the differences in diversity and abundance of birds in and around Lake Zeway. Finding of Legesse *et al*. (2004) reported increase in intensive irrigation in the area of Lake Zeway and this support the idea that lake size is decreasing and this might have affect birds supported by the lake.

CONCLUSION

The study revealed that anthropogenic pressures of land use and cover surrounding the lake have negatively impacted wetland bird diversity and abundance in the area. Relatively high bird species diversity and abundance were observed in areas where there was good vegetation cover relatively around undisturbed areas. Conservation measures should be taken to avert negative pressures posed on birds' diversity and their habitat in the area.

REFERENCES

Abebe, Y. D. 2003. Wetlands of Ethiopia. In: Proceedings of a seminar on the resources and status of Ethiopia's wetlands, pp.1-11, (Abebe, Y. D. and Geheb, K., *eds.*). IUCN, Gland, Switzerland.

Anderson, J.R., Hardy, E.E., Roach, J.J. and Witmer, R.E. 1976. A Land-use and Land -cover Classification System for with Remote Sensor Data. US Geological Survey, Washington D.C. USA. 40pp.

Ayenew T. 2009. Natural lakes of Ethiopia. Addis Ababa University Press, Addis Ababa, Ethiopia. 206 pp.

Ayenew, T. 2001. Recent changes in the level of Lake Abijata, Central Main Ethiopian Rift. *J. Hydro. Sci.* 47: 493 - 503.

Ayenew, T. 2009. Natural lakes of Ethiopia. Addis Ababa University Press, Addis Ababa, Ethiopia. 206 pp.

Bibby, C., Jones, M. and Marsden, S. 1998. *Expedition Field Techniques, Bird Surveys.* Bird-Life International expedition Advisory Centre, London, UK. 134pp.

Bibby, C.J. and Burgess, N. D. 1992. *Bird Census Techniques.* Academic Press, London, UK. 198pp.

Bird-Life International 2002. *Important Bird Areas and Potential Ramsar Sites in Africa*. Bird-Life International, Cambridge, UK. 6pp.

Bird-Life International 2012. Important Bird Areas Factsheet: Lake Zeway [Accessed on 2012 May 4].Available from http://www.birdlife.org.

Brambilla, M., Casale, F., Valentina, B., Bogliani, G., Crovetto, M., Falco, R., Roati, M. and Negri, L. 2010. Glorious past, uncertain present, bad future? Assessing effects of land-use changes on habitat suitability for a threatened farmland bird species. *Biol. Conserve.* 143: 2770–2778.

Brown, R.C., Jacobs, L.A. and Peet, R.K. 2007. Species richness, Small-scale, Encyclopedia of life sciences. John Wiley and Sons, Cambridge, UK. 8pp.

Buyantuyeu, A., Wu, J. and Gries, C. 2007. Estimating vegetation cover in urban environment based on Landsat, ETM+ imagery. A case study in Phoenix, USA. *Int. J. Remote Sensing,* 28: 269-291.

Clarke, K.R. and Gorley, R.N. 2009. PRIMER (Plymouth Routines. In Multivariate Ecological Research) v6 software. PRIMER.E. Ltd., United Kingdom.

Esikuri, E.E. 1998. Spatio-temporal Effect of Land-use Changes in A Savannah Wildlife Area of Kenya. Doctoral Dissertation, Virginal Poly Technique Institute and State University, USA. 54 pp.

EWNHS- Ethiopia Wildlife and Natural History Society. 1996. Important Bird Areas of Ethiopia. A first Inventory, Ethiopian Wildlife and Natural History Society. Addis Ababa, Ethiopia. 96pp.

Finlayson, C.M., Gitay, H., Bellio, M.G., van Dam, R.A. and Taylor, I. 2006. Climate Variability and Change and Other Pressures on Wetlands and Water-birds: Impacts and Adaptation. In: Water-birds Around the World, pp.88-97, (Boere, G.C., Galbraith, C.A. and Stroud, D.A., *eds.*). The Stationery Office, Edinburgh, UK.

Geberemariam, Z. and Dellebo, E. 1989. Water resources and fisheries management in the Ethiopian rift valley lake. *SINET*: *Eth. J. Sci.* 12: 432 - 441.

Guadagnin, D.L., Peter, Â.S., Fernando, L., Perello, C. and Maltchik, L. 2005. Spatial and temporal patterns of water-bird assemblages in fragmented wetlands of Southern Brazil. J. *the Water-bird Soci.* 28: 261 - 272.

Hengsdijk, H. and Jansen, H. 2006. Agricultural Development in the Central Ethiopian Rift Valley: A Desk-study on Water-related Issues and

Knowledge to Support: A Policy Dialogue. Plant Research International, Wageningen, The Netherlands. 26pp.

Hilli-Lukkarinen, M., Markku, K. and Jukka, S. 2011. The effect of changes in land use on waterfowl species turnover in Finnish boreal lakes. Ornis Fennica 88:01–10.

Jansen, H., Hengsdijk, H., Legesse, D. Ayenew, T., Hellgers, P. J. and Spliethoof, P. 2007. Land and Water Resources Assessment in the Ethiopian Central Rift Valley: Ecosystem for Water, Food and Economic Development in the Ethiopian Central Rift Valley. Alterra, Wageningen, The Netherlands. 83 pp.

Kolecˇek, J., Reif, J., Astny, K.S. and Bejcˇek, V.R. 2010. Changes in bird distribution in central European countries between 1985–1989 and 2001–2003. *J. Ornith.* 151: 923 – 932.

Legesse, D., Vallet-Coulomb, C. and Gass, F. 2004. Analysis of the hydrological response of a tropical terminal lake, Lake Abijata (Main Ethiopian Rift Valley) to changes in climate and human activities. *Hydrol. Process*, 18: 487 – 504.

Legesse, D., Vallet-Coulomb, C. and Francoise, G. 2005. Hydrological response of a catchment to climate and land use changes in Tropical Africa: Case study South Central Ethiopia. *J. Hydrol.* 275: 67 – 85.

Liordos, W. 2010. Foraging guilds of water-birds wintering in a Mediterranean coastal wetland. *Zool. Studies*, *49*: 311-323.

Muzein, B.S. 2006. Remote Sensing & GIS for Land Cover/ Land Use Change Detection and Analysis in the Semi-Natural Ecosystems and Agriculture Landscapes of the Central Ethiopian Rift Valley, PhD. dissertation, Dresden, Germany.

Norton-Griffiths, M.N. 1978. Counting Animals, 2nd ed. African Wildlife Foundation, Nairobi, Kenya. 26 pp.

Perol, B.V. 1995. Birds of East Africa: Collins Illustrated Checklist. Harper Collins Ltd., London, UK. 193pp.

Pomeroy, D.1992. Counting Birds. A Guide to Assessing Numbers, Biomass and Diversity of Afro Tropical Birds. African Wildlife Foundation. Nairobi, Kenya. 25 pp.

Reinkensmeyer, D., Miller, R. F., Anthony, R. G. and Mara, V. E. 2007. Avian community structure along a Mountain big Sagebrush successional Gradient. *Journal of Wildlife Management,* 71(4): 1057-1066.

Ricklefs, R. and Miller, G.L. 2000. Ecology, 4th ed. W.H. Freeman and Company, New York, USA. 822pp.

Sinclair, I and Ryan, P. 2003. The Field Guide to the Birds of Africa South of the Sahara. Princeton University Press, New Jersey, USA. 200 pp.

Sisay, L. 2003. Biodiversity Potentials and Threats to the Southern Rift Valley Lakes of Ethiopia. *In*: Wetland of Ethiopia, Proceedings of a Seminar on the Resources and Status of Ethiopia's Wetlands, pp.18-24, (Abebe, Y.D. and Geheb, K., *eds.*). IUCN, Gland, Switzerland.

Sutherland, W.J., Newton I. and Green, R.E. 2004. Bird's Ecology and Conservation. A Hand Book of Techniques. Oxford University Press, New York, USA. 386pp.

Syvertsen, P.O. 1995. Wintering water birds on Ethiopian Rift Valley Lake. *Walia*, 16: 3 - 16.

Waltert, M., Mardiastuti, A. and Muhenberg, M. 2004. Effect of land-use and bird species richness in Sulawesi, Indonesia. *Conservation Biology*, 18(5): 1339-1346.

Acknowledgements

We are indebted to Addis Ababa University for the financial support provided. We thank Dr. Aramede Fetene for his help in producing some of the maps using GIS software. Our gratitude also goes to Adami Tulu Jido Komolecha, Digda Bora and Zeway Dugda Districts officials for allowing us to carry out the research in their area. Finally, we also thank Wondo Genet Collage of Forestry and Natural Resources for vehicle services provided.

Studies on Hydraulic Performance of Furrow Irrigation to Optimise Design Parameters Suitable to Onion Field in Hawassa, Ethiopia

Kannan Narayanan and Brook Abate, School of Biosystems and Environmental Engineering, Hawassa University, Ethiopia

Abstract

Narayana, K. and Brook Abate, Studies on Hydraulic Performance of Furrow Irrigation to Optimise Design Parameters Suitable to Onion Field in Hawassa, Ethiopia. Journal of Science & Development 2(2)2014, 23-39.

Ground water is a scarce and expensive resource which needs to be utilized in a highly productive manner for agriculture. Inefficient use of ground water by surface irrigation will result in soil salinization in the long run. This demands precise application of required irrigation water with high efficiency. Furrow irrigation is most widely used among the surface irrigation methods. Furrow design parameters are inflow rate, the length of the run in the direction of the flow, the time of irrigation cutoff and soil infiltration characteristics. These parameters have been studied in order to design an optimum furrow length to achieve maximum application efficiency. Time ratio, which is defined as the ratio of the time required for infiltration of net amount of water needed for the root zone to the time when the water front reaches the end of the run, plays a key role in determining optimum furrow length to achieve maximum irrigation efficiency. In this study, using established model parameters, optimum time ratio and furrow length for maximum application efficiency in furrow irrigation were determined. The model was established from field tests conducted on onion grown furrows, 0.4 m wide and 70 m long, with two existing slopes 0.2 and 3% and each slope had three different inflow rates (0.3, 0.9, 2.7 L/s; 0.4, 0.7, 1.1 L/s respectively). Inflow rate of 0.3 L/s was very low for 0.2% slope in moderately permeable soil resulting long advancing time and less application efficiency. Under open end furrows, maximum attainable efficiency was 54.2% and the optimum furrow lengths to realize this efficiency were 32 and 74 m for 25 and 60 mm irrigation depth with 0.3L/s inflow rate. It was concluded that at higher slope of 3%, increase in the flow rate beyond 0.7L/s cause decrease in optimum length for the maximum attainable water application efficiency. When runoff is eliminated or reused, the maximum attainable efficiency of 75.9% and 71.1% can be achieved with 0.4 L/s and 0.9 L/s in 3% and 0.2% slope, respectively. For furrow slope 0.2%, peak irrigation demand of 3mm/day and a recommended furrow discharge of 0.9 L/s, suitable furrow length is 106 m length to have advance time of 10.7 min and 21.3min as total irrigation time to apply 40mm irrigation water for irrigation frequency of 7days. Optimum time ratio under different in flow rates for various irrigation depths reveals that for optimum furrow length and maximum application efficiency, the advance time should be two quarter of the total irrigation time.

***Keywords**:* Furrow irrigation advance; optimum time ratio; irrigation efficiency; uniformity

INTRODUCTION

Background

On a global basis, 69% of all water withdrawn for human use is currently consumed by agriculture, most in the form of irrigation (UN/WWAP, 2003; Prinz 2004) with very low use efficiency (30-40%). Surface irrigation methods having relatively lower water use efficiency when compared to the pressurized systems are responsible for this. Surface irrigation is widely practiced throughout the world, more than 95 % of world's irrigated area (UN/WWAP, 2003). Even in industrialized countries, for instance in the U.S., the area devoted to surface irrigation is still well over 70% (Playan *et al.* 2004). In Ethiopia irrigation efficiencies are generally low, of the order of 25 to 50%, and problems with rising water tables and soil salinisation are now emerging (EARO 2002). As the world is running into a very serious water crisis in this century (Shiklomanov, 2000; UN/WWAP, 2003), increasing water use efficiency in irrigation may be the most appropriate way of preserving our precious water resources since even 10% saving in agriculture is more than enough to meet all domestic use (Postel, 1997). Therefore, the ultimate objective of irrigation systems, especially surface irrigation, design should achieve maximum irrigation efficiency with a minimum cost.

Furrow irrigation is most widely used among the surface irrigation methods. It is designed on the basis of soil, crop, topography, size and shape of the irrigated area. A furrow irrigation system has several design variables that affect its performance. These are the inflow rate, the length of the run in the direction of the flow, the time of irrigation cutoff and soil infiltration characteristics. These parameters have been extensively studied by many authors in order to design an optimum furrow to achieve maximum application efficiency. The inflow rate design, which is affected by the slope, the length of the furrow and the intake rate of the soil, can be adjusted by the designer to achieve a good uniformity and to irrigate to the required depth in a reasonable time. Water application efficiency is influenced principally by the amount of water applied, the intake characteristics of the soil and the rate of advance of water in the furrows (Jurriens and Lenselink, 2001).

Optimal furrow length and irrigation cutoff can be determined, as related to soil infiltration characteristics, by the time ratio (ratio between the time required for infiltration of total amount of water required for root zone and the time when the water front reaches the end of the run) to achieve maximum application efficiency (Holzapfel*et al.,* 2004). It is true that the optimum furrow length where the maximum application efficiency can be achieved, changes with respect to the irrigation depth applied. But the maximum efficiency itself is a constant since it is affected by the infiltration function and advance function only.

In this study, a mathematical model was developed using hydraulics of surface irrigation to find out optimal time ratio to prove maximum application efficiency, tested in onion grown furrows and extrapolated for different field conditions may be the most appropriate way of preserving our precious water resources. Therefore, the ultimate objective of irrigation systems, especially surface

irrigation, design should achieve maximum irrigation efficiency with a minimum cost.
Ground water is still an untapped water resource for agriculture in Hawassa and not exploited to its full potential. The main constraint is heavy investment and economic feasibility for irrigated agriculture. In most irrigable lands, horticultural crops in general and vegetables in particular, play an important role in contributing to the household food security. The vegetable being cash crop with nutritional value generate income for the poor households. Higher profits can be achieved by increasing the production of a particular vegetable throughout the year when efficient irrigation system is used. This can justify the investment cost of tapping ground water. In Ethiopia, currently onion covers about 17,980 ha. Ethiopia has a great potential to produce onion every year for both local consumption and export. Due to such an important contribution of onion to the country, the proposed research will make some efforts for its promotion to year round cultivation and enhance land productivity.

Statement of the Problem

In the study area, onion is cultivated in limited area throughout the year where stream/lake water is available for supplemental irrigation. To cultivate onion throughout the year supplemental irrigation is needed during dry season. Ground water is one of the alternate sources available for irrigation but needs to be tested for its feasibility. In the University farm, furrow irrigation is practised in a non productive manner. Furrows are not constructed with suitable slope and the system is not operated with optimum discharge resulting waste of expensive ground water and induced soil erosion. Moreover, there is also a danger of land productivity in the long run if the present practice of irrigation is continued inefficiently. It demands for efficient application of irrigation water by appropriately manipulating inflow rate, slope, furrow length and irrigation time for improving the application efficiency. The constraint is lack of knowledge database providing information about optimum furrow length and irrigation time to maximise application efficiency for different land slope and soil texture conditions in Hawassa.

This study has been undertaken to study hydraulic performance of furrow irrigation in onion cultivation and reveal optimized furrow design parameters for maximum application efficiency. In furrow irrigation, the issue of infiltration variability and its influence over performance and management of surface irrigation are important. Uniformity of water application totally is dependent on the multitude of the complex soil properties over which the operator or the designer has no control. So the site specific hydraulic behavior of the furrow irrigation needs to be studied for better design and operation. The proposed study will bring out optimum design and operation parameters of the furrow irrigation suitable to the experimental area.

Justification

The Ethiopian Government has committed itself by including water as one of its national priority agenda and formulated a

15-year comprehensive Water Resources Development including small scale irrigation in the sustainable development and poverty reduction programme. The proposed research project falls in line with the Ethiopian government policy to develop the subsector to fully tap its potentials by assisting and supporting farmers to improve irrigation management practices and the promotion of modern irrigation systems, (Teshome A. 2006).

Research Hypothesis

Time ratio is crucial to regulate application efficiency. Furrow slope influences uniformity of application.

Objectives

The proposed research has general objective to study hydraulic performance of furrow irrigation with the following specific objectives to resolve the identified problems of rain-fed farming of onion cultivation.

1. To investigate time ratio under different flow rates and furrow slopes to optimize irrigation performance while accounting for spatial variation of soil characteristics.

2. To recommend optimum furrow length and advance time under varied application depths.

METHODOLOGY

Theory of Irrigation Model

Furrow irrigation system has several design variables that affect its performance. These are the inflow rate, the length of the run in the direction of the flow, the time of irrigation cutoff and soil infiltration characteristics. Optimal furrow length and irrigation cutoff can be determined, as related to soil infiltration characteristics, by the time ratio (ratio between the time required for infiltration of total amount of water required for root zone and the time when the water front reaches the end of the run) to achieve maximum application efficiency.

Optimum furrow length changes with respect to the irrigation depth applied. But the maximum application efficiency itself is a constant since it is affected by the infiltration function and advance function only. In this study, a mathematical model is fitted for the study area using hydraulics of surface irrigation to find out optimal time ratio to prove maximum application efficiency as below and tested in onion grown furrows.

Both the infiltration depth and water advancement on soil surface in furrow

irrigation are a function of irrigation time. This relationship is known as advance function expressed in empirical form as described by Hart *et al*. (1968):

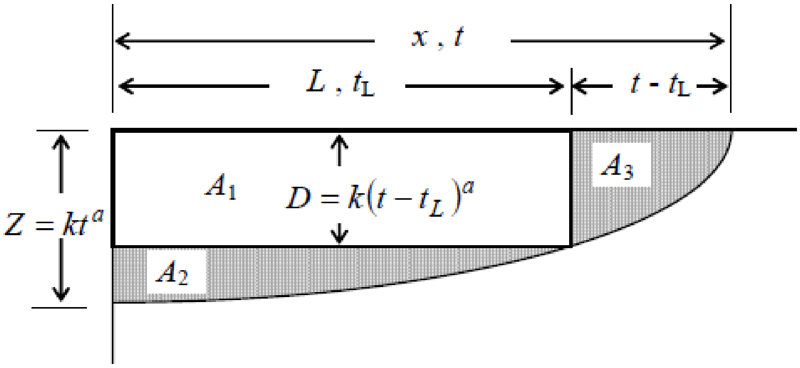


Fig. 1 Infiltration pattern through furrow length**.**

In Fig. 1, L: furrow length; D: required depth of irrigation to satisfy the rootzone; *k* and *a*: infiltration parameters; *t*: opportunity time; t_L: time required for the water front to reach the lower end of the furrow.

The irrigation water delivered per unit width that is furrow spacing (*W*), is distributed in V_1, V_2, and V_3 where V_1: total volume of water required for the root zone represented by A_1; V_2: deep percolation loss represented by A_2; V_3: volume of runoff flowing out from the downstream end of furrow having a length *L* represented by A_3.

$$L = a\,t^b \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where L is the length covered by water at time *t* (m), *t* is the total water application time (min), *a* and *b* are the empirical constants of advance function (Elliot *et al* 1982). Cumulative infiltration depending on the infiltration opportunity time may be explained by Lewis (Kostiakov) Equation (Bassett, 1972):

$$Z = c\,t^n \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where, Z is the cumulative infiltration depth (mm), *t* is the lapsed time (min), *c* and *n* are the constants for a given soil at a particular moisture level. The time available for infiltration or opportunity time at any point along the furrow must be known in order to design a furrow precisely. The opportunity time for infiltration (t_i) at section *s*, along the furrow at a given time *t* is given by,

$$t_i = t - t_s \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

where t_s is the advance time at a given section.

$$\text{Application efficiency } E_a = X^b(1-nX) \Big/ 1 - nb/(1+b) \quad \text{--------------} \quad (4)$$

Where, X = Time ratio of advance time to total irrigation time

Optimum time ratio, $X_{opt} = b/n/(1+b)$ ---------- (5)

From irrigation scheduling, required depth of irrigation water which is to be infiltrated at the downstream of the furrow (D_L). Total irrigation time is calculated by the formula below.

$$D_L = cT^n(1-X)^n \quad \text{---------- (6)}$$

Irrigation evaluations were performed in onion field located in research farm of Hawassa University. Optimal furrow length and irrigation cutoff can be determined, as related to soil infiltration characteristics, by the time ratio (ratio between the time required for infiltration of total amount of water required for root zone and the time when the water front reaches the end of the run) to achieve maximum application efficiency (Holzapfel *et al*., 2004). Mathematical model was established using hydraulics of surface irrigation to find out optimal time ratio to prove maximum application efficiency, tested in onion grown furrows. Uniformity of application (C_u) is determined from

$$C_u = (1 - \frac{\sum d}{nX})100$$

Where, d - numerical deviation of water depth from average application depth
X - water depth applied at each station
n - number of stations along the furrow

Experiment

The research was conducted at research farm of Hawassa University, located in the outskirt of Hawassa city to represent the hydro climatic conditions prevailing in SNNPR which needs alternative techniques to cope with dry season and improve land productivity in onion cultivation by promoting year round cultivation using ground water. Experiments were conducted to test the model in field plots prepared specifically for this research. Soil texture was sandy loam with average bulk density of 1.77 g/cm^3 and 120mm/m available water holding capacity taken from FAO standard. For the root zone depth of 0.4m and 50% depletion level, 24mm of water is to be replenished by irrigation sufficient for eight days. The furrow inflow rate and duration of irrigation was decided considering 50% depletion level. The research field was first leveled and two plots were formed with the slopes of 0.2 (plot A) and 3 (plot B) %. Then three furrows with 0.3 m width and 70 m length were constructed on each plot with three replications. Onion seedlings were planted on the furrows in 21st July, 2013 and six irrigations were applied during crop period when soil moisture depletes 40% of available water. Existing tube well was used to supply irrigation water. The inflow rates were 0.3, 0.9 and 2.7 L/s to plot A and 0.4, 0.7 and 1.1 L/s to plot B. The rates were measured volumetrically and maintained stable during the irrigations. Measurements

were done only on the middle furrows of each plot to eliminate the side effects. Stations with 10 m intervals were marked along the side of the furrows to investigate the water advance and recession speed. The time elapsed, both, for the advancing water front to reach to each station after the application from the top end of the furrow and the recession from the station were recorded. Then, parameters *a* and *b* in advance equation were computed for each slope and application rate using Curve expert software with these recorded data. Similarly, parameters *k* and *a* in infiltration equation were determined from the double ring infiltrometer method. Irrigation time was decided through examining the moisture deficit in the soil profile up to 0.4 m depth gravimetrically. Actual quantity of irrigation water applied varied depending on limitations of flow rate control and furrow slope. Although the length of the furrows were made 70 m, time ratio and irrigation efficiencies were calculated for the furrow lengths of 20, 40, 50, 60 and 70 m for each of the three slope and inflow rate. Noting t_L (the time elapsed for the advancing water front to reach to a particular length or station), t-t_L (the time required for the net amount of water to infiltrate fully), and X (time ratio), the irrigation efficiencies were calculated. Optimum furrow lengths and maximum application efficiencies were also calculated. Soil Texture analysis, bulk density and basic Infiltration rate, were measured for the experimental plots. The geometrical and hydraulic characteristics of the furrows are noted.

Fig 2 Field experiments

Meteorological Data

Crop water demand was calculated from climate data using CROPWAT software. Rainfall, temperature, humidity, solar radiation and wind velocity data obtained from Meteorological station of Hawassa were used to arrive at irrigation demand.

RESULTS AND DISCUSSION

Irrigation demand

The experiment to study the furrow hydraulics was conducted in November and December when the rainfall was less and the crop water demand was met mostly by irrigation. Effective rainfall was 351mm and total irrigation demand was198 mm. Peak irrigation demand was 2.9 mm/day in November. Since adequate rainfall occurred in July, August and September, irrigation demand was low (Fig. 3, 4). Total crop water demand was 459 mm of which 43% needs to be met by supplemental irrigation and the rest is contributed by rainfall.

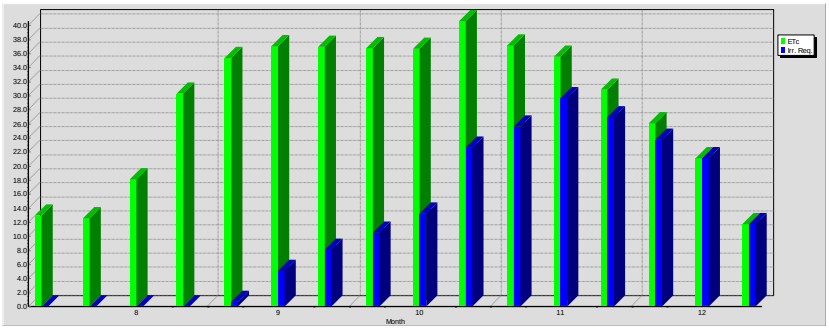


Fig. 3 Crop water and Irrigation demand of Onion

Depending on flow rate and furrow slope the quantity of water applied in each irrigation event varied due to field restrictions. In plot A, depth of applied irrigation water was 27, 18 and 17 mm under flow rate of 2.7, 0.9 and 0.3 L/s, respectively, whereas in plot B, it was 15, 39 and 27 mm under 1.1, 0.4 and 0.7 L/s respectively. This permitted to have irrigation interval of 5 days to a maximum of 13 days. Discharge of 1.1 and 2.7 L/s does not provide opportunity to apply more irrigation water under slope of 3 and 0.2% respectively. Discharge of 0.4 L/s allows higher irrigation water depth in 3% furrow slope (plot B). These slopes are existing in the farm and furrow irrigation has not been practiced with suitable flow rates in these slopes resulting soil erosion and damage of furrows. This also results in wastage of water as surface runoff going out of the field. With high flow rate of 4 L/s, water was applied in the interconnected furrows and irrigation was done in unorganized manner in the existing pattern followed in the farm way due to lack of training. Three such irrigations were done with duration of 1 hour per irrigation. From fourth irrigation to 10th irrigation event, irrigation flow rate was done in controlled manner in plot A and plot B as per the flow rates mentioned above

.

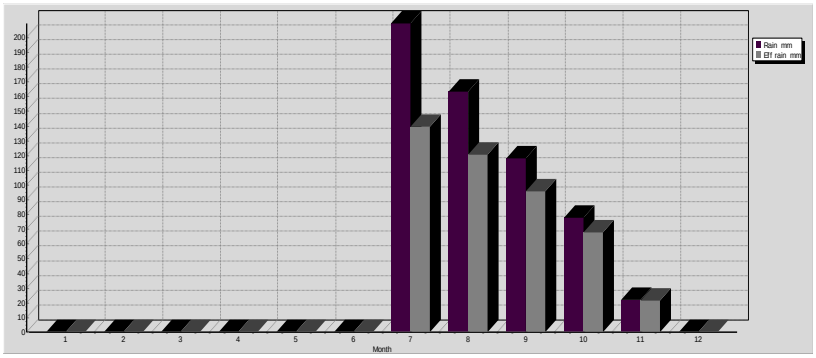


Fig. 4 Rainfall and effective rainfall during the experiment

Infiltration and Advance Characteristics

Water advance and infiltration parameters obtained from the experiments are presented in Table1. *Fitted Infiltration function* $Z = 5.987\, t^{0.807}$

Table 1 shows that parameters a and *b* are in nonlinear relation to the inflow rate whereas these are directly proportional to

inflow rate as reported by Konukeu *et al* (2006). Some deviation occurred may be due to variability of soil texture and error in construction of uniform bed slope. The water application efficiency strongly depends on parameters b and n in advance and infiltration functions. These two parameters reflecting the hydraulic behavior of the soil and the maximum application efficiency also depends on the magnitude of these parameters.

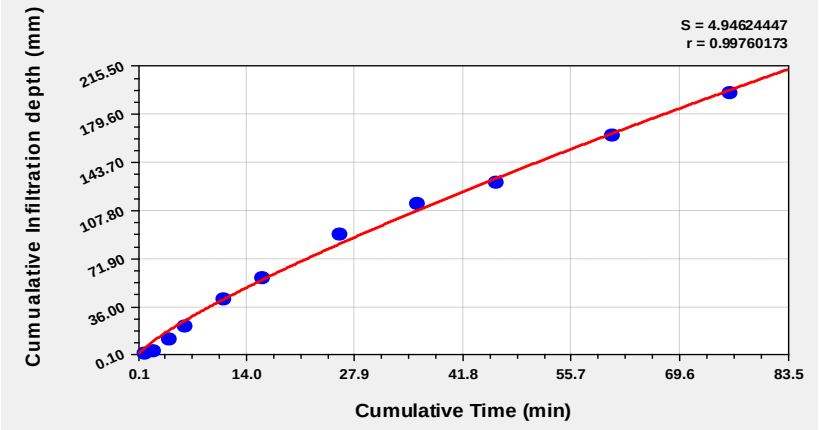


Fig. 5 Cumulative Infiltration curve

Correlation coefficient of 0.99 indicates the fitted power function strongly relates cumulative infiltration with cumulative time with standard error of 4.95mm which is less than 10% of normal water application depth of 50 mm in surface irrigations. A variation of 10% in irrigation water application depth is allowable as a design guideline. From 10 to 40minutes of cumulative time the deviation is positive and in the beginning and after 40minutes the deviation is negative (Fig.5). It implies that when we use the model to schedule irrigation time between 10 to 40minutes, there is a possibility of over irrigation due to positive deviation.

Table 1 Infiltration and advance parameters with slope and inflow rate

Furrow	Slope %	Inflow rate, (L/s)	Infiltration parameters		Advance parameters	
			c	n	a	b
		2.7			22.1	0.933
A	0.2	0.9			20.91	0.685
		0.3	5.987	0.807	7.56	0.764
		1.1			19.66	0.796
B	3	0.7			6.63	0.887
		0.4			8.77	0.467

The infiltration parameters and the Manning roughness coefficient are critical variables in the design and evaluation of surface irrigation systems (Mailapalli *et al*., 2008; Rodríguez and Martos, 2010). Their values vary during an irrigation event, and the estimation of advance and recession times using constant values may lead to

considerable errors. Such errors will result in inaccurate design of furrows resulting expensive water loss. To minimize such errors incorporation of infiltration parameters in the furrow design is inevitable. In the present study most of the irrigation events occurred in the second half of the crop period due to insufficient rainfall. Thus infiltration parameters measured in that period will be more relevant for the design of furrows suitable for the study area. In such case inflow – outflow will be more appropriate rather than double ring infiltrometer. So, further improvement is possible if infiltration parameters are measured more accurately. Moreover, infiltration property depends on soil condition and crop characters such as root penetration and distribution. Being a shallow rooted crop yielding bulb in the top soil, it will have an influence on soil infiltration. This influence can also be well considered in the measurement of soil infiltration and incorporating the infiltration parameters in the furrow evaluation and design.

Time Ratio and Application Efficiency

At a specific slope and inflow rate, the time ration, *X*, will decrease with increasing furrow length since t_L increases. For any given furrow length, either increasing inflow rate with a constant slope or increasing slope with constant inflow rate will increase t_L and thereby X value. This means that changes in the furrow lengths and inflow rates will ultimately influence the water application efficiency (Table 2). Therefore, a well-balanced design of these three variables (inflow rate, slope and furrow length) may lead the designer to a maximum efficiency. Mathematical analysis showed that the time ratio (*X*) was the factor for this well-balanced design. Generally, efficiency increases with decreasing *X*-value. However, for a particular inflow rate, this increase is not continuous but starts decreasing after certain *X*-value (Table 2). After reaching 0.47 there is no appreciable change in application efficiency. Maximum application efficiency of 55% was obtained with flow rate of 0.9 L/s for 0.2% slope at 60 m furrow length whereas in case of 3% slope, the maximum of 53% application efficiency was obtained with flow rate of 0.4 L/s. After 50 m furrow length the increase in application efficiency is not highly significant. Time ratio plays significant role in increasing the application efficiency until certain length.

Table 2. Influence of furrow length, slope and inflow rate on water application efficiency

Slope %	Flow rate, L/s	Furrow Length, m									
		20		40		50		60		70	
		X	E_a	X	E_a	X	E_a	X	E_a	X	E_a
0.2	2.7	0.2	31	0.37	45	0.48	50	0.57	52	0.68	52
	0.9	0.14	34	0.29	49	0.4	54	0.47	55	0.6	54
	0.3	0.16	33	0.32	48	0.42	52	0.47	54	0.5	54
3	1.1	0.16	32	0.33	47	0.41	51	0.52	54	0.51	54
	0.7	0.18	30	0.43	50	0.58	53	0.65	52	-	-
	0.4	0.15	49	0.64	53	-	-	-	-	-	-

X – Time ratio, E_a – Application efficiency

According to Arbat (2011) when the time ratio was below 1 the irrigation performance indices were improved and this conforms to the results obtained in the present study. Soils suffering from surface crust or fine structure have the highest

water loss potential due to evaporation from the large wetted surface area and runoff (Al-Qinna and Abu-Awwad, 1998). So, selecting the suitable flow rate is important to enhance vertical water penetration and to reduce wetting soil surface, thereby lessening water loss by evaporation and runoff. In 0.2% slope significance difference found at p value of 0.01. Flow rate of 0.3 and 0.9 L/s can be grouped together and performed well in terms of application efficiency followed by 2.7 L/s. Coefficient of variation of data is 1.42; standard error of deviation is 0.58% with critical difference of 1.62%. At 3% slope no significant difference was found among the furrow flow rates. Rodríguez (2003) reported that constant versus variable inflow can affect the estimation of infiltration parameters in furrow irrigation and thus the design parameters. Practicing variable flow rates instead of keeping it constant during irrigation can also be an option to maximize water intake and reduce runoff or ponding in the downstream of the furrows. The pattern of varied flow rate will depend on slope since poor intake will result in the upstream when slope is increased.

Optimum Furrow Length and Maximum Application Efficiency

Using the parameters obtained in the field experiments, calculated *X* values to realize maximum efficiencies, furrow lengths to achieve these efficiencies and some other elements of calculations are summarized in Table 3, Fig 5 and 6. Generally at any given slope, increasing inflow rate (Table 3) leads time ratio to decrease as seen in 3%. This is not true in case of 0.2% slope at 2.7 L/s flow rate where the time ratio increased with increase in flow rate due to less depth of application. Because of high flow rate, it was not possible to apply more depth due to runoff and flow was cutoff as soon as water front reaches the end of the furrow. Therefore, the maximum efficiency and furrow length to provide this efficiency will increase while inflow rate increases at the same slope facilitating higher total irrigation time resulting less time ratio.

Table 3 Optimum time ratio and maximum efficiency

Slope	Flow rate, L/s	Optimum time ratio	Maximum pplication efficiency, %
3%	1.1	0.549	53.8
	0.7	0.582	52.9
	0.4	0.394	59.4
0.2%	2.7	0.598	52.5
	0.9	0.504	55.2
	0.3	0.537	54.2

The value of 0.8 as infiltration power factor ‘n’ points that the infiltration rate of the soil is moderate since it approaches close to 1. Irrigation efficiency was medium for this kind of soil since there will be considerable deep percolation and surface runoff losses. In 3% slope, maximum efficiency of 59.4% is obtained at optimum time ratio of 0.394 whereas in 0.2% slope 55.2% is obtained at time ratio of 0.504. This indicates that for getting maximum application efficiency the time ratio should be minimum for the given slope and flow rate. To achieve this furrow length should be shortened to reduce the

advance time or increase the total irrigation time i.e in each irrigation as for as possible apply more depth of irrigation water.

From Fig. 6, it is clear that maximum application efficiency of 59.4 was obtained at 0.4 L/s in 3% slope and 55% occurred at 0.9 L/s in 0.2% slope. Inflow rate of 0.3L/s was very low for 0.2% slope in moderately permeable soil resulting long advancing time. Flow rate of 0.3 L/s results higher time ratio low application efficiency in 70 m furrow length with 3% slope. Under open end furrows, maximum attainable efficiency was 54.2% and the optimum furrow lengths to realize this efficiency are 32 and 74 m for 25 and 60 mm irrigation depth with 0.3 L/s inflow rate whereas maximum efficiencies were 55.2% and 52.5% and corresponding optimum furrow lengths were 71 & 149 m and 167 & 46 m for 0.9 and 2.7 L/s inflow rates, respectively, when the slope was constant at 0.2%. This implies that, at a certain slope, maximum efficiency for a particular furrow length is achieved applying the optimum inflow rate.

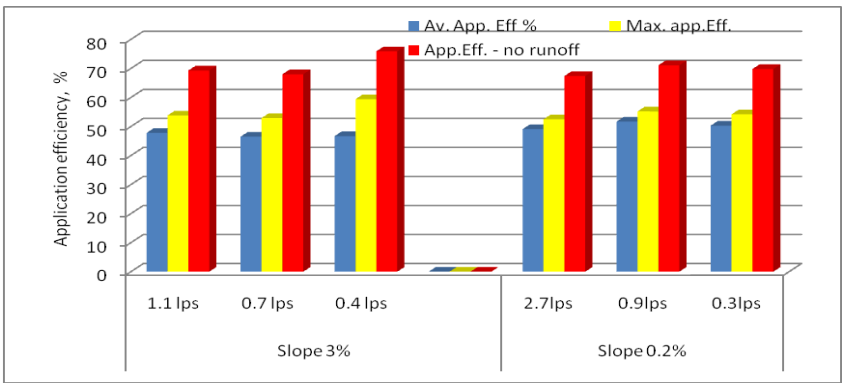


Fig.6 Application efficiency

If the inflow rate is to increase, furrow lengths should be increased in order not to decrease the application efficiency (Fig. 7) but this is limited to 0.2% slope. At higher slope of 3%, as seen in Fig.8, increases in the flow rate beyond 0.7 L/s cause decrease in optimum length for the maximum attainable water application efficiency. When runoff is eliminated or reused maximum attainable efficiency of 75.9% and 71.1% can be achieved with 0.4 L/s and 0.9 L/s in 3% and 0.2% slope respectively. The application efficiency found in this study can be considered low in furrow irrigation, as according to Clemmens and Dedrick (1994) the typical efficiency range is between 60% and 80%. This shows the need of modifying the existing furrow design for improved application efficiency.

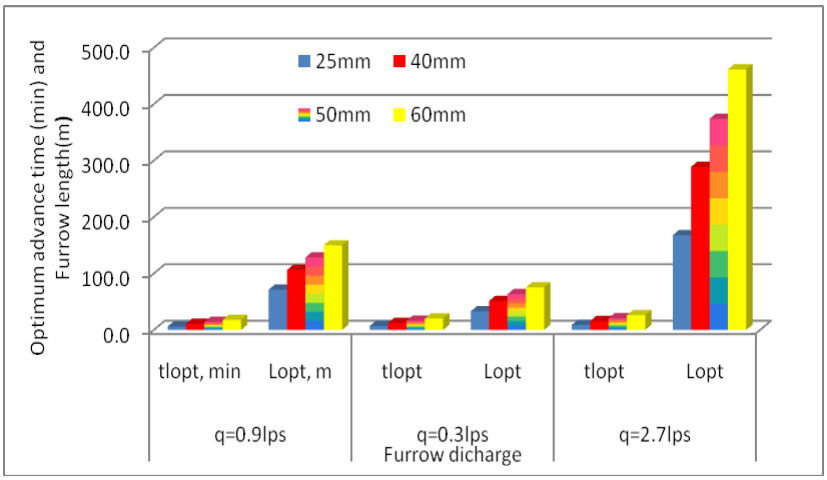


Fig. 7 Optimum advance time and Furrow length under 0.2% slope

Application efficiency is affected by the rate of supply, infiltration rate of soil, storage capacity of the root zone, land levelling, etc. Water is mostly lost through deep percolation at the head end and through runoff at the tail end. Care should be taken to select appropriate flow rate to avoid tail water runoff otherwise runoff reuse should be practiced to improve application efficiency. Application efficiency and uniformity normally increase as the furrow length decreases. On similar soils, and of the same slope and irrigation depth, furrows can be longer when a larger stream size is used for irrigation. This is because water will be advancing rapidly down the furrow. However, the stream size should not exceed the maximum non-erosive stream size determined in field trials. From analysis, it is observed that optimum furrow length increases with water application depth. Optimum furrow length can go up to 400 m with 2.7 L/s in 0.2% slope whereas in 3% slope it is around 100 m with 0.7 L/s. A larger irrigation depth requires more contact time for water to infiltrate to the desired depth than a shallow irrigation depth. The irrigation depth can be increased by making the furrow longer in order to allow more time for the water to reach the end of furrow, which increases the contact time. Care should be taken, however, to avoid too high percolation losses at the top end. Furrows put on steeper slopes can be longer because water moves more rapidly. However, with slopes steeper than 0.5% (0.5 m drop per 100 m length), the stream sizes should normally be reduced to avoid erosion, thus shorter furrows have to be used. Under smallholder conditions the maximum slope of 0.5% should not be exceeded (James, 1988).

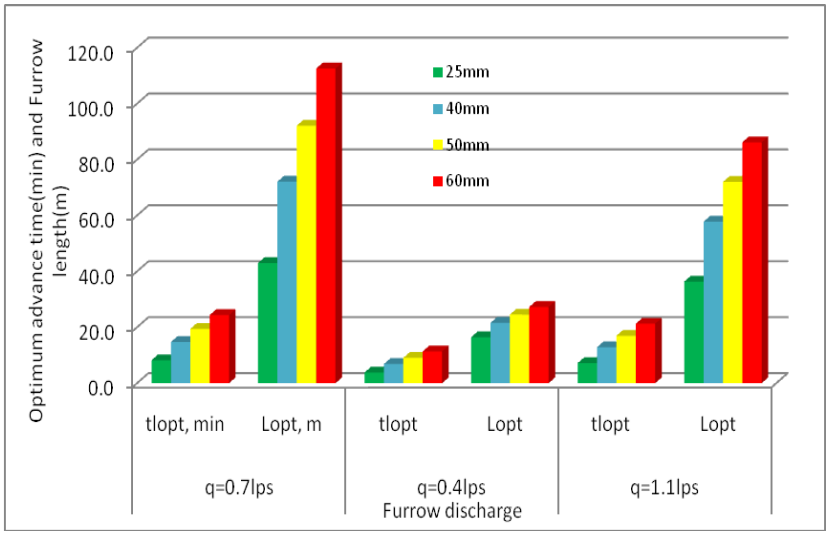


Fig. 8 Optimum advance time and Furrow length under 3% slope

Uniformity of Application

In general it is found that higher uniformity mostly results in low application efficiency and vice versa. In the present experiment also it is proved. Higher uniformities are observed in 0.3 L/s and 0.9 L/s under 0.2% slope and the corresponding application efficiencies are 50 and 44% respectively. This is mainly due to more percolation in the upstream side caused by long opportunity time for infiltration. Flow rate of 2.7 L/s is practically not suitable for 70 m blocked furrow in 0.2% slope due to overflow at the end of the furrow. Flow rate of 0.3 L/s permits more application depth with good uniformity at 70 m furrow length with 0.2% slope but its maximum attainable application efficiency is less than that of 0.4 L/s inflow rate in 3% slope. Flow rate of 1.1 L/s gives maximum uniformity with the limitation of 22 mm average depth of application and less maximum attainable application efficiency compared to other flow rates. But recommendations of inflow rates are made based on both application efficiency and uniformity. Uniformity of water application is governed by furrow slope and flow rate. Furrows should be put on proper gradients that allow water to flow along them and at the same time allow some water to infiltrate into the soil. Furrows put on steeper slopes can be longer because water moves more rapidly resulting poor uniformity of application. However, with slopes steeper than 0.5%, the stream sizes should normally be reduced to avoid erosion, thus shorter furrows have to be used. Under smallholder conditions the maximum slope of 0.5% should not be exceeded (James, 1988). In slope of 0.2% slope, inflow rate of 0.9 L/s will be more ideal in all aspects. Distribution uniformity of 60 to 80% was observed by Lecina *et al*. (2005) when evaluating furrow-irrigated fields in Zaragoza, Spain (85.7% ± 2.2%) and by Hanson *et al*. (1995) in California (81.0% ± 11.3%). The present study results are in good agreement with their findings. In 3% slope both the application efficiency and distribution uniformities were low compared to slope of 0.2% inferring the need to lower inflow rate.

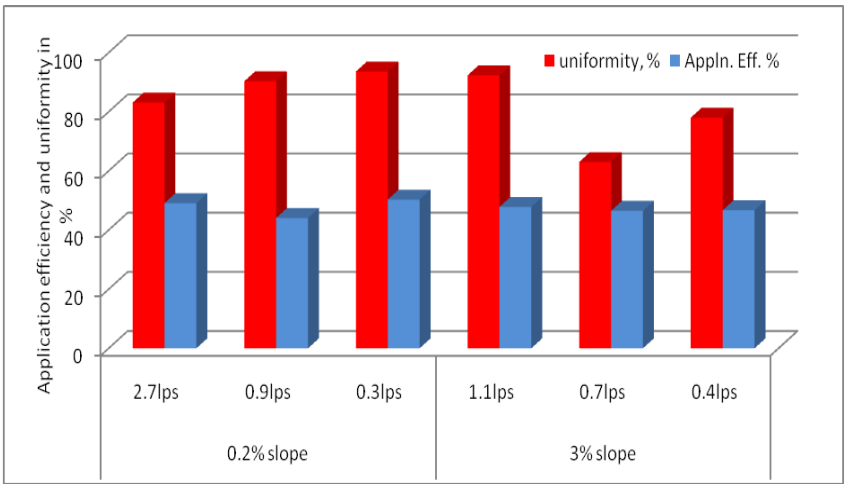


Fig. 9 Uniformity of application under different flow rates

In higher slope increasing the flow rate causes better uniformity but lower application efficiency in 70 m furrow length. In 200m furrow length Arbat (2011) found that when the flow rate was 3.30 L/s, twice that of the current situation, most of the water losses due to deep percolation took place at the end of the furrow. In comparison with the current situation, the distribution uniformity was reduced by up to 84.1% even though the application efficiency barely changed. This infers that higher flow rate in short length furrows improves uniformity of application rather than long furrow length. Analysis of variance indicates that at 0.2% slope 0.3 L/s performed well followed by 0.9 and 2.7 L/s with standard error of 0.45%, critical difference of 1.26% and coefficient of variation of 0.63%. At 3% slope 1.1 L/s performed well followed by 0.4 L/s and then 0.7 L/s with standard error of 0.08%, critical difference of 0.4 and coefficient of variation of 0.14%. It is also observed that during the average soil water content was 12% which will be sufficient for most crops according to Dzingai (2010).

CONCLUSION

Empirical power functions for water front advancement in the furrow and cumulative infiltration depth have been fitted for different inflow rates under existing slopes of the farm where furrow irrigation is practiced for onion cultivation. The fitted power function parameters are used to determine actual and maximum attainable application efficiencies. Time ratio is found as crucial to influence application efficiency under varied flow rates and slopes. Condition for maximum attainable application efficiency is found in terms of optimum time ratio expressed with power parameters of advance and infiltration functions. Actual opportunity time was determined considering recession time of the water front in the furrows and results in significant correction in arriving time ratio and thus the actual application efficiency.

Optimum furrow length can be calculated using the optimum time ratio giving maximum attainable application efficiency.

Higher uniformity of application can be achieved by adopting less flow rate of 0.3 L/s in 0.2 percent slope with average application efficiency of 50.3% and provides scope for higher depth of water application. Increasing the depth of irrigation can improve uniformity of application when 0.3 L/s inflow rate is adopted. Detailed analysis of optimum time ratio under different in flow rates for various irrigation depths reveals that for optimum furrow length and maximum application efficiency, the advance time should be two quarter of the total irrigation in the study area. Flow rate of 2.7 L/s or more should be avoided since it results in poor uniformity and limits irrigation water application depth to just 8mm in the downstream end in addition to soil erosion. Recommended to practice irrigation either three sets of six furrows at a time with furrow inflow rate of 0.3 L/s or single set of 6 furrows at a time with furrow inflow rate of 0.9 L/s which are considered as more optimum flow rates. This will reduce water loss due to runoff and poor uniformity of application as it happens in the current practice of irrigation with pump discharge.

REFERENCES

Arbat, G, J. Puig-Bargues, M. Duran-Ros, J. Barraganand F. Ramirez-de-Cartagena, 2011. Irrigation performance and gross water productivity in furrow-irrigated ornamental tree production. Spanish Journal of Agricultural Research. 9(2), 627-640

Al-Qinna, M. I., and A. M. Abu-Awwad. 1998. Infiltration rate measurements in arid soils with surface crust. Journal of Irrigation Science, 18(2): 83-89.

Clemmens A.J., Dedrick A.R., 1994. Irrigation techniques and evaluations. In: Advances series in agricultural sciences (Tanji K.K., Yaron B., eds). Springer, Berlin, Germany. pp. 64-103.

Dzingai, G. H. 2010. Response of Navel orange trees to timed partial root zone drying in northern Zimbabwe. M.Sc. thesis, Department of Physics, Faculty of Science, University of Zimbabwe.

Elliott, R.L.,Walker, W.R.,& Skogerboe, G.V. 1982. Zero Inertia modeling of furrow irrigation advance. Journal of irrigation and Drainage Engineering ASCE 108(IR3), 179-195

EARO (Ethiopian Agricultural Research Organization), 2002. Concept Paper on Agricultural Water Management. Addis Abeba, Ethiopia.15pp.

Hart, W. E., D. L. Bassett and T. Strelkoff, 1968. Surface irrigation hydraulics-kinematics. Journal of Irrigation and Drainage Engineering-ASCE 94: 419-440.

Hanson B., Bowers W., Davidoff B., Kasapligil D., Carvajal A., Bendixen W., 1995. Field performance of microirrigation systems. In: Microirrigation for a changing world. Proc Fifth Int Microirrigation Congress, Am Soc Ag Engineers, Orlando, FL, April 2-6. pp.769-774.

Holzapfel, E. A., J. Jara, C. Zuniga, M. A Marino, J. Paredes and M. Billib, 2004. Infiltration parameters for furrow irrigation. Agricultural Water Management 68: 19-32.

James, L.G. 1988. Principles of farm irrigation system design. John Wiley & Sons.

Jurriens, M., K. J. Lenselink, 2001. Straightforward furrow irrigation can

be 70% efficient. Irrigation and Drainage 50: 195-204.

Konukcu, F. 2006. Optimum time ratio for maximum application efficiency in Furrow irrigation. Journal of Tekirdag Agricultural Faculty 3(3) 129-137

Lecina S., Playán E., Isidoro D., Dechmi F., Causapé J., Faci J.M., 2005 Irrigation evaluation and simulation at the Irrigation District V of Bardenas (Spain). Agric Water Manage 73(3), 223-245.

MAILAPALLI D.R., RAGHUWANSHI N.S., SINGH R., SCHMITZ G.H., LENNARTZ F., 2008. Spatial and temporal variation of Manning's roughness coeff icient in furrow irrigation. J Irrig Drain Eng 134(2), 185-192.

Postel, S. 1997. Last Oasis: Facing Water Scarcity.W. W. Norton and Co inc (2nd ed.). Washington. 218p.

Playan, E., J.A. Rodriguez and Garcia-Navarro, 2004. Simulation model for level furrows. I: Analysis of field experiments. Journal of Irrigation and Drainage Engineering-ASCE 130: 106-112.

Prinz, D. 2004. Water and development (the challenge ahead). Water Resources Management: Risks and Challenges for the 21st Century. EWRA Symposium, September 2-4, 2004 Izmir, Turkey.

RODRÍGUEZ J.A., 2003. Estimation of advance and infiltration equations in furrow irrigation for untested discharges. Agric Water Manage 60, 227-239.

RODRÍGUEZ J.A., MARTOS J.C., 2010. SIPAR_ID: freeware for surface irrigation parameter identification. Environ Modell Softw 25(11), 1487-1488.

Shiklomanow, I. A. 2000. Appraisal and assessment of world water resources. Water International, 25: 11-32.

TeshomeAtnafie, 2006. Irrigation Policies, Strategies and Institutional Support Conditions in Ethiopia.Proceedings of Symposium on Best Practices and Technologies for Agricultural Water Management in Ethiopia, March 7-9, 2006, Addis Ababa, Ethiopia.

Tsukuba international Agricultural training centre.Training manual of Irrigation for non-paddy field, Japan International cooperation agency.

UN/WWAP, 2003.UN World Water Development Report.Water for People, Water for Life.UNESCO, Berghahn Books.

Coverage of Democratic Issues in the Ethiopian Press

Nigussie Meshesha
Hawassa University, School of Language & Communication Studies, P.o.box 05

Abstract

Nigussie Meshesha The Coverage of Democratic Issues in the Ethiopian Press; Journal of Science & Development 2(2)2014, 41-63

The press is very vital in building democracy and democracy cannot be thought without respecting the rights of citizens. Democratic governments express their loyalty to citizens through allowing freedom of expression and press. The present study aims at finding out the coverage pattern of news regarding the different democratic issues covered in three selected national daily newspapers in Ethiopia in order to demonstrate how the press framed news in the nation's democratic process. This is because the degree and nature of news coverage of the press is believed to indicate how the press functions towards democracy. In the study quantitative content analysis method was employed to analyze data obtained through systematic random sampling. Based on the sampling method proportional sample newspapers were taken from about one year's publication by forming continuous and constructed weeks. A total of 168 (56 each) sample newspapers were included. From the sample newspapers only news items were taken and classified into 12 identified major categories. The news items were analyzed quantitatively using frequencies and percentages by measuring the number of news appeared and the space provided for the categories and sub categories. The finding of the study revealed that Amhara, Oromiya, Tigray and SNNPR, and Addis Ababa City council obtained more coverage than the other regional states and Dire Dawa city council. The result of study also indicated that the private press neglected national news and focused more on international affairs. Moreover, there was also difference in the degree of fairness where the government press was less critical unlike the private one. Generally, it was found out that the coverage pattern of the press was much affected by the ownership style and that, in turn, affected the degree of fairness of the press in providing balanced information towards serving democracy.

Key Words*: democracy, press, newspapers, framing, national, balance, news coverage*

INTRODUCTION

The press touches the whole gamut of life since it functions in the socio-political, economic and cultural milieu. Mainly, press and politics have been mutually reinforcing and one affects the other. Gripsrud (2008) mentions that democracy is linked up with the press where the latter is one of the major forces in any political system. Consequently, "media-centered investigations of power that seek to

document the political, economic and cultural means by which media is shaped to further advantage those in power" would portray the overall condition in which the press functions. The press is taken as an icon for democracy and so it becomes the public sphere through its coverage pattern Jeffrey (2005). The coverage pattern of the press particularly newspapers depends on bringing up stories based on ones editorial policy and capacity to set agenda. This is because, according to Theaker, (2004:148) by "selecting the stories which go on the front page or are included in nightly television news programmes, the media determine what people think about." This may indicate how the press covers up stories based on its own ideological choice. The press is a mediator or becomes, according to Theaker, promoter of democracy. This is enhanced by the press being an arbitrator through its coverage about politicians and citizens where direct communication between them is often difficult. So the mass media is expected to be a bridge between the public and the government through its coverage.

Ocitti (1999) discusses the relationship between press and democracy. The press is the vessel through which citizens are well informed for free participation in democracy where the ultimate political authority is vested in the people. Consequently, citizens should be well informed about all government's actions and decisions and the press is the means in which citizens are guaranteed to exercise their rights. However, the degree of informing citizens can be determined by the ownership style and responsibility of the press. This is because ownership can affect how the press outputs are farmed. In relation to this, DeFleur and Denis (1991) view the activity of the press as designed to influence various audiences through the meanings conveyed by professional communicators. Moreover, the press has its psychological effect on users particularly in various social, cultural and political spheres. It is also believed that the press provides an image of the world and explanation of the world, but there is possibility of content bias as it is a mediated communication. Besides, the press frames the meaning in which the overall social and political system operates (Entman 2007). When interpreting an event, journalists also frame or create the schema of interpretation of categories and infulnce the minds of users.

It is strongly believed that the press and democracy are mutually reinforcing. From this perspective, it is useful to examine how the press functions in Ethiopia. Of course, the role of the press in Ethiopia towards democracy has been much appreciated in the Constitution of Ethiopia (1995) and other subsequent press proclamations. In addition, many scholars duly argue for the vitality of the press in building democracy in Ethiopia (Gudeta, 2008, Birhane 2006, Getachew 2003). However, no research was found on the coverage pattern and how the press has gone in line with those political and academic expectations through its contents towards building democracy. Thus, the present study aimed at addressing how the press has functioned by examining the contents of three daily

newspapers towards serving democracy in Ethiopia.

Theoretical Framework

The coverage pattern of the press is the function of the framing strategy, which emanates from the editorial policy and the journalists perception of the world and the image created. According to Iorgoveanu and Corbu (2012) our perception of reality and how we represent reality is the byproduct of the framing strategy. How issues are labeled and events presented indicate how meanings are made and become part of our cognitive structure. The framing of an issue may imply the degree of importance given to an issue, which may partly become an issue of agenda setting.

In similar vein, Reese (2001) states the study of news framing of a media helps to understand the role of media in political life. Framing is defined as it is "the way events and issues are organized and made sense of, especially by media, media professionals, and their audiences". Particularly, framing of news gives the whole picture in which the media works and how different issues are constructed, and meanings are made. Reese mentions that the way media represent reality or topic can be researched as frame analyses. Frames link the process of news production and the cognitive structure developed by receiver through the contents produced. According to Gorp (2007:61) the framing entails to "the typical manner in which journalists shape news content within a familiar frame of reference and according to some latent structure of meaning". This indicates that the press or "mass media provides the public with story lines, or frames, for understanding the news", Brewer and Sigelman (2002:23).

Thus, examining how the news is framed can indicate the coverage pattern in one hand and how they work towards promoting democracy in Ethiopia on the other. Consequently, the study aimed at examining how the contents of the press were framed in line with covering democratic issues.

METHODS OF THE STUDY

The study employed quantitative content analysis method to analyze the content manifestations of the press in Ethiopia. Generally, the universe of the data was the publications of the three national dailies of the government and the private newspapers namely *Addis Zemen*, *The Ethiopian Herald* and *The Daily Monitor* of one year's publications from January 2007 – December 2008. The relevant data were gathered from news stories of these three newspapers. The reason why these

newspapers were chosen is that they were the only national dailies in the nation. Furthermore, it would be difficult to include other government or private newspapers for comparison since most of them are weeklies.

The sampling procedure involved a number of steps. First, the researcher made a pilot study about the thematic categorization and tested their relevance to the contents of the newspapers. Next, the researcher took continuous and constructed weeks' publications from the year 2007/08. Then the researcher took four continuous and constructed weeks all throughout the year in random selection. In other words, from the annual publications of the newspapers, the researcher randomly selected four continuous and four constructed weeks' publications considering time and financial constraints. The year was divided into four sub periods of three months. A continuous and a constructed week were randomly selected from each sub period. The diversification of the samples is believed to create diversity in the sampled editions in the way they become representative of the universe. The systematic variations of the news sample of the publications are quite of great use in sampling because as Lacy, Robinson and Riffee (1995: 336) say "Variations of simple random sampling have been developed to control for systematic variation in daily newspaper content." Step three involved the categorization of the news and editorials that appeared in the publications based on their major thematic category, sub categories (of democratic issues), page wise coverage (front, and inside), and geographical (local, zonal, regional, national, continental and international) and news balance (favourable, neutral and unfavourable)

The data taken was comprised a total of 56 publications of each newspaper. In each sub period one continuous and one constructed week were chosen. The sample population was about 15.34 % for the three national dailies as it was believed to be representative of the universe, Lacy and Riffe (1995). The one year period was divided into four sub periods, that is, January to March, April to June, July to September and October to December. Moreover, from each sub period continuous weeks were chosen randomly. A continuous week was taken from each sub period which totally makes four weeks publication and form twenty eight newspaper for each newspaper. The same number of newspapers was included for each newspaper. The constructed weeks were formed as they make artificial weeks taking a day from one week and take the second day from the next week (from the coming week), take the third day from the week that follows the second week and so on. In the constructed week on average more than two weeks were taken from each sub period and the samples taken were 28 publications for each newspaper.

As a result, the total issues included in the study for each newspaper became 56 and totally 168 newspapers for the three daily newspapers were taken as samples. Two standardized sheets were set about the news coverage of the three newspapers. The first sheet enlists the thematic category, their

geographical distribution, and frequency along with the news and editorial item. The second sheet includes the democratic issues together with the regional states in the way they got coverage. It also consists columns for the front and inside page coverage in the way to show the contents of the newspapers in the inside and front pages.

Based on the prepared coding sheets the democratic issues that appeared in the newspapers were coded and quantified. The coding process itself marks the measurement of the contents and it is taken in the same way between coders. The degree of variations about the coders was measured by inter-coder reliability because reliability is the rubber stamp for validity of the research. The validity of the research can be assured by measuring reliability of the coded message or data.

The study, therefore, applied the formula used by Holisti (1969) for the method of finding the reliability of coded messages. The formula is presented as follows.

$$R = \frac{2(\text{total number of agreed decisions between two coders})}{\text{The number of sample newspapers taken by coder one + coder 2}}$$

This can be easily put as:

$$R = \frac{2(S)}{C1+C2}$$

where S denotes the shared decisions between coders, C1 represents first coder and C2 stands for coder 2.

The news items were considered as items of analysis. The frequency of this genre was counted and put in terms of their appearance in the sample newspapers. The counted items were dealt within their categories. The data classified were interpreted using quantitative method of analysis. The data were put in tabular forms and further interpreted in percentages for analysis. Then the data was analyzed based on the figures indicated in the tables in numbers and percentages.

The variation in the space given to a news item differed based on the importance of the issue as the news room prioritizes. All the news items were measured in centimeter and the news items appear in the front page and which continued in the inside page is taken as it is in the front case. The pictures that appear in the front page were treated in the same way as front page news. Besides, correction factor was used since there are differences among the newspapers in their columns and total space. The space given to the news and editorial items was measured in column centimeters. Then the percentage

of the space availed to the categories and subcategories were calculated in relation to the total space of the newspapers. Thus, first it is relevant to calculate the total space of each of the subject categories and put it in relations to the spaces given to the various categories and comparison was made. The correction factor for the newspapers was calculated using one column centimeter of body type contains four agate lines with the column of 25ems as 12 ems=1 inch as the way of calculation was seen based on Murthy(1998).

Table1- Correction Factor Calculated for the Dailies

Newspapers	Correction Factor
Addis Zemen	0.84
The Ethiopia Herald	0.84
The Daily Monitor	0.68

$$K = \frac{W}{25} \times \frac{L}{4 \times 10}$$

Where

K = correction factor

W= Width of the column in ems

L= Average Number of Lines of body type per 10 centimeters

Normally the extent of coverage, that is, the contents, the news framing strategy of following fairness principle, the agenda of the press, the regional states coverage, and the pattern of democratic issues coverage portray how democracy is practiced in the country.

In order to measure the degree of fairness the formula for measuring the coefficient of imbalance was applied as proposed by Janis and Fadener (1965).

$$Cf = \frac{f^2 - fu}{r\,t} \qquad f > u$$

$$Cu = \frac{fu - u^2}{r\,t} \qquad f < u$$

Where f= favourable units of contents, U=unfavourable, t=number of units of total content and r= total units of relevant content.

RESULTS AND DISCUSSION

The news coverage of the selected three newspapers was categorized into twelve major categories and twelve sub categories under the democratic issues category which is the area of concern. These include ruling party, opposition party, election, good governance, gender equality, human rights, public participation, conflict resolution, sustainable development, freedom of press and expression, minority and ethnic groups, and others. Moreover, the extent of coverage, that is, the contents, the news framing strategy of following fairness principle and the agenda of the press, the regional states coverage, and the pattern of democratic issues coverage portray how democracy is practiced in the country.

RESULTS

Balance of News Coverage

Frequency of Coverage

As indicated in the table below (table 2) the democratic issues got the second highest coverage of the favorable news from all the categories in *Addis Zemen*. It got 342 (24.90%) for favorable, neutral 100 (21.01%) and 49 (30.82%) unfavorable frequencies news following the development news which got the highest total coverage and the highest coverage for favorable and neutral news items, that is, 539(36.66%)and 105 (22.06%). Though the development news was given the highest coverage for positive and neutral news, it got the second highest for the negative news, 8.81%. The least covered news category in all the newspapers is the entertainment category.

		Addis Zemen						The Ethiopian Herald						The Daily Monitor					
		F		N		U		F		N		U		F		N		U	
S. No	Categories	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq	%	Freq	%	Freq.	%	Freq.	%	Freq	%
1	Democratic Issues	342	24.9	100	21.0	49	30.8	231	24.7	26	19.2	9	52.9	33	19.2	18	36.0	15	36.5
2	Development	539	36.6	105	22.0	14	8.8	401	42.9	52	38.5	1	5.8	42	24.4	14	28.0	7	17.0
3	Economy & Finance	94	8.3	52	10.9	21	13.2	86	9.2	25	18.5	0	0.0	19	11.0	1	2.0	2	4.8
4	Social Welfare	58	3.6	22	4.6	3	1.9	40	4.2	7	5.1	1	5.8	4	2.3	3	6.0	1	2.4
5	Culture & Heritage	36	2.8	13	2.7	10	6.2	21	2.2	4	2.9	1	5.8	15	8.7	1	2.0	0	0.0
6	National integration	38	2.1	4	0.8	12	7.5	23	2.4	1	0.7	1	5.8	8	4.6	5	10.0	7	17.0
7	Science & Technology	19	4.1	3	9.03	0	6.9	14	1.5	3	2.2	0	0.0	3	1.7	1	2.0	0	0.0
8	International Affairs	54	12.4	19	16.1	1	12.5	98	10.5	14	10.3	0	0.0	32	18.6	3	6.0	1	2.4
9	Human Interest	6	1.2	0	5.4	0	5.0	7	0.75	2	1.4	4	23.5	5	2.9	0	0.0	2	4.8
10	Entertainment	40	0.7	2	0.4	2	1.2	1	0.1	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0
11	Sport	45	2.7	32	6.7	7	4.4	9	0.96	0	0.0	0	0.0	10	5.8	3	6.0	6	14.6
12	Others	11	0.1	0	0.0	2	1.2	2	0.2	1	0.7	0	0.0	0	0.0	1	2.0	0	0.0
	Total	1282	100	352	10	121	100	933	100.	135	100	17	100.0	172	100	50	100	41	100

Table 2- Nationwide Frequency of News Coverage in the Dailies

The Ethiopian Herald covered the highest frequency for development and then to democratic news for favorable(F) and neutral(N) news stories. The development news obtained 42.98% (401) for favorable, 38.52% (52) for neutral where democratic issues secured 24.76% (231) and 19.26% (26) respectively. As in table 2, *The Daily Monitor* the highest coverage of the national interest was given to the democratic issues, but the highest of the favourable news was given for development news followed by democratic issues and international affairs. The democratic issues gained the highest neutral and unfavourable (U) stories. The newspaper covered 172 for favourable, 50 for neutral and 41 for unfavorable frequencies of news.

Space Wise Coverage

Unlike the frequency of the news, the space coverage of the newspapers is presented in summarized way as indicated in the tables that follow. The overall news coverage of all the categories in *Addis Zemen* depicts that it devoted the highest space. It totally provided 574677.3 column centimeters and 482729 being measured with agate lines as in table 3. *Addis Zemen* has 0.84 correction factor and with that the total space allotted to it is multiplied. Besides, the second, *The Ethiopian Herald* got space coverage of 332,497.1 whereas *The Daily Monitor* got 263,973.5 square centimeters.

Addis Zemen devoted 33.26% for democratic issues, 21.27% for development 21.27% and sport 8.90% and 8.65% for economy and finance. The least covered news categories are national integration with 2.23%, entertainment 1.68% and others 0.35%. *The Ethiopian Herald* provided space for democratic issues that accounts 25.01%, development 25.00%, international affairs 13.10% and economy and finance 9.26%. The least covered news categories in terms of the space of coverage are culture and heritage, 1.58% and entertainment, 1.05%. Still, *The Daily Monitor*, on the other hand, provided lesser space compared to *Addis Zemen*. The democratic issues from all the categories were given the highest coverage with 42.48%. The second top most covered category was development.

Table 3- Space wise News coverage of the Dailies

		Addis Zemen			The Ethiopian Herald			The Daily Monitor		
S. No.	Categories	Space/cm	Standardized	%	Space	Standardized	%	**Space**	Standardized	%
1	Democratic issues	227538.3	191132.1	33.26	99012.59	83170.58	25.01	164900	112132	42.48
2	Development	145523.8	122240	21.27	98970.25	83135.01	25.00	17011.5	11567.82	4.38
3	Economy and Finance	59155	49690.2	8.65	36647.68	30784.05	9.26	9888.25	6724.01	2.55
4	Social Welfare	32381.5	27200.46	4.73	16984.5	14266.98	4.29	1920	1305.6	0.49
5	Culture and Heritage	18842	15827.28	2.75	6250.75	5250.63	1.58	4769	3242.92	1.23
6	National Integration	15228.5	12791.94	2.23	12158.5	10213.14	3.07	4780.25	3250.57	1.23
7	Science and technology	16629	13968.36	2.43	29545.5	24818.22	7.46	10411.25	7079.65	2.68
8	International affairs	42020.5	35297.22	6.14	51862.33	43564.36	13.10	64737.25	44021.33	16.68
9	Entertainment	11469.75	9634.59	1.68	4170.25	3503.01	1.05	11268.25	7662.41	2.90
10	Human Interest Story	52108.68	43771.29	7.62	10619	8919.96	2.68	12334.5	8387.46	3.18
11	Sport	60860.5	51122.82	8.90	29258.75	24577.35	7.39	85996	58477.28	22.15
12	Others	2382.25	2001.09	0.35	349.75	293.79	0.09	180	122.4	0.05
	Total	574677.3	482729	100.00	332497.1	279297.5	100.00	263973.5	221737	100.00

The Ethiopian Herald gave the highest coverage to democratic issues where it gained 34685.5 cms that accounts 53.40% from the total space allotted to all editorial coverage. Development story got 13.52% and national integration category got 12.53%. Still, culture and heritage gained 7.10%. The economy and finance category secured only 5.42% and the social welfare category got 4.28%, the international affairs 2.69%. However, the rest of the categories got less than one percent as they got insignificant space coverage. *The Daily Monitor* provided 32263.62 centimeters space coverage to all the categories where it gave only 5.77% of the total coverage for democratic issues. This, however, brings the democratic issues into third largest coverage in *The Daily Monitor* because much of the coverage goes to the international relations category which alone secured 72.27%. In other words, the highest coverage of the editorial stories was given to international relations category. The second highest coverage next to international relations is national integration, which also gained small percentage, 7.99%. The development category got 3.83%, science and technology 2.65%, and social welfare and sport categories gained 2.24% each.

Geopolitical Coverage of News

Ethiopia is a federal state which is comprised of nine regional states and two autonomous city councils. Based on this, how the coverage pattern went along with the federal structure was analyzed. So table 4 presented about region wise coverage of news in the newspapers. The region wise coverage of the three selected newspapers in the present study was worked out by examining the news coverage of the twelve categories. News items of national or central level significance were also categorized separately. Such news types did not belong to any of the regions or autonomous cities. Therefore, it would be wise to treat such news separately as national news where they are equally important to each of the states and autonomous cities. In regional level, news items that had the concern of each separate region or autonomous cities were treated separately from news of national importance.

With regard to region wise coverage of the administrative regions the central government obtained the highest coverage of 592 news from total of 1755 news items in *Addis Zemen* where the favourable news makes 33.8% from the total 1501 favorable news. The newspapers altogether provided 2169. *The Ethiopian Herald* provided 487(52.2%) of news items to central government from 933 favorable news items and 556 news from the total 1085 favorable news items out of the total 1713 news. *The Daily Monitor* provided 200 news of national importance from the total of 2689 news. The most covered regions include Amhara, Oromiya, SNNPR, Tigray and Addis Ababa city council with 277, 246, 125,91 and 91 in *Addis Zemen*

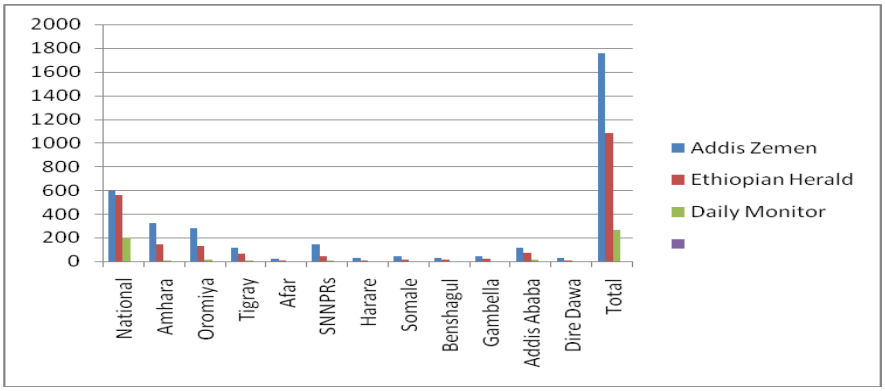
whereas 122, 111, 59, 58 and 34 for Amhara, Oromiya, Tigray, Addis Ababa city council and SNNPR respectively in *The Ethiopian Herald*, respectively as in table 4. However, *The Daily Monitor* provided, in fact, limited coverage to news of nationwide importance and Addis Ababa where the rest of the regions were provided minimal or no coverage at all. Among the regions Harare, Afar, Gambelle and Benshangul Gumuez got little or no coverage in the national dailies as in table 4.

Table 4- Geopolitical coverage of the Dailies

S. No.	Regional Representation	Addis Zemen						The Ethiopian Herald						The Daily Monitor					
		F		N		U		F		N		U		F		N		U	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq	%	Freq	%	Freq.	%
1	National	507	33.8	56	39.7	29	25.6	487	52.2	62	45.9	7	41.1	115	71.9	48	81.3	37	84.1
2	Amhara	277	18.4	16	11.3	26	23.0	122	13.0	22	16.3	0	0.0	7	4.4	2	3.4	1	2.2
3	Oromiya	246	16.4	14	9.9	21	18.6	111	11.9	14	1.3	2	11.7	10	6.2	2	3.4	0	0.0
4	Tigray	91	6.0	11	7.8	11	9.7	59	6.3	6	4.4	1	5.9	4	2.5	1	1.7	0	0.0
5	Afar	20	1.3	3	2.1	1	0.9	7	0.7	0	0.0	1	5.9	0	0.0	0	0.0	0	0.0
6	SNNPRs	125	8.3	13	9.2	6	5.3	34	3.6	9	6.6	0	0.0	8	5.0	0	0.0	2	4.5
7	Harare	27	1.8	3	2.1	1	0.9	7	0.7	2	1.5	0	0.0	2	1.2	1	1.7	0	0.0
8	Somale	33	2.2	5	3.5	2	1.7	14	1.5	2	1.5	1	5.9	3	1.9	0	0.0	0	0.0
9	Benshagul	22	1.4	5	3.5	1	0.9	11	1.1	1	0.7	2	11.7	2	1.2	0	0.0	0	0.0
10	Gambella	35	2.3	5	3.5	1	0.9	15	1.6	4	2.9	1	5.9	0	0.0	1	1.7	0	0.0
11	Addis Ababa	91	6.0	10	7.0	13	11.5	58	6.2	12	8.9	2	11.7	7	4.3	2	3.4	4	9.0
12	Dire Dawa	27	1.8	0	0.0	1	0.9	8	0.8	1	0.7	0	0.0	2	1.2	2	3.4	0	0.0
	Total	1501	100.	141	100	113	100.	933	100	135	100	17	100	160	100	59	100	44	100

Of the democratic issues category news of national importance got the highest coverage with 592 frequencies in comparison with each of the states and city councils in *Addis Zemen*. At regional level, or news that have the concern of each separate region is treated separately from news of national importance. The highest covered regions are Amhara, Oromiya and SNNPRs in *Addis Zemen* whereas Amhara, Oromiya and Tigray are highest covered regions in *The Ethiopian Herald*. However, *The Daily Monitor* mostly covered nationwide coverage, and provided little attention to regional issues except that it provided relatively better coverage to Addis Ababa City council.

Addis Zemen provided the highest news items of national importance from the three newspapers as it is observed from the graph below. Besides, news of nationwide coverage obtained more coverage compared to news covered about any of the regional governments. The least covered regional governments are Afar, Harare, Somale, Benshangul and Gambella. One of the two city councils, Dire Dawa also obtained very less coverage.



Graph 1- Geopolitical Distribution of News

Although all the three newspapers provided different coverage for the democratic issues, the category obtained due emphasis in all the three. In fact there is a wide range of variation from the highest covered sub category, that is, good governance to the least covered opposition party sub category. In *Addis Zemen* good governance got 225, which is the highest. Good governance sub category gained 37.98%, 53.49% and 75.76% from the total for favorable, neutral and unfavorable news respectively. In table 4 the degree of coverage in terms of the frequencies of news provided to the different democratic issues or sub categories is demonstrated. The good governance sub category was given 78.67% for favorable, 10.22% for neutral news and 11.11% for unfavorable news. In addition, sustainable development news sub category was the second most covered democratic issue and it got 93.10% for favorable news out of 87 frequencies given to the sub category. Moreover, it provided 2.30% for neutral and

4.60% for unfavorable news stories. The third highly covered news story was the ruling party and it got 63 frequencies of news and the favorable news accounts to 100.00%. The least covered democratic sub category, that is, opposition party was given the total frequency of only 6 news stories in the sampled newspapers of *Addis Zemen* and 5 of the 6 news was covered under neutral news.

Moreover, the next most important in the newspaper from the democratic issues was women participation sub category and it got 43 frequencies of news where the favorable news got 90.70%, neutral stories account for 6.98% and unfavorable news. The sixth important issues out of the eleven democratic issues is the election news and got 32 frequencies and the favorable news was given 84.38%, whereas the neutral and unfavorable news account only 15.63% and 0.00%, respectively. The citizen participation issue was also given 30 frequencies and the favorable news Election is the third largely covered democratic issues and it got 8.66%for favorable, 16.00% for favorable and 16.67% for unfavorable news. The least covered democratic issues are conflict resolution 0.43%, opposition party 0.87% and 1.73% for minority and ethnic group in covering favorable news. Generally, the three most highly covered democratic issues in the government English daily are good governance with 92 frequencies, sustainable development with 60 frequencies and election, 26 frequencies. However, the least covered democratic issues of countrywide coverage include conflict resolution and opposition party categories.

The Daily Monitor (private daily) provided a scanty coverage where it covered only 66 frequencies. Out of the total frequencies good governance got the highest coverage, that is, 66.67% with 34 frequencies, sustainable development 27.27% and gender issues 6.06%. Out of the total coverage the favorable news got 33 frequencies, whereas the neutral and unfavorable news together got the rest 33 where the former got 18 and the latter got 15 frequencies.

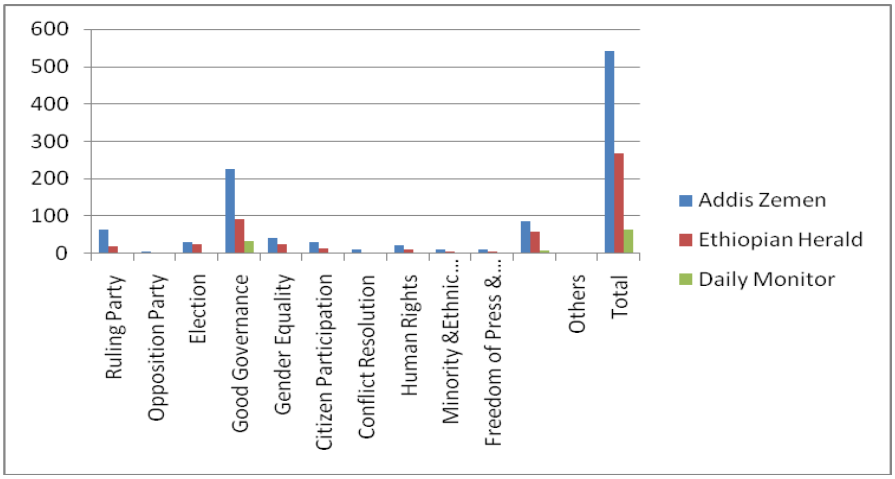
accounts for 100%. The human rights were given 22 frequencies and favorable news only was given the total percentage, that is, 100.00%. The conflict resolution issue also got 12 frequencies and it makes 100.00%.

Like in *Addis Zemen*, the major democratic issue in *The Ethiopian Herald* (government English daily) is good governance (table 5). *The Ethiopian Herald* devoted 268 frequencies of news for democratic issues of nationwide importance. The favorable news alone got 231 frequencies, which is the highest and many times larger than the frequencies for neutral and unfavorable where the latter two got 25 and 12. The good governance gained 73 frequencies (31.60%) for favorable news, 14 frequencies (56.00%) for neutral and 5 frequencies (41.67%) for unfavorable news. The second largest coverage was given to sustainable development, 24.68% for favorable, 8.00% for neutral and 8.33% for unfavorable news.

Table 5. Democratic Issues Frequency of News coverage

		Addis	Zemen		The	Ethiopian	Herald	The	Daily	Monitor
		F	Ne	U	F	Ne	U	F	Ne	U
1	Ruling Party	63	-	-	20	1	-	-	-	1
2	Opposition Party	1	5	-	2	-	-	-	-	1
3	Election	27	5	-	20	4	2	-	2	3
4	Good Governance	177	23	25	73	14	5	22	11	1
5	Gender Equality	39	3	1	23	0	2	2	-	2
6	Citizen Participation	30	-	-	15	1	-	-	1	-
7	Conflict Resolution	12	-	-	1	-	-	-	1	1
8	Human Rights	17	3	2	10	1	1	-	2	1
9	Minority &Ethnic Groups	9	2	1	4	2	1	-	-	-
10	Freedom of Press & Expression	10	-	-	6	-	-	-	1	4
11	Sustainable Development	81	2	4	57	2	1	9	-	1
12	Others	-	-		-	-	-	-	-	-
	N=	466	43	33	231	25	12	33	18	15

The coverage pattern of the democratic issues, in graph 2, indicated that good governance was the major democratic issue in the government dailies. *Addis Zemen* provided the highest coverage to democratic issues from any of them. The least covered issues were about opposition party, conflict resolution, minority and ethnic relations and freedom of press as in the following graph. *The Daily Monitor* provided the least coverage of democratic issues because it rarely covered about national matters for its focus on international affairs, entertainment and sports.



Graph 2- Democratic issues coverage

In regard to space wise coverage, country wide news was covered 117,775.1, centimeters in *Addis Zemen*, 52689.78 centimeters in *The Ethiopian Herald* and 5527.55 square centimeters in *The Daily Monitor*. Among the democratic issues, good governance was the most highly covered issue where it got 44.06% in *Addis Zemen*, 31.86% in *The Ethiopian Herald* and 33.60% in *The Daily Monitor*. The least covered democratic issue is the opposition party sub category and it accounts only 0.66%. The other highly covered democratic issue that follows good governance is sustainable development. It got the second space coverage in Addis Zemen with 16.61% and, which is also the second largest in *The Ethiopian Herald* with 24.86%, but it became the fourth largest covered in *The Daily Monitor* with 11.56%. Moreover, the ruling party is the third highly covered democratic issue as it got 11.68% in *Addis Zemen*, but it became the sixth largest covered news story in *The Ethiopian Herald* with 6.42%, but the second least covered in *The Daily Monitor* with 0.62% next to minority and ethnic group, which was given no space. The most highly covered democratic issues in *The Ethiopian Herald* newspaper were Good Governance, sustainable development and election where they got 31.86%, 24.86% and 10.77% space coverage respectively.

		Addis Zemen			The Ethiopian Herald			The Daily Monitor		
S. No.	Categories	Space	Standardized	%	Space	Standardized	%	Space	Standardized	%
1	Ruling Party	16370.75	13751.43	11.68	4025.5	3381.42	6.42	50	34	0.62
2	Opposition Party	924.75	776.79	0.66	213	178.92	0.34	1082.5	736.1	13.32
3	Election	5555.75	4666.83	3.96	6752.75	5672.31	10.77	1197.5	814.3	14.73
4	Good Governance	61770.5	51887.22	44.06	19985.43	16787.76	31.86	2731.25	1857.25	33.60
5	Gender Equality	10403.75	8739.15	7.42	5566	4675.44	8.87	502.5	341.7	6.18
6	Citizen Participation	8355.5	7018.62	5.96	5349.75	4493.79	8.53	245	166.6	3.01
7	Conflict Resolution	2408.25	2022.93	1.72	0	0	0.00	282.5	192.1	3.48
8	Human Rights	5991.5	5032.86	4.27	2677	2248.68	4.27	715	486.2	8.80
9	Minority and ethnic group	2836.25	2382.45	2.02	1710.25	1436.61	2.73	0	0	0.00
10	Freedom of press and expression	2302	1933.68	1.64	855.25	718.41	1.36	940	639.2	11.56
11	Sustainable Development	23289.5	19563.18	16.61	15591	13096.44	24.86	382.5	260.1	4.71
12	Others	0	0	0.00	0	0	0.00	0	0	0.00
	Total	117775.1	117775.1	100.00	52689.78	52689.78	100.00	5527.55	5527.55	100.00

Table 6- Democratic Issues Space wise News coverage

Gender equality was the other democratic issue, which got better coverage compared to the rest of the democratic issues with 8.87% followed by citizen participation that gained 8.53% space. The least covered democratic issues in regard to the space they were allotted by the respective newspaper were conflict resolution that gained no space allotted to it, opposition party 0.34% and freedom of press and expression1.36%. Specifically to *The Daily Monitor* the space wise coverage of the democratic issues portrays that good governance like the rest two newspapers got the highest coverage. It got 33.60% out of the space provided to the democratic issues that were covered at local, zonal, regional and national levels. The second largest coverage goes to election that secured 14.73% and followed by opposition party, which accounts to 13.32%. The least covered democratic issues in *The Daily Monitor* were minority and ethnic group with no space allotted to the subcategory followed by the incumbent party that secured only 0.62%. The news space provided to human rights accounts to 8.80%, which is the fourth largest space coverage. Besides, gender Issues got 6.18% and it became the sixth largest covered. The space allocated to sustainable development only makes 4.71%, it is the seventh largest covered democratic issue.

Normally the extent of coverage, that is, the contents, the news framing strategy of following fairness principle is important to indicate the direction of news coverage. The degree of fairness in news coverage was calculated using coefficient of imbalance by Janis and Fadener cited in Murthy (1998).

	Direction of Coverage				Coefficient of Imbalance
	N	F	Ne	UF	
Addis Zemen	2169	1556	426	187	0.56
The Ethiopian Herald	1713	1046	500	167	0.44
The Daily Monitor	2689	716	979	994	-0.43

N =News Items, F=Favourable, Ne=Neutal, U=Unfavourable;

Table 7. Degree of Fairness in news coverage

It was found that *The Daily Monitor* covered more unfavourable news. However, the government dailies covered more favourable news. As a result, there is "north -south dichotomy" between the government and the private press. The coefficient of imbalance demonstrated the news coverage pattern of the government dailies was mostly positive with 0.56 and 0.44 for *Addis Zemen* and *The Ethiopian Herald* respectively. However, *The Daily Monitor* had negative coefficient of imbalance. It is believed that the press forms one of the major player in a society and it can meet the expectations by presenting accurate, timely and fair and

exact news. In other words, the press should present fair and balanced news in order to feed the society with accurate and exact news which become the base for appropriate political, social and legal actions. This is not an exception to the Ethiopian press to exercise its right towards addressing social evils by disclosing ill deeds and urging for legal measures.

DISCUSSION

The framing strategy of the news items in the press usually emanate from the ownership style or editorial policy of the newspapers. Besides, the representation of reality emanates from journalists perception of reality and the already created image, Iorgoveanu and Corbu (2012). It was found out that democratic issues were the most covered news items among the identified categories in the study because they were framed as the major issue of the nation. Generally, among the democratic issues good governance issues were framed as most important ones compared to the rest of the sub categories as demonstrated in graph 2 and table 6 by three of the newspapers. This implies that the press has dealt more on good governance issues, which is the key aspect of a democratic system.

It has been noted that the issue of democracy and the use of press as a mean of promoting democracy is underlined in the Constitution of Ethiopia. Consequently, the government press also tended to follow this path of the government. However, the government press covered more favourbale news about democratic issues compared to the private press, which seemed also to take a separate path in the news coverage. This implied that the government press framed the news items in such a way that it favours the efforts of the government whereas the private press seemed to relatively cover unfavourable news about the democratic issues, this can emanate from framing bias coming from the type of the press as Entman (2007). This was revealed in the coefficient of imbalance calculated where the principle of fairness is not much upheld. The journalists of the private press seemed to cover more unfvaourable news about democratic issues, perhaps, in relation to the editorial policy of the press on one hand and their perception of reality on the other because the coverage pattern is affected by the ownership style and journalists attitudes.

Finally, there were variations among the newspapers in their coverage of news items of nationwide importance where *Addis Zemen* framed the news items which have national importance. *The Ethiopian Herald* covered on national matters, but emphasis was also given to international affairs as an English medium. On the other hand, *The Daily Monitor* provided meager coverage to the democratic issues as it provided very limited news of nationwide importance. These coverage patterns were followed as indicated above by the framing strategy employed by the press based on the influence of ownership style and journalists

framing of different issues (Theaker, 2004). The tendency to neglect national news and more coverage of international affairs and entertainment by the private press may indicate the less contribution of the press playing towards the democratic development of the nation.

CONCLUSION

Democratic issues were framed as one of the top most agenda of the three national daily newspapers. In fact, it was found out that the coverage pattern of the press was highly governed by the ownership style of the press in the country. This is seen from the very fact that government newspapers demonstrated more news slant to the government than the private newspaper whereas the private newspaper was more critical to government activities. Besides, the private newspaper covered rarely about political matters and it gave more coverage for international matters. No matter how the government and the private press differ in their focus and being critical, they provided due emphasis for democratic issues particularly to good governance. The dailies took democracy at the top of their agenda when they framed their news, but the government newspapers covered mostly favourable news whereas the private newspaper mostly covered unfavorable news of nationwide matters. It was also found out that the unbalanced and less critical approach in the nature of news coverage of the government press, disregard of the private press for domestic issues coverage in favour of foreign news, and very less or unbalanced coverage among the regional governments as national dailies except Amahara, Oromiya, Tigray and SNNPR and Addis Ababa City Council, which of course obtained better coverage, could hamper the role the press towards playing its active role in the democratic process of Ethiopia. In turn, the less functioning of the newspapers in terms of following proximity principle along with unbalanced coverage of news might indicate the social and political lacunae that possibly prevail in the democratization of the country. Hence, from the limitations vividly portrayed it can be possible to say that the press in Ethiopia should be highly improved towards democratizing the country.

REFERENCES

Birhane G. Mariam 2002. "The Ethiopian Freedom of Mass Media has been Disregarded and Still Remains in an Uncertain Future'" (P.641-650) *Themen.* Nord-Sud aktuell

Brewer, Paul R. and Lee Sigelman 2002. "Political Scientists as Color Commentators: Framing and Expert Commentary in Media Campaign Coverage" (P.23-35) Press/Politics 7(1)

The Constitution of Ethiopia 1995. The Federal Democratic Republic of Ethiopia.

Davis, Aeron. 2007. *The Mediation of Power: A critical introduction*: New York: Routledge

DeFleur, Melvin L. and Everette E. Dennis (1991) *Understanding Mass Communication*. New Delhi: GOYLSaaB Publishers.

Entman, Robert M. 2007. "Framing Bias: Media in the Distribution of Power" (P. 163–173) *Journal of Communication* Vol. 57 Washington, DC: International Communication Association School of Media and Public Affairs, George Washington University.

Getachew Metafaeria 2003. "Ethiopia, Status of Media in" (P561-569*) Encyclopedia of International Media and Communications,* Vol 1. Elsevier Science.

Gorp, Baldwin Van 2007. "The Constructionist Approach to Framing: Bringing Culture Back (P. 60–78)" Journal of Communication, Vol.57. International Communication Association

Gripsrud, Jostein 2008. "The Cultural Dimension of Democracy" (P.197-214) *Media, Democracy and European Culture*. Ib Bondebjerg and Peter Madsen eds.Bristol and Chicago: Intellect

Gudeta Seifu 2008. "Self-regulation of the private press in Ethiopia: Prospects and challenges" Faculty of Journalism and Communication, School of Graduate Studies Addis Ababa University, MA Thesis (Unpublished)

Iorgoveanu, Aurora and Nicoleta Corbu 2012. "No consensus on framing? Towards an integrative approach to define frames both as text and visuals" (P.91-102). Revista comunicare Vol.27

Janis, I. L. and Fadener R.1965. "The Coefficient of Imbalance" (P.55-82) *Language of Politics: A Quantitative Semantic*s. H.D. Lasswel, N.Leites and Associates (eds)Cambridge: MIT.

Jarvis, Sharon E. and Soo-Hye Han 2009. "Political Communication" (P.749-758) *21st Century Communication A Reference Handbook.* William F. Eadie (ed.): California; Sage Publications, Inc.

Jeffrey, Robin 2005. "The Public Sphere of Print Journalism" (P.257-266). *Practicing Journalism: Values, Constraints, Implications*. Nalini Rajan (ed.) New Delhi Thousand Oaks London: SAGE Publications

Lacy, Stephen, Kay Robinson and Daneil Riffe 1995. "Sample Size in Content Analysis of Weekly Newspapers" P.

336-345 *Journalism and Mass Communication Quarterly* Vol. 72, No. 2 Washington DC. George Washington University, Association for Education in Journalism and Mass Communication.

Murthy, D.V.R 2006. *Developmental Communication* Kerala: Olive Green Publishers.

_____ 1998. Developmental Journalism and the Indian Press: A content Analysis of Selected Newspapers(PhD Thesis): Andhra University, Visakapatnam (Unpublished).

Ocitti, Jimmy 1999. Media and Democracy in Africa Mutual Political Bedfellows or Implacable Arch-Foes, Cambridge: Harvard University Retrieved on October 30, 2008 from http://www.wcfia.harvard.edu/fellows/papers/1998-99/ocitti.pdf

Reese, Stephen D. 2001. "Prologue--Framing public life: A bridging model for media research" in *Framing Public Life: Perspectives on Media and our Understanding of the Social World*. Stephen Reese, Oscar Gandy, and August Grant (eds.), pp. 7-31. (Mahwah, N.J.: Lawrence Erlbaum

Theaker, Alison. 2004. *The Public Relations Handbook*. 2nd ed. Oxfordshire, USA: Routledge.

An Assessment of Gandhi's Misconception on the Origin of Violent Human Nature ; Metaphysical Justifications for the Invitability of Human violence

Sisay Assemrie,
Madawalabu University; Bale Robe, Ethiopia. Email:-sisay.assemrie @gmail.com

Abstract
Sisay Assemrie . An Assessment of Gandhi's Misconception on the Origin of violent Human Nature ; Metaphysical justifications for the Invitability of Human violence Journal of Science & Development 2(2)2014, 65-86.

In his project of Ahimsa (Ethics of Non-Violence), Gandhi believed that men are naturally non-violent. He argued that violent human behavior has originated merely from a social environment or human's culture. Thus, he advocated the possibility of eliminating human violent behavior through effectively practising the principles of Ethics of Non-Violence in our daily life. Although it is true that social environment (human's culture) has its own influence by aggravating or discouraging an aggressive behavior of men, scientific studies proved that this behavior has significant biological/genetic, evolutionary, psycho-spiritual and dialectical origins. Accordingly, violence is proved to be a part of human nature that universally describes man-kind irrespective of their culture, time and other circumstances. Therefore, the advocacy of principles of Ethics of Non-Violence that are required to eliminate violence is unrealistic. By highlighting the roles of science in the study of conflict, peace and security; this article *can be helpful to serve as a ground-work for other researchers that want to conduct deep researches with regard to the naturalness of human violence. I employed critical approach to show gaps of Gandhi's project of Ahimsa and to illustrate the naturalness of human violence.*

Key words: Human Violnce, Gandhi, Methaphysics, aggressive behavior

INTRODUCTION

Ahimsa is not only a theory but also it has been one of the major ethical principles in the real life of Indian people. The term *Ahimsa* as used by Gandhi has a very wide and deep moral connotation that had been mainly employed to liberate India from British colonial rule and to mitigate socio-economic and political upheavals of the Indian people during 20th centuary (I. C. Sharma, 1965: 325). Gandhi's Ethics of Non-Violence/*Ahimsa* is mostly considered as a means of solving conflicts without the use of physical force or violence. But the moral concept of Ahimsa is used in a much wider sense than only the absence of violence or force. Because, the actual meaning of Ahimsa implies not causing any kind of hurt or making harm to anybody physically and mentally by using physical force, language or other means (Prana, 2003: 2). It also stands for the realization of the love born of universal element of spirit or God on the real world (I. C. Sharma, 1965: 325).

Gandhi considered violent behavior of men that inflict pain and injury on God's creations as the product of social or cultural

construction. Thus, he had advocated the possibility of eliminating violence and other social evils not only from India but also from the earth through his life. Scientific studies on the origin and nature of human aggression proved that violent behavior has significant biological/genetic, evolutionary, psycho-spiritual and dialectical origins.Violent behavior is proved to be part of human nature. Thus, we cannot eliminate it by any means.

STATEMENT OF THE PROBLEM

The moral philosophy of Gandhi's Ethics of Non-Violence is too broad and has ideal and real components. As much as my observation is concerned adequate research works have not been conducted on the critique part of Gandhi's Ethics of Non-violence or why Gandhi's project of *Ahimsa* has not been realized on the earth. Particularly, little research works have been done with respect to providing scientific foundation for the factual origins of human violence and other elements of social evils.

OBJECTIVES OF THE STUDY

This article is designed to have the following main theoretical objectives:-

1. To Highlight Gandhi's project of Ethics of Non-Violence/ *Ahimsa*
2. To elaborate factual origins and natural inevitability of human's aggressive behavior and other social evils
3. To overview the roles of science in the study of conflict, peace and security
4. To give an important insignment with regard to the naturalness of human violence for other researchers

METHODOLOGY

Sources:- This study is based on secondary data sources/materials such as books, commentaries, magazines, publications, dissertations, journals, articles, and internet web sites. Due to shortage of published materials, unpublished sources are also used.

Research Methodology - In principle or theory, it is easy to understand that the moral philosophy of Gandhi's Ethics of Non-Violence is interesting and ambitious to every body. But, when we critically evaluate its practicability on the real world or material life, it has many problems and failures. Thus, qualitative methodologies that are going to be employed in this research are both descriptive (for Part -One) and critical approach (for Part- Two).

The Meaning of *Ahimsa* (Ethics of Non-Violence)

The concept of Ethics of Non-Violence is a very old, complex and basis of Indian moral philosophy. It is not only a moral philosophy but it has been also one of the major ethical principles in the religious and secular life of Indian people (I. C. Sharma, 1965: 325). Prophet Sri Chaitanya, Lord Krishna (dieties in Indian tradition), and the religion of Sanatana Dharma (the first traditional religion and base of other modern religions of India) had preached their believers that *Ahimsa* is the principle of non-injury of life and the only way to merge into the absolute truth or God (Prana, 2003: 1).

Among the dominant religions of India; Hinduism, Buddhism, Jainism and Christianity are based on the religious teaching of "not causing injure to any living being". It implies the teaching of each of the dominant religions considered *Ahimsa* as the principle of human life to nurture and preserve all creations (Ibid). Particularly, Buddhism prohibits all forms of violence and destruction against any kinds of creatures. In order to build non-violent society that never cause injury to each and every human being, Lord Buddha had advised the following to his followers:

> *Do not look at others' mistake, what others have done and not done, but rather look at what you yourself have done or failed to do... place yourself in others' position and refrain from beating and killing. By friendship you conquer the angry, by goodness you conquer the evil, by generosity you can conquer the miser and the liar by truthfulness. In battle, anyone [may] conquer thousands and thousands, still the greatest victor is the one who conquers himself* (Ibid: 4).

From the above quotation, we can infer that Buddhism as a religion consists of non-violent moral values such as love, non-injury, honesty, fellow-feeling, patience, unity, and respect. Since Gandhi had lived among the follower of Buddhism in his childhood, he had built his personality by the moral principles of this religion (Gandhi: An Autobiography or the Story of My Experiments with Truth, 1948: 10).

In addition to the religious and traditional influences, Gandhi's personal relationships with many Asians, Europeans, Africans and his intellectual exercises had helped him to have a firm stand on *Ahimsa*.The essay of Thoreau's "Civil Disobedience" and John Ruskin's "Unto This Last", which narrate the misery of inequality, unfairness, exploitation and the need to oppose unjust events had inspired him to struggle against all forms of evils that exist in the world. Even more, his personal correspondence with Leo Tolstoy that wrote many fictions on the power of spirit, from 1909 to 1910 had left a deep impression on his life struggle for political and social justice by non-violent strategy (Lal, 2009:285).

While employing the moral philosophy of *Ahimsa* as the guiding principle of his practical life, Gandhi had exercised both the warrior and pacifist motifs of religious and secular strategies of various traditions. "From the warrior motif comes the idea of fighting as the sacred duty, and from the pacifist the prohibition against harming" (Lester R. Kurtz and Ramadhani Kurtz, 2005: 350). This is to mean that practitioners of Ahimsa must fight like

the warrior but without causing any kind of injury or pain to his or her enemy.

In the history of Ethics of Non-Violence, Gandhi is the first to practically apply it to real life by giving broad connotation and identifying it with truth or God. Through spiritualizing secular life, his goal was to solve social, economic, and political upheavals of the world and to actualize the life of heaven on earth (Sharma, 1965:326 and 335).

Particularly to his country, Gandhi had employed it as a tactic to make India politically independent from British colonial rule and to bring about individual and collective improvement and regeneration of Indian society by rediscovering indigenous, historical and religious practices. He had also employed it to uplift the poor section of the society (mainly the rural population), to build Muslim-Hindu unity, and to ensure equality to the untouchable (the outcastes) and women. As result, in his country, he has been considered as the 'father of the nation and great saint ' (I. C. Sharma, 1965: 325 & http://www.answers.com/topic/mohandas-gandhi).

Gandhi's ethics of pragmatic non-violence is commonly defined as the means of God realization or getting nearer to God/truth, who is the source of human spirit (Sharma, 1965: 326). Other scholars, Lester R. Kurtz and Ramadhani Kurtz (2005: 352-50) defined Ethics of Non-Violence as a means of eliminating the existing disharmony that exist within the social organization and natural environment. According to those scholars, *Ahimsa* is a movement for eliminating violence in all aspects of social life and treating the entire nature with respect and civility to develop a harmonious interaction between human beings and natural environment.

Ethics of Non-Violence is also defined as a means of realsing peaceful co-existence, justice, stability, permanent safety, equality and freedom in the arena of national and international politics.This goal is assumed to be achieved through conducting open or non-secretive deliberations, dialogues, debates, persuasions and non-cooperation with evil actors (Sharma, 1965: 336 and Bhaneja, 2007:221).

In general, the comprehensive definition of Gandhi's Ethics of Non-Violence which includes the above definitions has negative and positive elements. The negative element of Ethics of Non-Violence is defined as not causing any harm to anybody both physically and mentally or, not making any pain or injury to any kinds of creatures by any possible way (Sihra, 2006: 42-43; Prana, 2003: 1; Bhaneja, 2007: 221).

Insisting the superior moral characters of *Ahimsa*, Gandhi had demanded his coworkers that they must be civil, non-conspiring, and under no circumstance counter violence with violence (Ibid). Because, he believed that by following the path of truth or accepting the moral superiority of negative elements of Ahimsa, it is possible to bring change in the heart of the opponents.

From the definitions of Sihra, prana and Bhaneja, we can infer that in the negative element of Ahimsa, individuals or practitioners of Ahimsa are not expected to forward love and charity to other creatures. Because, love and charity can't be extended only by refraining from injuring other

creatures or participating in to Non-violent actions.

In its positive element, *Ahimsa* connotes one's mental consciousness of oneness, love and charity, compassion, eternity of the soul and omnipresence of truth. What is essentially important in this element of *Ahimsa* is, individuals must extend positive moral values to other creatures (Sihra, 2006: 42-43).

Metaphysical Basis of *Ahimsa* (Ethics of Non-Violence)

Misconceiving the metaphysical aspect of Gandhi's Ethics of Non-Niolence, people believe that Gandhi had preached the moral philosophy of meekness, passivism and unconditional obedience. But, he argued that non-violent behavior when "inspired from the inner most recess of human personality is mightier than the mightiest weapons on the earth " (Sharma, 1965: 327). Because, he believes that non-violent behavior arises from the central force or spirit of man which is man's being of God, by possessing his traits (Ibid). He analyzed this fact as the following:

> *If God as truth is the basis and background of the universe and man, the only way to Godliness is the life of non-violence and love, and hence God, life, truth and love are identical , and all are again the ultimate good* (Ibid: Emphasis is my own).

From the above argument, we can infer that God, truth or the central reality, love and non-violence designate identical or one reality. This idea necessarily leads us to conclude that Ethics of Non-Violence is undoubtedly an ethical-religious-metaphysical system of thought that advocate activism, strength and courage for equality and social justice.

Throughout his life struggle for justice and equality among human beings by the non-violent strategy, Gandhi consistently preached that every human being has potential to develop and attain godliness or divine spirituality. In his campaigns, Gandhi regularly reminded that non-violence begins with inner practice and all human beings have potential of such practice irrespective of cultural and socio-economic backgrounds (Ibid and Namita, 2008: 57).

The universality of godliness as defined by Gandhi is grounded on his metaphysical analysis of Ethics of Non-Violence. It is originated from his firm conviction that the soul force or the spirit is universally given to men, and men are expected to develop it by practicing spiritual awakening principles of *Ahimsa* (Ibid). Spiritual awakening or development through inner practices is the highest manifestation of humanity and absolutely necessary for practitioners of *Ahimsa* to attain moral progress, and self-actualization (godliness). This can be achieved through exercising moral principles of Ahimsa in our daily material life and conducting deep pray to God (Prana, 2003: 2 and Bhaneja, 2007: 222-3).

It is to mean that;- First, by cultivating the moral attributes/principles of Ahimsa such as selflessness, truthfulness, humility, tolerance, love, kindness, forgiveness, humbleness, patience, feeling of unity,

brotherhood, sense of justice, freedom fearlessness, honesty and alike in our daily material life; we can develop the " psychic divinity" which is a the kind of divine power that all prophets possess.

Second, in addition to cultivating the good moral qualities of Ethics of Non-Violence in our daily material life, we must also conduct spiritual practices of meditation and praying to God. Particularly, as Prana (2003: 7) indicated, we must meditate or pray to God, 'Take me from the temporal feeling of individuality to the Eternal feeling of universality, from darkness or ignorance to Light or wisdom, from death or fear to Immortality which gives permanent happiness'.

In turn, these material and spiritual inner practices for spiritual awakening or self actualization have crucial contribution to practitioners of Ahimsa. Kashtan (2006: 13) elaborated that those practices are significant to increase strength, confidence, effectiveness, happiness, freedom, righteousness, acceptance, wellbeing, dignity, humanity, and feeling of immortality.

Basic Principles of *Ahimsa*

Principles of *Ahimsa* are moral values and actions that are expected from practitioners of the Ethics of Non-Violence. Even though many scholars (such as Namita, 2008, Godrej, 2011, Prana, 2003 and Bhaneja: 2007) listed out many principles, the common and basic principles of Ahimsa are;- principle of searching the truth, non-possession, equality, complete self-purification, hate the sin and not the sinner, and the principle of civil disobedience, protest, persuasion and non-cooperation with evil doers . The principle of searching the truth is considered as the most significant principle in Gandhi's Ethics of Non-Violence. In this context, truth is defined as search for love or universal absolute/ God. It is to mean that; absolute truth/God can be expressed by the divinity and spiritual unity of human-kinds (Ibid).

The second principle of Ahimsa is principle of non-possession. This principle prohibits practitioners of Ahimsa to divest from both desiring and possessing private material property. Since there is no difference among human beings, in metaphysical aspects of Ethics of Non-Violence, all material properties should be utilized for the benefit of humanity, not for private utility. In addition, lusting for private material property is also considered as soul destroying event, which inspires man for immoral actions and behaviors (Bhaneja: 2007, 216-17). The principle of equality dictates the absence of superior or inferior status among human kinds in the world. In our daily life, God has countless names and forms, which is expressed by individual's souls.These individual's souls collectively form one supreme soul or God. "One form can appear small or big, weak or strong, clever or foolish, but the inner vitality is the same". Thus, we must forget all feelings of individuality, class, race, sect and community and uphold equality (Prana, 2003: 3). To explain this principle, Gandhi said:

> *A variety of incidents in my life have conspired to bring me in close contact with people of many creeds and many communities, and my experience with all of them warrants the statement that I have known no distinction between relatives and strangers, countrymen and foreigners, white and colored,*

> *Hindus and Indians of other faiths, whether Musalmans, Parsis, Christians or Jews. I may say that my heart has been incapable of making any such distinctions. I cannot claim this as a special virtue, as it is in my very nature* (Gandhi:An Autobiography or the Story of My Experiments with Truth, 1948: 145).

The fourth principle of Ahimsa is the principle of complete self-purification of the heart or mind. This has been a life-long goal to be pursued in Gandhi's Ethics of Non-Violence. It is assumed to be achieved through self-devotion, sacrifice, or suppressing of all desires of self-interest and senses perception for the realization of higher or universal self (Bhaneja, 2007: 217-18).

To attain this goal; First, one has to become absolutely passion-free in thought, speech, and deed; to rise above the opposing currents of love and hatred, attachment and repulsion. Second, it is necessary to disengage his/herself from the desire of self-interest, which is the result of egoistic consciousness of individuals, class, race, community, etc. Egoistic people may not refrain from causing pain or injury to other people and at the same time may feel no considerable sympathy for the suffering of others.

The basic assumption of this principle is; since we are one, letting others suffer means letting oneself to be suffering. So, we have to understand that self-interest is based on common interest. According to Prana(2003:3), "Desire [of self interest] creates worries, sadness, jealousy, hatred, anger, pride, idleness and confusion. The inclination of desire [of self interest] is present when there is lack of love".

Ethics of Non-Violence requires the principle of hate the sin and, not the sinner (Bhaneja, 2007: 218).This principle is based on the idea that "Man and his deed are two distinct things", consequently, we must understand the difference between the action and the actor. In this case, a good deed must be appreciated and a bad deed needs to be condemned, but the doer of the deed, whether he/she is a cause for good or bad deed always deserves respect and love.

During his political movement to free his country from the British colonial rule, Gandhi did not show any hatred against the English people. 'He even got shocked and sorry if he heard that one white man had been killed or tortured by an Indian' (Prana, 2003: 4).

The sixth core principle of Gandhi's ethics of non-violence is the principle of civil disobedience, protest, persuasion and non-cooperation with evil doers. Although this principle is proved to be adversarial to opponents in practice, Gandhi always maintained that his social, economic and political non-cooperation principle has its roots not in hatred but in love (R. Kurtz, 2009: 5).

According to Kashtan's illustration (2006: 8-9), even though the British were resisting his efforts, he never wavered his conviction and had tried to convince what the British were doing in India was not to their benefit. He maintained that the goal of his non-cooperation campaign is to contribute to every one's benefit.

The underplaying argument of non-cooperation principle implies:-First, practitioners of Ahimsa must consistently oppose and scarify themselves to actualize love/truth on the world, without causing

any kind of injury. At the same time, their opposition must be guided by the benefits of humanity, not by individual or group interest.

Gandhi's Characterization of Non-Violence Ethics

Gandhi's Ethics of Non-Violence consists of many moral values and attributes which are highly interrelated. In this topic, I attempts to highlight the fundamental moral values or attributes of Ethics of Non-Violence. First, Ethics of Non-Violence is characterized as the law of wisdom, which enables practitioners of Ahimsa to expresses divine love, real freedom and happiness. We see every where only the names and forms of the individual souls or self. As long as we have ignorance this duality of soul exists. By wisdom or rationality we realize that everything is the manifestation of the divine self and whatever we see is a projection of one-self (Prana, 2003: 1-3). It implies that, since we are one, we must love everybody irrespective of the individual behavior or action. To elaborate this idea, Sharma (1965: 326 -328) wrote the following:

> *We have to love all human beings, whether they are good or bad, kind or cruel, broad minded or selfish, because the spirit, central in them, is the unitive force. Thus, Gandhi believed that even the meanest person was capable of being reformed because man is the image of God* [...] *non-violence is the law of our species as violence is the law of the brute or [jungle]. The spirit lies dormant in the brute and knows no law but that of physical might. The dignity of man requires obedience to a higher law to the strength of the spirit [....] it is an active force of the highest order. It is soul force or the power of God head within us.*

The basic argument of Sharma is that when we have knowledge of oneness or non-duality of soul; - hostility, enmity, jealousy, violence, etc., can't find a place in our mind. This knowledge inspires us to forget ourselves so as to realize the sufferings of others. In general, wisdom of non-dualistic human soul is the way to express divine love, compassion, patience, tolerance, emancipation (real freedom) and real happiness. Prana(2003: 30) explained the interrelation of wisdom, love/compassion, freedom and happiness as the following:

> *We have seen that there is jealousy, hostility, and enmity between brothers and sisters or other members of the same family. It is because of lack of love, and it is the source of violence. Love cannot blossom as long as these tendencies are present. All these are born of ignorance. In divine love there is a feeling of oneness with the world. [Because] Love can break the selfish boundary of our ego. In love, anger turns into compassion, fear into friendship, and destructive excitement into calm tranquility. When there is a shower of love in our heart, the heart is automatically filled with kindness, which is the source of compassion.*

As Bhaneja (2007:221) elaborated, from divine love, the moral attributes of forgiveness arise in our mind, which plays a significant role to remove violence from our mind. Extending forgiveness and treating our enemies in the spirit of love

during our suffering enables us to be free from any kind of hatred and revenge. It also helps us to gain higher moral status over our enemies psychologically.

When practitioners of *Ahimsa* have done wrong, even if their faults are insignificant and negligible, they must feel repentant and confession. For the faults of other, even if it is significant and innegiglable, they must extend forgiveness and love to the evil doers. Second, *Ahimsa* is not the creed of the coward or refuge for cowardice, but that of the brave and the courageous. It needs the quality of courage to face any kind of consequences or willingness to take risks in the face of threatening force. It includes the willingness to face physical death in order to achieve the intention and experience of pure non-violence (Sharma, 1965: 331 and Kashtan, 2006: 3).

What fuels courage is the conviction of truth and integrity, coupled with the abiding trust by power of love. Because, we apply our heart or consciousness for transcending fear and judgment, to be open- minded, and to excavate our eternal needs, dreams, and values so as to know and care the well-being of someone regardless of his or her actions without any kind of cowardice (B. Gregg, 1981: 26 and 60 and Bhaneja, 2007: 222-3).

Thirdly, as the method of solving conflict, Gandhi believed that Ethics of Non-Violence is the greatest, the most active, efficient and sounder force than the reciprocal violence in the world. Psychologists proved that a negative emotion such as anger, hatred, and fear eats up enormous amount of our energies and imagination (B. Gregg, 1981: 55-58). The man who pays attention to violent emotions has also probability to be attracted to manners of evil doers (Ibid: 60). This implies, "If you hate a man sufficiently, you cannot get him out of your mind, you are attached to him, and you are his slave. The thought of him is an obsession; it wastes most of your time" (Ibid).

Fourth, Ethics of Non-Violence is also characterized by the absence of defeat in its application. Because, it is totally practiced for its own sake (whether or not the desired results could be attained).In times of great failure while practicing Ethics of Non-Violence, the campaign has never bee stopped. Rather the inner peace initiates mental creativity in finding alternate strategies for the unmet needs (Kashtan, 2006: 12-13).

As Sharma (1965:331) illustrated, the principle of self purification or using soul force also leads practioners of Ahimsa to rise above the contradictions of defeat and victory. Because, when men are able to get absolute purification of the heart, they will be changed in to spirit or God to rise above physical defeat or victory.

Gandhi's ethics of non violence has also the position of anti-modernity and civilization. Because civilization is believed to have been inspired by the rationalization of materialism and individualism that leads to soul destroying competition among human beings. Gandhi argued that the imperialist conception of man has corrupted the entire civilization to be a force of evil. In general, "Although it [civilization] had many achievements to its credit, it was fundamentally aggressive, imperialist, violent, exploitative, brutal, unhappy, restless, and devoid of a sense of direction and purpose" *(*Parekh, 2005:42).

This implies, because of modern society guided by capitalism had privileged the

body or neglected the soul; it had valued only material possessions and consumption by excluding almost everything else. In his view, modem civilization had resulted greed, self -indulgence, sense of unlimited desires or appetite, unrestrained satisfaction of wants, and lack of moral psychology in the world.

Part-Two:Gandhi's Misconception on the Origin of Violent Human Nature

Introduction

Scholars (like Elsevier, 2009, Ramirez and Goetz, 2002.etal, Hobbes,1651, Hegel,1807, Nietzsche, 1886, etc.), which are both from natural and social sciences have been made a long lasting debate on whether human violent behavior is learned from the social environment or innate to human nature. Among those scholars, Gandhi argued that violent behavior of men (that cause pain and injury to other men) is learned only from the social environment. As a result, he advocated the possibilities of eliminating this behavior through practicing principles of *Ahimsa* in our daily material life.

Although it is true that the social environment or culture has its own influence by aggravating or discouraging violence, scholastic studies proved that violent behavior of men has significant biological/genetic, evolutionary, psycho-spiritual and dialectical origins (Elsevier, 2009, Ramirez and Goetz, 2002.etal, Hobbes,1651, Hegel,1807, Nietzsche, 1886, etc.). Thus, violence is proved to be part of universal human nature that transcends cultures, time, and circumstances.

Biological and Evolutionary Origin of Violent Human Nature

Human aggressive or anti-social behavior is influenced by biological and evolutionary factors such as neural systems, hormones, and man's genetic drive to will to power, survival and reproduction (Ramirez, 2002: 5, H. Mehta. Goetz.etal, 2012:2, Neitsche, 1886: 40, and J. Bushman and F. Baumeister, 2004: 213). Assuming that this topic needs deep knowledge of science let me highlight how some of biological and evolutionary factors influence human beings to be violent. Among human neural systems, the two main regions that have received extensive empirical attention in scientific researches are the "amygdala" and the "orbit frontal cortex" , cortical and sub-cortical (Ramirez, 2002: 5-15 and H. Mehta. Goetz.etal, 2012:2-5). These studies proved that amygdala[1] plays a critical role in the affective and motivational drive to respond violently to the provocation of environmental discomforts, while an extensive network of cortical and sub-cortical regions are involved in the expression of violent behavior against agents of discomforts (Ibid).

Other scientific researchers (Elsevier, 2009: 180-3, Fox, 2005: 3-5 and G. Green, 1998: 24-25) also proved that in the course of violence among human beings, some of humans' hormones such as adrenaline,

[1]

serotonin[2], endorphins[3] and testosterone play a crucial role. The amount of serotonin, adrenaline and endorphins in the low levels discourage aggression, and the high levels increase calmness and confidence, which inspires men for violence. The high amount or flood of these hormones is also associated with success at the end of violence. Seeking to increase the amount of these hormones in humans' anatomy or hormones, many anti-depressant drugs are deliberately given to troops during serious wars among sovereign states, terrorism and freedom movements.

From the above scientific evidences, we can infer that violent behaviors of men are significantly influenced by human anatomy (hormones and neural systems). As a result, Gandhi's project of ethics of non-violence to organize a society free from any kind of aggression, retaliation, revenge and other evil behaviors is contrary to this scientific fact.

On the other hand, biological life as "will to power" is characterized by the existence of many goals, paths, and bridges. This implies that life needs climbing to many steps through many over comings and be comings. Thus, "will to power" causes violence, competition and domination to be prevalent among human beings (Neitsche, 1886: 41-42 and 61-2).

Neitsche's argument implies two facts. First, plurality and multiplicity of biological life is only reconcilable with mastery and domination. Second, because of human life needs height, it needs conflict within each step. Jenkins (A/N:7-8) summarized the core idea of "Will to power" or the biological origin of competition, domination and violence as the following:

> *Life is Will to Power and Will to Power is Life, I deduce that Will to Power is overcoming...It [Will to Power] appears to be about expansion, conflict, about having power, mastery and domination over what presumably, must be weaker people and things. This i s unavoidable as it is naturalistic. [It] naturally and inexorably follows from out of the nature of life itself. A person is perpetually going to be subject to the overcoming of others and will be subject to overcoming others.*

Amygdale and orbit frontal cortex are found in brain.their function is to link fearful stimuli and fear expression ,to increase sensitivity to stimulus,and are necessary for formation of fear memories and higly adaptive for survival (James Hall, laboratory of neuropsychology, national institute of mental health, 2002: 63).

2

Due to environmental discomforts, the message of the central nervous system to brain antagonize an essential action of serotonin normally present in the brain and thus provoke the mental disturbances that we observe in man's action and facial expression (B. Brodie & A. Shore, 2012: 632).

3

Endorphins are produced and released from the pituitary gland that exist around stomac). They are released during continuous fear; when there is high stress in our mind; this stress stimulates the release of endorphin hormones which calms the brain in the stress situation and brings the feeling of happiness (P. B. Rokade, international conference on chemical , biological and environmental science, 2011: 436).

From his expression, we can deduce that violence; suppression, opposition, enmity, retaliation and competition among human beings have been originated from men's physiological drives to master others. This is inspired by self-overcoming, the spirit to destroy the alien and the drive of strangers to be tyrants against the weaker ones.

In the light of the prism of Gandhi's project of ethics of non-violence, Neitsche will to power is associated with moral backwardness and barbarism. Thus, it is assumed to be applicable in uncivilized and undemocratic system of governance. But, competition, inequality, domination, and divergence among human beings is also manifested even within the civilized or democratic society. To elaborate the nature of "Will to Power" within the liberal democratic frame work, W.Thomas (1996: 2) stated:

> *We can think of nature and ecological systems as a vast "free market" of perfect competition, where all living organisms are competing with each other for limited resources (sunlight, water, minerals, etc.). Businesses and brands also compete with each other in a struggle for survival, and collectively tend to operate in ways analogous to natural eco-systems.*

The implication of his idea is, even in the liberal democratic framework, various instantiations of will to power are being contested for hegemony. Thus, the existing economical, politician and social values compete with each other at various levels. It is to mean that social structures, identities, and values can be contested by alternative ones inspired by active instantiations of will to power among human beings.

Other scientific studies considered violent human nature as the product and manifestation of evolutionary process. Current bioarchaeological and Paleontological researches proved, throughout the evolution of human species, interpersonal violence that causes pain, injury, homicide and warfare especially among men has been prevalent (L.Walker, 2001: 1-2).

Scientific studies proved that gene polymorphisms,[4] stages of quality and genetic variation by adaptation have been the main factors for the prevalence of violent human nature (J. Ferguson, 2009:1). It implies that violent behavior of men is originated from the influence of environmental variables that cause genetic or physiological changes throughout human evolution.

On the other hand, J. Bushman and F. Baumeister (2004: 213) and M.buss (2001: 968) analyzed that human violent behavior is transferred from our evolutionary past serving as a means of resisting challenges of nature to facilitate the biological motives of survival and

[4] It symbolizes population differences in several morphological characters due to genetic variation mutations and meiosis. Much of the morphological variations must be due to differences in the gene pools of the populations. Because of the whole process of meiosis is suppressed and replaced by a single equational division. Accordingly, there is no chromosome reduction. There is no recombination either. As the parthenogenetic weevils are also polyploidy, new (and in general recessive) mutations should have limited chances of expressing themselves (Juhani & saura, department of genetics, 1980).

reproduction, not useless as Gandhi had advocated. Thus, violent or bad behaviors of men such as employing force, favoritism to group members, hierarchies, collective identities, fear, enmity, cowardice, hatred, revenge, retaliation, and sexual jealousy have been cultural universals throughout the evolution of man.

It is also true that most animals that are biologically similar to human beings have been behaving aggressively due to competition for resources, dominance, or to escape from potential threat of their species and other natural disasters. By using the analogy of animals' aggressive behavior, we can deduce that men are naturally violent. Because, by thinking power or employing their mind, human beings could not eliminate such kind of natural conflicts that occur among animal species.

Even more, as (J.Bushman and F. Baumeister, 2004: 205-207) explained, human aggression has many features that are essentially unknown among animal species. For instance, ideological and religious divergences, use of advanced military technology, genocide, long delayed revenge, multi-generation feuding, and many patterns of homicide have been unique to human race.

In general, since the above counter arguments against Gandhi's Ethics of Non-violence are based on scientific principles of testability, confirmation, observation and physical laws of nature, we can understand that men are naturally violent species at least in some extent. As a result, by using ethics of non-violence /divine love or absolute truth, it is difficult to actualize spiritual life on the earth and build a society free from any kind of violence, fear, hatred, harm and indignations.

Violence as the Manifestation of Psycho-egoistic Human Nature

As stated by **(**Sharma,1965: 326 , Prana, 2003:3 and Sihra, 2006:42 **),** in his Ethics of Non-Violence, Gandhi argued that, when men have knowledge or wisdom of the non-duality of the soul; they develop absolutely positive mind or mentality. Thus, they can transcend the feeling of egoistic judgment, hostility, jealousy, hatred, inequality, violence etc (Ibid).

Psychoanalytic theories contend that some of our actions and ethical behaviors are determined by the unconscious content of our minds. Among human actions and behaviors, aggressive behaviors are determined by unconscious psychic motivations, not by the rational conscious thinking process. As a result, by wisdom, we may not absolutely eliminate negative feelings or bad moral values (J. Bushman and F.Baumeister, 2004 and Hobbes,1651).

Thus, violence is naturally originated from the unconscious psycho-egoistic motivation of human beings. As J. Bushman and F.Baumeister (2004: 205- 207) explained, Freud is one of the most famous proponents of this view. He analyzed that people have a recurring need to inflict or damage other creations, and this desire must be satisfied periodically one way or another. This inate aggressive drive resides in the "id" component of the tripartite personalities, mediated by a realistic "ego" and a moralistic "superego" (Ibid).

Freud's psycho-analysis of human nature vividly shows, to live an effective and satisfactory life, men should have to satisfy

their innate aggressive drive or necessity in the satisfactory amount. If not, it would be manifested by harming or killing human beings and smashing property.

Hobbes (1651: 52 &54) also illustrated that due to men are psychologically an egoistic animal, there is no standard principle of bad and good. In the moral calculation of men, whatever the object of men's appetite that produce felicity of life has been good and the object of aversion has been considered as evil.

To maintain the felicity of life which has no end and standard rule, men have the desire of power after power that ceases in death. This desire of power after power is a corner stone for violence to be prevalent among human beings through the course of human history. In Leviathan (part I, chapter 6), he stated that " [desire for] riches, honor, command or other power inclines to competion, enmity and war; because the way of one competitor to the attaining of his desire, is to kill, subdue, supplant or repel the other".

According to his argument, naturally we find three principal causes of violence. First, competition for material gain; Second, diffidence for safety; and Third, glory for reputation.

In general, the basic argument of psychoanalytic theory implies, while individuals are extending relationships with other creations, they are emotionally forced to calculate their private felicity of life. This vividly shows the psycho-egoistic nature of mankind and natural inevitability of competion and violence among human beings.

As a result, the positive elements of Ahimsa that promotes the interest of the whole humanity such as the mental consciousness of unity, love, compassion, confession etc., could not be true. The project of building a classless society and the world without economic, political or social disparities and hierarchies is also unrealistic.

Other psychologists, J. Bushman and F. Baumeister (2004: 213) pointed out that men have an instinctual psychology toward both life and death. From the two instinctual psychologies, death is proved to be the aggression instinct. Naturally, men would not have any innate desire for death, because death is not adaptive in the psychology of survival and reproduction. It is to mean that the psychology of aggression is originated from its contribution for men's' survival and reproduction.

Supporting the argument of J. Bushman and F. Baumeister, M. buss (2001: 966-7) and V. Rabstejnek (A/N:3 and 7) elaborated the nature of fear in evolutionary psychology as , due to strangers and other tribes have been dangerous to their interest (even to their life), humans beings have consciously developed fear to our group members, naives and competitors.

From the above argument, we can infer that negative feelings of men such as fear or phobia, conflict, anxiety, hatred, retaliation, cowardice, injury, separation, and etc., are the product of men's psychological desire to life and reproduction. Therefore, unless human beings are able to secure their survival and reproduction without any kind of fear (indeed impossible on the earth), eliminating bad moral values only through practicing principles *Ahimsa* is difficult.

In addition to its role for reproduction and survival, Machiavelli (1532: 102-5)

analyzed that the psychology of fear has positive contribution to the development of sovereign states and social institutions. Among the four responses of men to their leaders, the psychology of fear had been the most useful response of citizens that has significantly contributed for unity, victory and progress of ancient civilizations and morality.

Machiavelli (in page 104) also explained, during the formation of new principalities, it is much safer to be feared than to be loved. Because, in the real life situations, men love according to their own will and fear according to the strength of a man. Psychologically, men are "ungrateful, fickle, false, cowardly, covetous, and as long as you succeed they are yours entirely; they will offer you their blood, property, life, and children, [if you failed] they turn against you". As a result, a wise man should establish himself on which is in his own control or strength and not in that of others or on the will of love.

In Gandhi's ethics of non-violence, evil-doers are generaly considered as destructive and ineffective (Bhaneja, 2007: 218-222). Thus, we must always hate and non-cooperate with their actions and behaviors. But as explained by Machiavelli (above) world history has been proving that this cannot be always true. Because, at least in some contexts, actions of evil doers have been empirically contributing for the betterment of human civilization and life improvement. At the same time, men have been cooperative to the activities and behaviors of evil doers.

From the above argument, we can infer that even though it has been true that "peace imposed by violence is not psychologically peace, but a suppressed conflict", in the history of world politics, violent methods has been in some contexts more moral, effective and efficient than Ethics of Non-Violence.

To evade such kinds of facts, Gandhi advocated that Ethics of Non-Violence must be "totally practiced for its own sake whether or not the desired results could be attained...the principle of self- purification ultimately enables practitioners of Ahimsa to rise above the contradictions of defeat and victory". While Gandhi had projected Ethics of Non-Violence to solve social upheavals that exist in the real world, to be effective and victorious in each and every of his life struggle, he slided into abstraction to hide his failures.

Dialectical Law of Nature Vs Ethics of Non-violence

The main goal of Gandhi's project of Ethics of Non-Violence is to actualize absolute love, justice, equality, stability, peace, unity, attraction, etc., and to establish a world without fear, separation, anger, competition, hatred, indignation, exploitation and conflict. But, due to actions and behaviors of human kind in some extent (with limited power to control nature) is regulated by the dialectical law of nature or contradictions, his project cannot be put in to practice.

The dialectical law of nature shows that the two contradictory realities (thesis and antithesis) and their product (synthesis) have been the governing principles of change throughout the development of human history (Hegel, 1807:18). Shimp (2009: 35-6) elaborated that the apparent contradiction between thesis and anti-thesis

has been resolved by making mutual compatibility or synthesis. The synthesis created by combination then becomes new thesis and for this thesis there has been anti-thesis. As a result, as Hegel (1807:207) stated thesis and anti-thesis compete with each other until a tipping point where human-beings are able to reach at a climax of civilization and consciousness. Miller (1984:175) reflected the existence of natural contradiction:

> *Nothing appears pure in and by itself, but only combination with [it's opposite]; air, light, moisture, solidity, heat, cold, movement, exhalations, [bad and good], and other forces...between light and heavy, strong and weak, greater and less, up and down. Thus, that which is on the right is not so by nature, but is so understood in the virtue of its position with respect to something else: for, if that changes its position, the thing is no longer on the right* (Emphasis is my own).

As to the history of spiritual contradiction, vividly analyzed in Hegel's "phenomenology of mind", the development of historical process is considered as man's gradual movement towards the absolute truth. He argued that, the dialectical process is a progressive movement towards the absolute, by relieving men's ignorance, by increasing self awareness, and gradually replacing man's perception of reality with newer and truer forms (Hegel, 1807: 28-29 and 134). He stated that:

> *Every time man's perception of reality is transformed in to a newer version, man takes one step closer to the absolute. Eventually reality as man perceives it will evolve to a point where the alienation of man from the absolute no longer exists or the state of reality where man and the absolute are reunited in the end of history* (Ibid).

The underplaying idea of the dialectical process implies that mankind is separated or alienated from the absolute or moral perfection. As a result, the logical completion of man's gradual movement towards the absolute history will be realized, when mens's conception of politics, morality, art, religion, science and other values arrive at definitive form to attain stable recognition institutionally. Which means, till the logical completion of men's development of consciousness or conception of those natural and social values, the whole course of human history is characterized by the prevalence of mistakes, contradictions, imperfections and conflicts.

The development of world history also shows that there have been no perfect human civilisations. It is characterized by the mixture of different civilizations (traditional and modern). The dialectics of individual's inner conscious with broader social life, and personal and universal narratives have been shaping major events and directions of world historical changes (Tamdgidi, 2002: 109). Generally, as Dragon (2009: 100) illustrated, world history has been the product of human alienation and reintegration.

The above argument implies that the role played by human agency in determining the direction of world historical events (including virtue) is interplay of objective truth and subjective interpretation of reality. Thus, till human beings are able to reach at the absolute consciousness that enables them to understand absolute or

universal truth, throughout the whole development of human consciousness, some kind of relative conception of truth or morality is inevitable.

At this point, Gandhi's Ethics of Non-Violence encounters two major challenges. First, since the development of human consciousness allows relative conception of reality, men have different moral judgment, which cause divergence, hatred, revenge, and violence to be prevalent. Second, till human beings reach at the point of universal virtuous consciousness or possess the traits of God, Gandhi's project of ethics of non-violence that needs absolute ethical mentality is inapplicable during the time of his non-violent struggle.

On the other hand, Marx had used the law of dialectical materialism to define class struggle /violance or contradiction that exist between the antagonism of the ruling and ruled class through out the development of human history. He analyzed that in all modes of human production, a type of contradictory relationships exist between the ruling class of society (as the thesis) and the lower class (as antithesis) is natural(Shimp, 2009: 37).

Marx's argument implies, the two contradictory realities (thesis and anti-thesis) are necessary for change or development of human history; and at the same time they are destructive of each other. For example, in the capitalist modes of production "A person cannot be a master without a servant and a person cannot be a servant without a master [...] Both a master and a servant can only be defined in relation to each other" (Ibid). But, the movement or struggle of a servant always causes destruction against the master. This contradictory relationship is also true in earlier modes of production. Marx and Engels (1848: 1) wrote:

> *In the earlier epochs of history, we find almost everywhere a complicated arrangement of society into various orders, a manifold gradation of social rank. In ancient Rome we have patricians, knights, plebeians, slaves; in the Middle Ages, feudal lords, vassals, guild masters, journeymen, apprentices, serfs; in almost all of these classes, again, subordinate gradations.*

From the law of dialectical materialism, we can infer that all contradictions throughout the development of human history have been reconciled by resulting more clearly contradictory positions. Those contrad-ictions has been created, due to all systems of thought in each modes of production are inextricably connected with the interest of the social class that controls the material means of existence (Marx , 1844 : 29 and McLellan, 1977: 187 and 91). McLellan (page 188) expressed, in the development of human history, "Every value judgment of right and wrong serves the interests of a particular social class at a given time".

Violence as One Aspect of Moral Subjectivism

In his project of Ethics of Non-Violence, neglecting the influence of material world on the relative and dynamics moral judgment of men, Gandhi had advocated

the possibility of ethical absolutism and spiritualism (Bhikhu, 1999: 6). Practitioners of Ahimsa are required to conduct delicate surgery of soul, to be free from any kind of environmental influence that causes contradiction, mistake and violence to be rampant among human beings. For this goal, Gandhi had kept experimenting all of his life to find ways of doing this delicate surgery (Ibid). However, in the real life situations of men, his ethics of absolutism and spiritualism cannot be practical. Because, human beings have different inner impulse to perceive the composition of their environment. As a result, men possess dynamic and relative conception of what is morally good or bad throughout the development of human history (Mitreanu, 2007: 5-8).

Men's understanding and interpretation of meaning of life or what is good or bad is determined by one's unique abilities (physical and mental), environmental conditions, culture, upbringing, education, continuously learning and all other life experiences (Ibid and Miller, 1984: 356). As a result, although there are universal or objective moral values , morality is mainly relative to the individual person, society, community, nation, culture or even to the whole human race. From the above expression, we can infer that men's moral judgment is determined by the uncontrollable (at least in some extent) and dynamic nature of the world. For example, as to the environmental determinism of human nature or morality, laboratory studies proved that hot temperature increase negative feelings such as aggression, annoyance and anger (G. Green, 1998: 42).

The implication of Mitreanu, Miller, G.Green and Voltaire's argument is, due to men's continuous learning or the influences of social and natural environment, they cannot become absolutely passion-free in thought, speech, and deed; to rise above the opposing events of love and hatred, attachment and repulsion consistently. Thus, the principle of complete self-purification of the heart or mind, which can be achieved through self-devotion, sacrifice, or suppressing of all desires of self-interest and sense's perception is almost ideal.

FINDING AND CONCLUSION

Gandhi had failed to understand the true origin of violent human behavior. His principles and moral attributes of *Ahimsa* are unrealistic. The fact that men learn aggressive behaviors from socio-cultural environment, they have an innate tendency to be violent by nature. Violent behavior of men has significant biological/genetic, evolutionary, psycho-spiritual and dialectical origins. That means, violence is proved to be part of universal human nature that transcends cultures, time, and circumstances.

1. Human aggressive or anti-social behavior is influenced by biological and evolutionary factors such as human anatomy, neural systems, hormones, and man's genetic drive to will to power, survival and reproduction. As a result, Gandhi's project of Ethics of Non-Violence to organize a society free from any kind of aggression, retaliation, revenge and other evil behaviors is contrary to this scientific fact.

2. Violent human nature is also the product and manifestation of evolutionary process. Current bio-archaeological and Paleontological researches proved, throughout the evolution of human species; interpersonal violence that causes pain, injury, homicide and warfare especially among men has been prevalent.

Human violent behavior is transferred from our evolutionary past serving as a means of resisting challenges of nature to facilitate the biological motives of survival and reproduction, not useless as Gandhi had advocated. Thus, violent or bad behaviors of men such as employing force, favoritism to group members, hierarchies, collective identities, fear, enmity, cowardice, hatred, revenge, retaliation, and sexual jealousy have been cultural universals throughout the evolution of man.

3. Psychoanalytic theories contend that some of our actions and ethical behaviors are determined by the unconscious content of our mind. Among human actions and behaviors, aggressive behaviors are determined by unconscious psychic motivations, not by the rational conscious thinking process. As a result, by wisdom or principles of *Ahimsa*, we may not absolutely eliminate negative feelings or bad moral values.

4. The underplaying idea of the dialectical process implies that mankind is separated or alienated from the absolute or moral perfection. Which means, till the logical completion of men's development of consciousness or conception of those natural and social values, the whole course of human history is characterized by the prevalence of mistakes, contradictions, imperfections and conflicts.

At this point, Gandhi's Ethics of Non-Violence encounters two major challenges. First, since the development of human consciousness allows relative conception of reality, men have different moral judgment, which cause divergence, hatred, revenge, and violence to be prevalent. Second, till human beings reach the point of universal virtuous consciousness or possess the traits of God, Gandhi's project of Ethics of Non-Violence that needs absolute ethical mentality is inapplicable during the time of his non-violent struggle.

5. In his project of Ethics of Non-Violence, neglecting the influence of material world on the relative and dynamics moral judgment of men, Gandhi had advocated the possibility of ethical absolutism and spiritualism.

However, in the real life situations of men, his ethics of absolutism and spiritualism cannot be practical. Human beings have different inner impulse to perceive the composition of their environment. As a result, men possess dynamic and relative conception of what is morally good or bad throughout the development of human history. Due to men's continuous learning or the influences of social and natural environment, they cannot become absolutely passion-free in thought, speech, and deed; to rise above the opposing events of love and hatred, attachment and repulsion consistently.

BIBLIOGRAPHY

Books

Baumeister, Roy and Bushman, Brad (2004), Human Nature and Aggressive Motivation: Why Do Cultural Animals Turn Violent? Grenoble Published in Presses Universities Of De Grenoble.

Bahikhu, Parekh (1999), Strengths and Weaknesses of Gandhi's Concept of Non-Violence,

Kingston, Published in Hull University Press.

Buss, David (2001), Human Nature and Culture: An Evolutionary Psychological Perspective, Oxford, Published By Blackwell Publisher.

Donald, Rees (2004), the New Brain Sciences: Perils and Prospects, England, Published By

Cambridge University Press.

Edwards, Paul (1958), Hard and Soft Determinism, Indeterminism and Freedom in the Ages of Modern Science, New York City, New York City University Press.

Farah, Godrej (2011), Gandhi's Corporeal Non-Violence: Ascetics, Warriors, And Ecological Citizenship, California, Published in University of California.

Fai Chen, Hon (2010), Civilization and Competition: Study Societies and State Formation in Late Qing China Hon, Center for Qualitative Social Research, Hong Kong, Published By Yan University.

Finlay, Christopher (2006), Violence and Revolutionary Subjectivity: Marx to Hisek Research Fellow, Dublin, Published By Ucd Greay Institute and Dublin European Institute.

Gramp, William (1965), Economic Liberalism: The Classical World View, Chicago, Random House, Published By University Of Illinois.

Green Russell (1998), Human Aggression; Theories and Implications for Social Policy,

University Of Calfornia, Santa Barbara Academic Press.

Gregg, Richard (1981), The Power Of Non-Violence Wyoming, Published in Primer Of

Company On Planting, Reprinted By Bio-Dynamic Literature.

Hegel, Friedrich (1807), the Phenomology of Mind, Translated by J.B.Baillie (2001),

(Accessible at Black mask Online. Http: //Www. Blackmask.Com Pdf).

Hobbes, Thomas (91651), Leviathan, Ed. M. Oakeshott, Oxford, Published By Blackwell (1946).

Hume, David (1739), Treatise Of Human Nature, Oxford, Published By Calderon Press (1896), Reprinted From The Original Edition in Three Volumes And Edited With An Analytical Index,By L. A. Selby-Binge.

Locke, John (1668), the Second Treatise of Government, Ed. J. W Gough, Oxford, Published By Blackwell.

Machiavelli, Niccolo (1532), The Prince, Translated By W. K. Marriott And Produced By Fable Publishing Of Chico, California. EBook classics at Fable Publishing Company.

Marx, Karl and Engels, Friedrich (1848), the Communist Manifesto: Excerpts from English

Language Edition, Yale, Published By the Yale Avalon Project.

Marx, Karl (1844), Economic and Philosophic Manuscripts, Translated By Martin Milligan

(1959), From the Germany Text, Moscow, Progress Publisher.

Mehta, Stefan and Justin, Carre (2012), Genetic, Hormonal, and Neural Underpinning of Human Aggressive Behavior: Handbook of Nero-

sociology, Chicago, Published by Springer Science and Business Media.

Miller, Ed. L (1984), Questions That Matters: An Invitation To Philosophy, Hill Company,
Published By Mc Graw.

Nietzsche, Friedrich (1887), On the Genealogy of Morals, Nanaimo, Translated by Ian Johnson of Malaspina University College.

Nietzsche, Friedrich (1886),Beyond Good and Evil, Translated by Helen Zimmern, Produced by John Mamoun, Charles Franks, And David Widger (2013), New York, University Of Network City.

Prana, Samhita (2003), Ahimsa: The Practice Of Non-Violence, Brisbane, Australia, Published In Griffith University.

Ramirez, Martin (2002), Hormones And Aggression In Childhood And Adolescence,
Department Of Psychology And Institute for Bio-functional Studies, Madrid, University Of Compultense.

Rousseau, J. J(1762), The Social Contract, Translated By G. D. H. Cole, London, Published by J. M Dent and Sons Ltd (1913).

Sharma, C. Ishwar (1965), Ethical Philosophy Of India, Lincoln, University Of Kebangsaan
Malaysia, Nebrastra Johnson Publishing Company.

Sihra, Karen (2006), Philosophical Contributions Of Gandhi's Ideas On Non-Violence: Research And Practice In Social Sciences ,Vol.2,No.1,Ontario Institute For Studies In Education, University Of Toronto.

Smith, Adam (1759), the Theory of Moral Sentiments (Second Edition), London, Printed For A. Kincaid and J. Bell in Edinburgh.

Tamdgidi, Behrooz (2002), the Dialectics of World History: A Guiding Thread, Khorasan, Iran, Published in the Omar Khayyam Center for Integrative Research in Utopia, Mysticism And Science.

Walker, Phillip (2001), Bio-Archeological Perspective on the History of Violence, Santa Barbara, Published in University of California.

Articles, Journals and Other Documents

Bhaneja, Balwant (2003), Understanding Gandhi's Ahimsa (Non-Violence): Reflection on an Autobiography, the Story of My Experiments with Truth.

Drago, Antonino (2009), Swaraji Hind: the Birth of a New Model of Developmentalism.

Elsevier (2009), Hormones, Brain And Behavior, Published At San Diego Academic Press, 2nd Vol, and Pp.167-203.

Ferguson, Christopher (2009), Natural Born Killers: the Genetic Origins of Extreme Violence.

Finlay, Christopher (2009), Hannah Arendt's Critique of Violence: Thesis Eleven.

Fox, Robin (2005), the Human Nature of Violence: Social Issues Research Center, Originally Presented at an International Conference on Drinking and Public Disorder: Organized By Mcm Research to Largely Non-Academic Audience.

Gandhi, Mahatma (1948), an Autobiography or The Story of My Experiments With Truth, Translated from The Gujarati By Mahadev Desal, Navajivan Publishing House.

Jenkins, Martin (N/A),Examination Of Nietzsche's Doctrine Of Will To Power, Dissertation Submitted In Support Of Fellowship From International Society For Philosophers Journal.

Kashtan, Miki (2006), Non-Violent Communication; Gandian Principles for Every Day Living.

Lal, Vinay (2009), Gandhi's West, The West's Gandhi: New Literary History, Vol.40.

Lester, Kurtz (2005), solving the Qur' anic Paradox.

Mitreanu, Cristian (2007), a Business Relevant View of Human Nature.

Namita, Nimbalkar (2008), Satyagraha as the Gandian Solution to Resolve Conflict (Accessible At Joshi-Bedekar College, Thane/Website:Www.Vpmthane.Org).

Rabstejnek, Carl (N/A), Fear of Success (Accessible www. Houd. Info).

Shimp, Kaleb (2009), Validity of Karl Marx's Theory of Historical Materialism.

Soyler, Tamer (2010), Gandhi, Civilization, Non-Violence and Obama: Journal of Alternative Perspectives in the Social Sciences, Vol.2, No 1,430-445, Humbold University.

Thomas, Jerry (1996), Survival Of The Fittest (Accessible At Www. Decisionanalyst.Com).

Evaluation of Methods for Roots Processing on Removal of Anti-nutritional Factors of Selected Cultivars of Cassava (*Manihot esculenta C.*) Grown in Ethiopia.

[1] Abebe Haile, [2] Negussie Retta and [3] Cherinet Abuye

[1] Hawassa University, College of Agriculture, P.O. Box 5 e-mail: abebe.haile@gmail.com School of Nutrition, Food Science and Technology, Hawassa, Ethiopia

[2] Addis Ababa University, College of Natural Science, Centre for Food Science and Nutrition, P.O. Box 571, Addis Ababa, Ethiopia.

[3]Engine/Save the Children USA, P.O., Box 387, Addis Ababa, Ethiopia

Abstract

Abebe Haile, Negussie Retta and Cherinet Abuye Evaluation of Methods for Roots Processing on Removal of Anti-nutritional Factors of Selected Cultivars of Cassava (Manihot esculenta C.) Grown in Ethiopia. Journal of Science & Development 2(2)2014, 87-100.

Locally grown cassava cultivars were subjected to study the effect of boiling, sun-drying and fermentation processing methods on removal of anti-nutritional factors. The root product flours were analyzed for anti-nutritional factors using standard methods. The data generated were statistically analyzed using statistical package for social scientists (SPSS). Out of the three processing techniques, fermentation of grated cassava roots for 72 hours sufficiently reduced HCN content to safe level (<10 ppm, WHO) of human consumption. The unprocessed cassava root of Gamo cultivar (48.00 ppm) belonged to the category of sweet or non-toxic. Whereas, cultivars of Hayik (78.07 ppm), 28 (83.70 ppm), 44/72-NW (129.20 ppm) and Koree (159.00 ppm) were found to be moderately toxic. Cultivars of 192 (211.17 ppm) and 5538-19 (247.20 ppm) belonged to highly bitter (highly toxic) cultivar too. Reduction in phytate and tannin levels were highest for sun-dried followed by fermented and boiled flours. However, reduction in oxalate contents were highest for fermented followed by boiled and sun-dried flours. The study reveals that the effect of processing methods found to be significant (P<0.05) on removing anti-nutritional factors.

Key words: Cassava, cyanide, phytate, processing methods

INTRODUCTION

Ethiopia with its diverse agro-ecologies and suitable environments, allows the growth of numerous root and tuber crops many parts of the country's smallholder farmers. Cassava (*Manihot esculenta C.*) plant is exotically was introduced to Ethiopia at the middle of nineteenth century (Desalegn, 2007). Cassava is known in Ethiopia in different names such as "Muka Furno (Oromifa)", "Yenchet Boye (Welayitigna)", and "Tesike/Mogo (Koreegna)". Cassava is an essential part of the diet for more than half a billion people in the world, important carbohydrate supply and source of income for farmers in several African countries (Nweke, 2004). However, cassava in

Ethiopia is considered as less important, and was planted at the backyards and farm borders as fences. Moreover, consumption and processing of cassava in the country is in a primitive stage as compared to many African countries.

It is known that cassava-based diets have been associated with two neurological disorders: tropical ataxic neuropathy (TAN) and Konzo. Both occur to people whose diets are largely restricted to high-cyanide cassava. When raw cassava or inadequately processed cassava was consumed different symptoms of health problem happened to the consumer (Banea-Mayambu, et al., 1990). Apart from HCN cassava contains anti-nutrients like tannin, oxalate and phytate which inhibit the absorption of minerals to the body (Paredes-Lopeze, et al., 2006).

For Ethiopians, the consumption of cassava as food is of immense importance and regarded as the food security crop for millions of people. Therefore, this calls for methods for enhancing the nutrient content at the same time reducing the anti-nutrients without adversely affecting the acceptability of the crop. Cassava-based traditional food products could become even more important in feeding additional segments of the increasing Ethiopian population in the future. This study investigates the effect of common processing methods on nutritional quality of cassava roots cultivars grown in Ethiopia.

MATERIALS AND METHODS

Source of materials and study areas

The study cassava samples were collected from Agricultural Research Centre: Western (Jimma), Northern (Hayik) and Southern (Amaro) parts of Ethiopia. The seven cultivars of cassava roots were 12 to 14 months old, and with accession number/local name of 28, 192, 5538-19, 44/72-NW; Gamo (red skin) and Koree (white skin); and Hayik (red skin), taken from Western, Southern and Northern parts of the country, respectively. The cultivars were selected on the bases of most released varieties and highly grown areas of the country. The cassava roots were manually harvested, packed into a sack, and transported within one day to the laboratory of the Centre for Food Science and Nutrition (CFSN), Addis Ababa University (AAU). These studies were carried out in two laboratories. Sample preparation by processing techniques were performed in the CFSN laboratory, AAU. While, all chemical analyses were done in the Ethiopian Public Health Institute (EPHI) former EHNRI laboratory, AA, Ethiopia.

Sample preparation by three common processing methods

Sun-drying

Undamaged and uniformly matured raw fresh cassava tubers were taken and then washed with potable water to remove dirt. The tubers were peeled and manually cut in to pieces on chopping board with a stainless steel knife. The pieces were sun-dried to less than 12 % moisture content (db) using the procedure of Gomez, et al. (1984). The dried chips were ground into flour by electrical grinder (Mouliex, A2424A, France) and then the flour was sieved by 40 mesh size (450 μm) stainless steel sieve (W.S. Tyler Co., Member, Ohio,

USA) packed into polyethylene bags and stored in a cool and dry environment away from sunlight until analysis.

Boiling

Using methods described by Cooke and Maduagwu (1978), the raw fresh cassava roots were peeled, sized and placed into stainless steel pan and boiled for about 45 minutes. The cooked cassava roots were crushed and then sun-dried to less than 12 % moisture content. Furthermore, the dried cassava roots were ground into flour using electrical grinder (Mouliex, A2424A, France), sieved by 40 mesh size (450 μm) stainless steel sieve (W.S. Tyler Co., Member, Ohio, USA), packed in polyethylene bags and stored in a similar manner like sun-dried flour until analysis.

Fermentation

Cassava fermentation was followed the Nigerian traditional cassava roots processing methods (FAO, 1998) with slight modification. Six Kg of each of the tuber roots from the seven cultivars were sorted, peeled, washed with tap water, cut into smaller pieces and grated by electrical grinder. The grated pulps were put into a 1000 mL measuring cylinder and the cylinder was covered with aluminium foil and allowed to ferment naturally (spontaneously) at ambient temperature for 72 hours. After 72 hours of fermentation, the paste was spread over the tray and sun-dried to less than 12 % moisture content (db). The sun-dried paste was milled by electrical grinder (Mouliex, A2424A, France), sieved by 40 mesh size (450 μm) stainless steel sieve (W.S. Tyler Co., Member, Ohio, USA), packed and stored in similar manner like other samples.

Chemicals and Reagents

All chemicals and reagents used in laboratory analyses were of analytical grade or A.C.S. reagents.

Anti-nutritional Factors Determination

Total Cyanide Content

The total cyanide content of the raw cassava roots sample was analyzed using hydrolysis according to the procedure of Bradbury, et al. (1991) and the flour sample was analyzed by Picrate kit (Bradbury, et al., 1999). The absorbance of the solution was measured at 510 nm and the total cyanide content in ppm was calculated by multiplying with 396.

Phytate Content

Phytate content of the unprocessed and processed cassava flour samples were determined according to the procedure of Latta and Eskin (1980) as phytic acid.

Tannin Content

The tannin content of the unprocessed and processed flour of cassava root was determined according to Maxson and Rooney (1972).

Oxalate Content

The oxalate content was determined using the method of Ukpabi and Ejidoh (1989) which involves digestion, oxalate precipitation and permanganate titration.

Statistical Analysis

Analysis of the different parameters was computed using statistical package for social scientists (SPSS, ver. 16). Data were analyzed using two-way analysis of variance (ANOVA) based on the standard method for factorial experiment as described by Steele and Torrie (1980). Differences between means was found using Duncan's Multiple Range Test ($P < 0.05$).

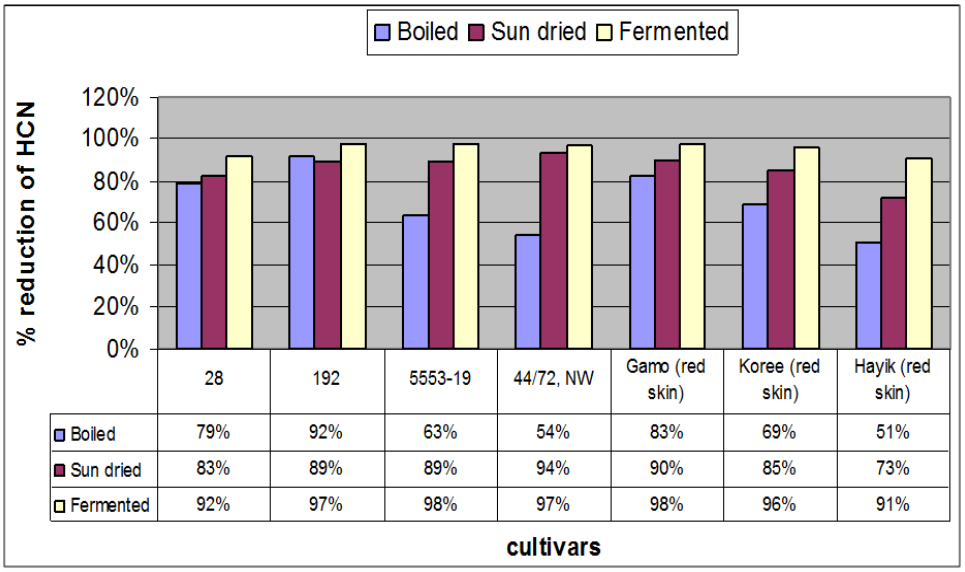
RESULTS AND DISCUSSION

Effect of common processing methods on anti-nutritional factors

Total cyanide content

The result Table 1 shows the total cyanide values for the marginal means were 136.62, 39.91, 17.44 and 4.93 ppm, for the raw, boiled, sun-dried and fermented flours, respectively. The highest and lowest level of the cell means total cyanide obtained for boiled 5538-19 cultivar (90.33 ± 0.25 ppm) and fermented Gamo cultivar (1.09 ± 0.07 ppm), respectively. The total cyanide levels of commonly processed cassava roots flour was significantly varied ($P<0.05$) to each other. The Interaction of cultivars and processing methods, cultivars and processing effects are found to be significant ($P<0.05$). The pattern of total cyanide reduction was observed in the fermentation, followed by sun-dried and boiled. Of the three processing methods, fermentation significantly reduced the cyanide content ($P<0.05$) having the value below the recommended safe level value (10ppm) HCN, dwb (WHO 1991). This limit has been questioned because it was established with HCN as gas through inhalation instead of ingestion. Ramalho, et al. (2007) reported an experiment in which it is used linamarin extracted from cassava and given orally to mice. In such experiment the lethal dose (LD_{50}) was 324.86 ppm linamarin for body weight, a value three times higher than that recommend by WHO. The present study result of all fermented cassava roots flour is not associated with acute toxicity. Furthermore, it was observed to be below the lethal dose for humans' intake by mouth (0.5-3.5 mg/kg body weight for a 60 kg adult) which amount to 30-210 mg HCN (Montgomery, 1980; Solomonson, 1981). While in other processing methods the total cyanide cell means levels are above 10 ppm except for the two cultivars 192 (sun drying=8.27 ppm) and Gamo (sun-drying=4.60 ppm; boiling=8.23 ppm) which are less than recommended value (10ppm) of WHO. This might be due to the soil condition and genotypic difference. The cyanide level of the seven cultivars of sun-dried results (4.60 - 26.84 ppm) are in between for the 5 genotypes oven dried results observed value (8.33 - 28.8 ppm) reported by Charles, et al. (2005).

The total cyanide content of unprocessed cassava roots of the seven cultivars was ranged from 48.00 to 247.20 ppm. The unprocessed cassava roots of Gamo cultivar (48.00 ± 1.10 ppm) which belong to category of sweet, which is defined as having low cyanide content value (<50 ppm), and thus is non-toxic. The cassava roots having cyanide content of 50 to 200 ppm belongs to the bitter (moderately toxic) categories such as cultivars of Hayik (78.07 ± 0.16 ppm), 28 (83.70 ± 0.40 ppm), 44/72-NW (129.20 ± 0.18 ppm) and Koree (159.00 ± 1.07 ppm). Cultivars of 192 (211.17 ± 1.04 ppm) and 5538-19 (247.20 ± 0.40 ppm) belong to highly bitter (highly toxic) cultivar, according to the cassava toxicity category (Bourdoux, 1982). The seven unprocessed cultivars result show high variability of HCN content in cassava roots, this might be due to genotypic difference and others. The maximum and minimum percentage reduction was observed to be for fermented cultivars of Gamo and 5553-19 (98 %), and boiled cultivar Hayik (51 %), respectively (Figure1).



	28	192	5553-19	44/72, NW	Gamo (red skin)	Koree (red skin)	Hayik (red skin)
Boiled	79%	92%	63%	54%	83%	69%	51%
Sun dried	83%	89%	89%	94%	90%	85%	73%
Fermented	92%	97%	98%	97%	98%	96%	91%

Figure 1. Effect of processing techniques on percentage reduction of total cyanide in cassava root flours.

Phytate, tannin and oxalate levels

Phytate The phytate, tannin and oxalate levels obtained from seven cassava roots cultivars and common processing methods are indicated in Table 2. The interaction effect due to processing methods and cultivars were found to be significant ($P<0.05$). Similarly, the cultivars and processing effects were significant ($P<0.05$). The marginal means of phytate levels of processed cassava roots flour was found to be in the values of 655.15, 403.80 and 425.80 mg/100 g, for the boiled, sun-dried and fermented flours, respectively. The marginal means of processing methods over levels of cultivars are significantly ($P<0.05$) different with the mean for processed sun-dried (403.80 mg/100 g) being the lowest followed fermented and boiled. The mean phytate level was highest for boiled cultivar of Gamo (910.66 mg/100 g) followed by Koree (818.70 mg/100 g) and the lowest belongs to fermented cultivar 44/72-NW (108.57 mg/100 g). The marginal means of cultivars over levels of processing methods are significantly ($P<0.05$) different with the cultivar Hayik (269 mg/100 g) being the lowest. The cell mean phytate content of processed cassava flour was significantly different ($P<0.05$) from one another except for the phytate content of boiled (44/72-NW) and sun-dried (Hayik). The complexing of phytate with nutritionally essential elements and the possibility of interference with protolytic digestion have been suggested as responsible for anti-nutritional activity. One of the factors is the presence of phytate, which is negatively charged phosphate compound that binds minerals and inhibits absorption (Howarth, et al., 2001). The variability of phytate content in cassava roots is not only due to cultivars factors but also it might be due to the total phosphorous content, found in soil

and fertilizers, which can influence the phytic acid concentration (Maga, 1980). The phytate contents of seven unprocessed cassava roots varieties presented in this investigation are found to be higher than the phytate content values (253 - 624 mg/100 g) of cassava roots reported by Oke (1990); Edeogu and Ekuma (2007). Among the processing methods, sun-drying and fermentation are appeared to be effective to reduce the phytate levels, when compared to the boiling. The decrease in the phytate content of the fermented cassava flour for all the seven cultivars could possibly be attributed to the secretion of the enzyme phytase. This enzyme is capable of hydrolyzing phytate, thereby decreasing the phytate content of the cassava flour (Nwokoro, et al., 2005)**.** The high content of phytate of nutritional significance is lowering the availability of many other essential dietary minerals. Thus, reduction of phytate is expected to enhance the bioavailability of dietary minerals of the cassava (Siddhuraju and Becker, 2001).

Table 1. Total cyanide levels in seven cassava cultivars roots of raw and processed in to three different methods (in ppm).

[1]Results are mean values of three replicates ± SD, *****- Interactions significant at P < 0.05, [1] means with the same letters within a

Tres[1, 2]	Cultivars*										
	28	192	5538-19	44/72-NW	Gamo (red skin)	Koree (white skin)	Hayik (red skin)	Marginal means	P of cultivar	P of Proc. method	P of cultivar x Proc. method
Raw	**83.7 ± 0.40d**	**129.2 ± 0.18d**	**247.2 ± 0.4d**	**211 ± 0.104d**	**48 ± 1.10d**	**159 ± 1.07d**	**78.07 ± 0.16d**	**136.61**	**	**	**
Boiled	**17.58 ± 0.56c**	**16.26 ± 0.06c**	**90.33 ± 0.25c**	**59.17 ± 0.20c**	**8.23 ± 0.18c**	**49.77 ± 0.75c**	**38 ± 0.12c**	**39.90**			
Sun-dried	**14.20 ± 0.74b**	**8.27 ± 0.41b**	**26.78 ± 0.82b**	**23.34 ± 0.33b**	**4.60 ± 0.41b**	**23.45 ± 0.65b**	**21.45 ± 0.58b**	**17.44**			
Fermented	**6.57 ± 0.30a**	**3.39 ± 0.18a**	**5.19 ± 0.15a**	**5.37 ± 0.49a**	**1.09 ± 0.07a**	**6.20 ± 0.11a**	**6.70 ± 0.43a**	**4.93**			
Marginal means	**30.51**	**50.01**	**92.37**	**64.03**	**15.48**	**59.60**	**36.05**				

column are not significantly different with a<b<c<d (P>0.05), [2] tres - treatments/processing methods, * - accession number/name of cultivars,******- Interactions significant at P<0.05.

Tannin The results shown in Table 2 signify that the tannin level of processed cassava roots cultivars of boiled, fermented and all of the sun-dried flours was obtained below the detectable limit. However, the marginal means of tannin level of boiled three cultivars (28, 192 and 5538-19) and fermented two cultivars (192 and 5538-19) of cassava roots flour were found to be 4.37 and 4.16 mg/100 g, respectively. In those cultivars, tannins were not completely removed during fermentation and boiling, which might be due to the genotypic difference, environmental or combination effects. The mean tannin level of unprocessed cassava root flours was found to be 66.89 mg/100 g. The observed tannin content of unprocessed cassava root is different from that reported (Sarkiyayi and Agar, 2010), whose values are 0.40 and 0.6 mg/100 g for sweet and bitter cassava, respectively. The tannin content of the study is lower than that of rice value (513 - 572 mg/100 g) reported by Saikia (1999). The presence of tannins can cause browning problems in both fresh food and processed products, and they act as anti-nutritional factor by provoking an astringent reaction in the mouth there by making the food unpalatable, they also form complex with proteins, precipitate proteins in the gut, inhibits digestive enzymes and microorganisms (Oboh and Elusiyan, 2007). This has nutritional implication for both human and livestock in that there is damage to the intestinal tract through absorption of tannic acid toxicity in the gut, also interference with the absorption of iron and a possible carcinogenic effect (Onimawo and Akubor, 2005). **Oxalate** The result Table 2 shows the marginal means of raw and processed cassava roots flour oxalate levels were found to be in the values of 27.16, 17.75, 18.13 and 10.28 mg/100 g for the raw, boiled, sun-dried and fermented flours, respectively. The effects of cultivars and processing methods were found to be significant ($P<0.05$). Similarly, the interaction of cultivars and processing methods was significant ($P<0.05$). The three common processing techniques are found to be effective in reducing the oxalate levels of seven cassava root cultivars. The ingestion of oxalic acid cause series health problem due to formation of calcium oxalate which is insoluble at physiological pH and can be deposited in the brain and kidney tubules. The lethal dose for oxalates in adults is estimated to be 143 - 428 mg/kg (Libert and Franceschi, 1987). The highest marginal means oxalate levels reduction are found to be for fermented followed by boiled and sun-dried flours. The possible reason to the observed high reduction in oxalate level is due to both fermentation and boiling cause considerable cell rupture and facilitate the leakage of soluble oxalate into fermenting and cooking water (Albihn and Savage, 2001). These average oxalate level variation observed is much higher than the range reported in previous study value (1.35 - 2.88 mg/100 g) for leaves (Correa, 2000; Wobeto, et al., 2007). The processed cultivars flour has shown significant ($P<0.05$) variability in cell means oxalate levels except for the cultivar Hayik (13.04 ± 0.06 mg/100 g). Whereas, the highest and lowest cell means oxalate levels found were 30.63 ± 0.21 and 19.81 ± 0.26 mg/100 g flour in Koree and 192 unprocessed cassava cultivars, respectively.

Table 2. Raw and processed cassava root cultivars flour phytate, tannin and oxalate levels in mg/100 g.

Pars[1]	Tres[2]	Cultivars*										
		28	192	5538 -19	44/72-NW	Gamo (red skin)	Koree (white skin)	Hayik (red skin)	Marginal means	P o C	Po Pm	P o C x Pms
Phytate	Raw	724.98 ± 23.80d	741.84 ± 44.10d	871.53 ± 23.15d	622.24 ± 11.10c	1087.38 ± 21.68d	.868.33 ± 5.25d	711.34 ± 0.69c	803.95	**	**	**
	Boiled	547.74 ± 26.47c	506.80 ± 28.47a	.154.55 ± 21.35a	526.13 ± 28.75b	910.66 ± 0.40c	818.7 ± 1.56c	121.47 ± 0.54a	655.15			
	Sun-dried	137.76 ± 0.02a	569.82 ± 7.00b	225.88 ± 35.14b	535.21 ± 9.60c	713.32 ± 0.57b	521.70 ± 0.51b	122.91 ± 0.21b	403.80			
	Fermented	518.38 ±103.56b	720.41 ± 0.00c	745.57 ± 14.01c	108.57 ± 2.10a	611.79 ± 0.21a	153.78 ± 0.60a	122.13 ± 0.97b	425.80			
Marginal means		482.22	634.72	749.38	448.04	830.79	590.63	269.46				
Tannin	Raw	73.54 ± 0.00b	74.18 ± 4.40c	87.15 ± 2.31c	62.22 ± 1.10	47.74 ± 1.09	57.83 ± 0.11	65.58 ± 0.41	66.89	**	**	**
	Boiled	14.59 ± 0.47a	3.88 ± 0.97a	12.12 ± 0.37a	Nd^C	Nd^C	Nd^C	Nd^C	4.37			
	Sun-dried	Nd^C	Nd^C	Nd^C	Nd^C	Nd^C	Nd^C	Nd^C	-			
	Fermented	Nd^C	4.82 ± 1.60b	24.32 ± 4.03b	Nd^C	Nd^C	Nd^C	Nd^C	4.16			
Marginal means		22.03	20.83	30.81	15.56	11.93	14.46	16.39				
Oxalate	Raw	27.84 ± 0.50d	19.81 ± 0.26d	26.70 ± 0.29d	29.99 ± 0.24d	25.11 ± 0.28d	30.63 ± 0.21d	30.05 ± 0.34b	27.16	**	**	**
	Boiled	13.61 ± 0.22b	10.63 ± 0.21b	21.20 ± 0.21c	24.34 ± 0.00b	12.49 ± 0.40a	29.00 ± 0.01c	13.04 ± 0.06a	17.75			
	Sun-	16.31 ±	17.99 ±	16.03 ±	27.29 ±	18.15 ±	18.01 ±	13.07 ±	18.13			

dried	0.24c	0.24c	0.25b	0.26c	0.16c	0.05a	0.08a				
Fermented	7.14 ± 0.51a	4.14 ± 0.53a	3.35 ± 0.02a	3.18 ± 0.00a	15.04 ± 0.08b	26.00 ± 0.12b	13.10 ± 0.11a	10.28			
Margina means	16.22	13.09	16.62	21.20	17.70	27.91	17.31				

[1]Results were mean values of triplicate determination (dwb) ± SD, PoC - P of cultivar, PoPm - P of processing methods, PoC x Pms – P of cultivar x processing methods, [1]means with the same letters within a column of respective group of parameters are not significantly different with a<b<c<d (P>0.05),

[2] Trets-treatments, [1]Pars-parameters, *- accession number of cultivars, Nd^{C} -below detectable limit (Nd taken as=0 value), **- Interactions significant (P < 0.05).

CONCLUSIONS AND RECOMMENDATION

All processing methods enhanced the availability of nutrients in cassava by decreasing the anti-nutritional factors including cyanide, phytate, tannin and oxalate. Among the anti-nutritional factors analyzed, the low content of tannins in the three processing techniques of the seven cassava root cultivars is one good advantage for consumers of cassava in terms of inhibitory effect of tannin on nutrient availability. Out of the three common processing methods, fermentation of the cassava roots flour sufficiently reduced toxic cyanide (HCN) content to a safe level of human consumption (<10 ppm, FAO) compared to other methods.

Organized public information regarding removal of anti-nutritional factors by processing methods should be promoted to consumer.

Acknowledgements

We would like to thank Addis Ababa University (AAU), Hawassa University (HU) & Agri-service Ethiopia (ASE) for financial support, EPHI (former EHNRI) for giving me service in laboratory analysis, and Dr. Haward Bradbury of the National University of Australia is duly acknowledged for his kind provision of the cassava cyanide kits free of charge. The experiment was conducted as part of PhD study of the first author at Centre for Food Science and Nutrition, College of Natural Science, AAU.

REFERENCES

Albihn, P.B. and Savage, G.P. 2001. The effect of cooking on the location and concentration of oxalate in three cultivars of New Zealand-grown oca (Oxalis tuberosa Mol). *Journal of the Science of Food and Agriculture*, 81: 1027-1033.

Banea-Mayambu, J.P., Tylleskar, T., Gitebo, N., Matadi, N., Gebremedhin, M. and Rosling, H. 1990. Geographical and seasonal association between linamerin and cyanide exposure from cassava and the upper motor spastic paraparesis in Mozambique. *Journal of Tropical Medicine Hygiene*, 93: 257-261.

Bourdoux, P., Seghers, P., Mafuta, M., Vanderpas, J., Vanderpas-Rivera, M., Delange, F. and Ermans, A.M. 1982. Cassava products: HCN content and detoxification processes. In: *nutritional factors involved in the goitrogenic action of cassava*, (Pp. 51-58), Delange, F., Iteke, F.B. and Ermans, A.M. (Eds.). IDRC, Ottawa, Canada.

Bradbury, H.J., Egan, S.V. and Lynch, M.J. 1991. Cassava toxicity and food security: analysis of cyanide in cassava using acid hydrolysis of cyanogenic glycosides. *Journal of*

the Science of Food and Agriculture, 55: 277-290.

Bradbury, M.G., Egan, S.V. and Bradbury, J.H. 1999. Picrate paper kits for determination of total cyanogens in cassava roots and all forms of cyanogens in cassava products. *Journal of the Science of Food and Agriculture*, 79: 593-601.

Charles, A.L., Sriroth, K. and Tzou-chi H. 2005. Proximate composition, mineral contents, hydrogen cyanide and phytic acid of 5 cassava genotypes, Food chemistry, (92)4: 615-620

Cooke, R.D. and Maduagwu, E.N. 1978. The effect of simple processing on the cyanide content of cassava chips. *Journal of Food Technology*, 13: 299 - 306.

Correa, A.D. 2000. Farinha de folhas de mandioca (*Manihot esculenta Crantz cv. Baiana*) efeito de processamentos sobre alguns nutrientes e antinutrientes. 2000, 108 f. Tese (Doutorado em Ciência de Alimentos)-Universidade Federal de Lavras, Lavras.

Desalegn Tassew 2007. Dynamics of agro-ecological knowledge in Amaro special Wereda, Southern Ethiopia, MSc thesis, Haramaya University, Ethiopia.

Edeogu, C.O. and Ekuma, C.E. 2007. Anti-nutrients level in staple food crops in Nigeria. *Research Journal of Environmental Sciences*, 1: 302-309.

FAO 1991. Joint FAO/WHO food standards programme, Codex Alimentarius Commission XII (Suppl. 4), FAO, Rome.

FAO 1998. Processing of Roots and Tubers In: Storage and Processing of Roots and Tubers in Tropics: Agriculture and Consumer Protection paper. Available at

http://www.fao.org/docrep/x5415e/x5415e05.htm#5.1.2.i. Accessed on October, 2013.

Gomez, G., Valdreso, M., Dela Cuesta, D. and Salcedo, T.S. 1984. Effect of variety and plant age on the cyanide content of whole root cassava chips and its reduction by sun drying. *Journal of Food Science and Agricultural Chemistry*, 11: 57-65.

Howarth, N.C., Saltzman, E. and Roberts, S.B. 2001. Dietary fibre and weight regulation. *Nutritional Review*, 59: 129-39.
http://www.ias.unu.edu/proceedings/icibs. Accessed on 3, June, 2009.

Latta, M. and Eskin, M. (1980). A simple and rapid colorimetric determination of phytate determination, *Journal of Agricultural Food Chemistry*, 28: 1313-1315.

Libert, B. and Franceschi, V.R. 1987. Oxalate in crop plants. *Journal of Agricultural Food Chemistry*, 35: 926 - 937.

Maga, J. (1980). Phytate: its chemistry, occurrence, food interactions, nutritional significance and methods of analysis. *Journal of Agricultural Food Chemistry*, 30: 1-9.

Maxon, E.D. and Rooney, L.W. 1972. Evaluation of method for tannin analysis in sorghum grain. *Cereal chemistry*, 49:719-729.

Montgomery, R.D., Cyanogens, In: Liener I.E ed. Toxic constituents of plant foodstuffs New York, Academic Press, 1980, 149-160.

Nweke, F.I., New Challenges in the Cassava Transformation in Nigeria and Ghana, Paper presented at the NEPAD/IGAD regional conference "Agricultural Successes in the Greater Hornbof Africa", Environment and Production Technology Division, International Food Policy Research Institute Discussion Paper No. 118, 2004.

Nwokoro, S.O., Adegunloye, H.D. and Ikhinmwin, A.F. 2005. Nutritional composition of garri sievates collected from some locations in Southern Nigeria. Pakistan Journal of Nutrition, 4(4): 257-261.

Oboh, G.L. and Elusiyan, C.A. 2007. Changes in the nutrient and anti-nutrient content of micro-fungi fermented cassava flour produced from low- and medium-cyanide variety of cassava tubers. *African Journal of Biology*, 6(18): 2150-2157.

Oke, O.L. 1990. Roots, tubers, plantations and bananas in human nutrition. FAO Food and Nutrition Series, Rome.

Onimawo, I.A. and Akubor, P.I. 2005. Food Chemistry. In: *integrated approach with biochemical background.* AMBIK Press, Benin City, Nigeria. Pp. 157-167.

Paredes-Lopez, O. and Osuna-Castro, J.A., Molecular Biotechnology for Naturaceutical Enrichment of Food Crops: The case of minerals and vitamins, In: Food Biotechnology (Shetty K, Paliyath G, Pometto A, Levin, R.E editors), 2nd ed, RCC, Taylor & Francis, Boca Raton, Akure, Ondo State, Nigeria, 2006, 735-770.

Ramalho, R.T., Lopes, A.M. and Cereda, M.P. 2007. Oral lethal dose evaluation (DL50) of linamarin extracted from cassava in rats. In: *Brazilian Journal of Toxicology*, ISSN 1415-2983. In: CONGRESSO BRASILEIRO DE TOXICOLOGIA. Búzios, V. 20, additional no 3, Pp. 145. (in Portuguese).

Saikia, P., Sarkar, C.R. and Borua, I. 1999. Chemical composition, anti-nutritional factors and effect of cooking on nutritional quality of rice bean [*Vigna umbellate (Thunb; Ohwi and Ohashi*)]. *Journal of Food Chemistry*, 67: 347-352.

Sarkiyayi, S. and Agar, T.M. 2010. Comparative analysis on the nutritional and anti-nutritional contents of the sweet and bitter cassava varieties. *Advanced Journal of Food Science and Technology*, 2(6): 328-334.

Siddhuraju, P. and Beckerm, K. 2001. Effect of various domestic processing methods on anti nutrients and in vitro-protein and starch digestibility of two indigenous varieties of Indian pulses, Mucuna pruries varutilis. *Journal of Agriculture and Food Chemistry*, 49: 3058-3067.

Solomonson LP, "Cyanide as a metabolic inhibitor", in Vennesland, B.(Eds), *Cyanide in Biology*, Academic Press, London, 1981, 11-28.

Steele, R.G.D. and Torrie, T.H. Principles and procedures of statistics: A biometrical approach. 2nd ed. McGraw-Hill, New York, 1980.

Ukpabi and Ejidoh, Effect of Deep Oil Frying on Oxalates Contents and Degree of Itching of Cocoyam, In: Experimental Procedures for Food and Water analysis, F.O. Odo and

C.N Istiwu (ed). Computer Edge Publishers, 1989, 84-88.

White, W.L.B., McMahon, J.M. and Sayre, R.T. 1994. Regulation of cyanogenesis in cassava. *Acta Horticulture*, 375: 69-77.

Wobeto, C., Correa, A.D., De-Abrnu, C.M.P., Dos-Santos, C.D. and Pereira, H.V. 2007. Anti-nutrients in the cassava (*Manihot esculenta C.*) leaf powder at three ages of the plant. C*ienc and Technologia de alimentos,* 27: 108-112.

Indigenous Democracy: Alternative Conflict Management Mechanisms Among Tigray People, The Experiences of Erob, Community

Solomon Berhane
College of Social Sciences and Languages, Aksum University, Ethiopia, Aksum University, P.O. Box 1010, Email: solberhane@gmail.com

ABSTRACT
Solomon Berhane Indigenous Democracy: Alternative Conflict Management Mechanisms Among Tigray People, The Experiences of Erob, Community, Journal of Scince & Development 2(2) 2014, 101-122

The objective of this study was to explore how one of the communities in Northern Ethiopia, the Erob, deals with conflict using indigenous mechanism for the management of conflict and for examining how effective the mechanism is. The research design that the researcher employed was a qualitative approach particularly phenomenological. In doing so, I used three data collection tools such as semi-structured interview, focus group discussion and document analysis. The collected data were transcribed, organized, coded and categorized into themes and sub-themes based on the research objectives. Accordingly, the finding of the study revealed that regarding the conception of conflict, the participants of the study have different perceptions. Though most of the participants viewed conflict as inevitable and natural which could prevail in any society, on the contrary, few of them viewed it as bad and destructive. The types of conflicts presented and resolved in the study community are inter-personal, inter-group and inter-ethnic in nature which stemmed from competition over resources, violation of social values, drunkenness and extra sexual relationship with married women and unmarried girls. The findings further show the role and participation of women in the indigenous conflict management mechanism. Thus, the role and participation of women in the system is low and insignificant. The procedures (methods) of conflict management used by the study community vary depending on the nature and types of conflicts. Moreover, the findings of this study revealed that accessibility, restorative capacity, revealing crime committed under cover and acceptability as a major strengths of the system. On the contrary, economic extravagancy, time consuming or prolongation of appointments and exclusion of women from participation in conflict management are identified as the most glaring weaknesses of the system. Based on the above findings, sharing experiences with other communities and ethnic groups, challenging gender inequality, building institutional linkages between the formal court and the indigenous institutions, encouraging reform of the system regardingeconomic extravagancy and prolongation of appointments were forwarded as recommendations.

Key words: Democracy Indigenous Management Conflict

INTRODUCTION

Conflict has been studied by different scholars over the past centuries. However, still now there is no agreement upon the definition of the term. This is because; conflict vary considerably depending on the culture of a given society. As to Fisher (2000) conflict is defined as an incompatibility of goals or values between two or more parties in a relationship, combined with attempts to control each other and antagonistic feelings towards each other. Similarly, Mesfin (1999) stated that, conflict is a practice of disagreement on public issues that affect the lives of groups, essentially about means and ends regarding their mutual relationships, their diverse interests, their different values, their institutions and organizations. Rahim (1992) has also defined conflict as a process of social interaction involving a struggle over claims to resources, power and status, beliefs and other preferences. On the other hand, Chandan (1995) defined conflict as a disagreement between or among two or more nations, individuals, groups and organizations trying to gain acceptance of one's views or objectives over the other.

Generally, based on the above arguments conflict could be conceptualized as contradiction or disagreement between two or more parties arising from misunderstandings, competition for resource, power and prestige. Conflict takes various forms. That is, its nature varies substantially ranging from peaceful expression of grievance to outright use of physical force or violence. More specifically, depending on the prevailing circumstances, the parties involved in the conflict and the means preferred to settle disputes or conflict varies from relatively peaceful institutionalized ethnic conflict to violent struggle, civil war, and ethnic cleansing (Hussein, 2005).In other words, conflict is classified as destructive and constructive.

Constructive conflicts open up an issue in a confronting manner, develop clarification of an issue, improve problem solving equality, increase involvement, and provide more spontaneity in communication, initiate growth and strengthen a relationship and increase productivity (Ratzburg cited in Birhanu, 2010). Moreover, in a constructive conflict resolution, partners focus on current rather than past issues, share both positive and negative feelings, provide information in an open manner, accept mutual blame and search for similarities . Both partners win and as a result intimacy increases and trust grows in the relationship (Olsen &Defrain, 2000).

On the other hand, destructive conflicts divert energy from real task, destroy morale, polarize individuals and groups and deepen differences, obstruct cooperative actions, produce irresponsible behaviors, create suspicious and distrust decrease productivity (Ratzburg cited in Birhanu, 2010). As to Olsen &Defrain (2000), in destructive approaches to conflict resolution, partner bring up old issues, express only negative feelings, reveal selective information, focus on people rather than on issues and emphasize differences all with the goal of minimizing change. There are also some scholars who refrain from generalizing conflict as constructive and destructive .They prefer to take the neutral position. For example, Shellemberg (1996) indicated that we are more likely to be rewarded in our study of conflict if we can approach the subject

with a neutral attitude assuming conflict is neither something inherited good nor bad.

The basic assumption of the social frame of reference is that conflict is natural and inevitable in all human interaction. Because of the wide range of potential differences among people, the absence of conflict usually signals the absence of meaningful interaction. However, the manner in which conflict is handled determines whether it is constructive or destructive (Eshleman& Wilson, 1995).Similarly, as to Predence and Larry (2002), conflict is inevitable in any ongoing relationship, it happens whether we want it or not. Many of us, however, view conflict negatively. Conflict by itself, nevertheless, is not positive or negative. It is how we manage it that can have positive or negative consequences for our relationship.

Generally, from the above arguments on the constructive and destructive nature of conflict, one can understand that conflict is neither always constructive nor destructive. Conflict management is the process of reducing the negative and destructive capacity of conflicts through a number of measures and by working with and through the parties involved in the conflict (Best, 2004). Best added that the term conflict management is perhaps an admission of the reality that conflict is inevitable, but that all conflict can always be resolved; therefore, what practitioners can do is to manage and regulate them. The existing body of literature confirms that the nature and causes of conflicts and the mechanism for resolving them are deeply rooted in the culture and history of every society. While conflict is universal, the ways in which it is expressed and handled are not. If we are to learn how to deal with conflict effectively (our own and others), it is necessary for us to understand our cultural assumptions about conflict and conflict resolution mechanisms (Kifle, 2007).

Ethiopia is a country in which various ethnic groups live together. Each ethnic group has its own way of resolving conflicts. Different communities have distinct traditional settings and relationships, where a customary mechanism could play a significant role in resolving and preventing violent conflicts (Mellese, 2008). Ambaye (2008) stated that there are customary mechanisms of conflict resolution, which are most often ignored or abandoned with the rise of "modernity". Despite their wide spread use, the customary conflict mechanisms have been received surprisingly little attention by Ethiopian researchers. Traditional approaches of management vary considerably from society to society, from region to region and from community to community. There are many customary approaches to conflict resolution mechanisms, as there are different societies and communities with a specific customs in the world (Yasin, 2010). Thus, this paper will try to investigate the indigenous mechanisms of conflict management in Tigray Regional State, particularly in Erob community.

STATEMENT OF THE PROBLEM

Ethiopian societies apply different customary mechanisms to resolve or manage the diverse forms of conflict that arise within their ethnic groups or nearby

communities. Supporting this idea, Ephraim in Tarekegn, 2008 reported that throughout Ethiopia, among the ArsiOromo (*Jarsabiyya*), the Amhara (*Yeager- Shimagle*), theGurage(Yejewoka*Shengo*), the Wolayata(*DeiraCimma*) and other linguistic or Ethnic groups looked up to and their role in reconciliation is highly regarded. The issue of conflict and its resolution is further elaborated by referring to practical examples from the different nations and nationalities of Ethiopia. For example, Tsega (2005) conducted his study on Luba- Basa and Harama- Hodha: Traditional Mechanisms for conflict Resolution in Metekel, west Gojam.The word Luba-Basa is translated as liberating or making free while the word Harma-Hodha refers to sucking at the breast. The writer in his finding showed that, if refurbished, these institutions can be of a paramount importance to policy makers and practitioners. He further added these institutions are intra as well as inter-ethnic conflict resolution principles and are widely applied in many parts of Ethiopia and can even meet demands outside Africa.

Similarly, a research carried out by Uthman (2008) on the role of the Abegar (Divine father) in conflict resolution the case of Northern Wollo indicated that the Abegar institutions utilize a great variety of schemes and approaches for inter-personal or inter-group compromise for sustainable solutions to conflicts as it is not a top down approach but rather bottom up. On top this, indigenous conflict management mechanisms are by far a better alternative for conflict management. This is because at national level the formal court structures are often unable to provide access to justice for the disputants timely. In response to these and other related problems, different ethnic groups or communities develop their own systems as a way of handling conflicts. For example, among the Tigrians in general and Erob community in particular, there were and still are indigenous mechanisms of conflict management techniques. The ability to successfully manage conflict within one self and between persons reduces antagonism, disagreement and dislike. How a person manages his inner conflict has a direct impact on how he/she lives and deals with others. Tsegay (2003) in his study on "Ethno-Historical Survey of the ErobAgri-pastoralists'' pointed out that Erob had self-contained conflict management that sustained local inter-communal relations for centuries. He added indigenous dispute settlement among the Erob is a crucial research theme that requires thorough investigation. Yet, no comprehensive research is done about the indigenous conflict management mechanism practiced among the community. Reasonably, in this study, given the aforementioned points, the following objectives will be addressed.

OBJECTIVES OF THE STUDY

The study has the following general and specific objectives:

General Objective

The general objective of this research is to investigate the nature of conflicts and their indigenous management mechanisms among Erob community members.

Specific objectives

- To identify the root causes of conflict among Erob community.
- To explore the types of conflict mostly arising with in Erob community.
- To describe the indigenous conflict management methods that the community members employ in reconciling the disputing individuals, families and groups.
- To assess the role of women in managing conflict.
- To investigate the relationship between the indigenous mechanisms of conflict management and the formal court system.
- To explore the strengths and possible limitations of the indigenous conflict management mechanisms practiced by the community.

RESEARCH METHOD

Design of the Study

The research design that I employed was a qualitative approach particularly phenomenological which aimed at exploring the potential causes of conflict, levels (types) of conflicts, indigenous mechanisms of conflict management styles and their procedures. The main reason that initiated the researcher to use qualitative approach particularly phenomenological was to get in-depth and rich information about Erobs's indigenous conflict management mechanism. As to Creswell (2009) phenomenological approach is a strategy of inquiry in which the researcher identifies the essence of human experiences about a phenomenon as described by participants. Understanding the lived experiences makes phenomenology as a philosophy as well as a method and the procedure involves studding a small number of subjects through extensive and prolonged engagement.

Study Area

This study was conducted in Erob community, which is found in Tigray Regional State, Eastern Zone, ErobWoreda. ErobWoreda is located 947 Kilometers to the North of Addis Ababa or 167 north of Mekelle. It is bordered on the South by Saesi-thaedaemba, on the North and Northeast by Shemezana (Eritrea) and Indeli River, Afar region in the east and GulemekedaWoreda in its southwest.

Population And Sampling Procedures

Although the study area consists of 25,862 people, the population of this study only includes those members of the community aging 18 and above. This is because, it is assumed that the members of the community who are under the prescribed age have no detail knowledge and experience regarding conflict and its indigenous management mechanisms. Furthermore, since it is difficult to include all members of the community aging 18 and above in the study for various reasons, samples were taken purposefully based on the knowledge and experience they have on conflict and its indigenous management.

To get the interviewees and FGD participants having lived experiences and accumulated knowledge on indigenous conflict management mechanisms, the researcher had relied on the workers of ErobWorda Culture and Tourism Agency specially the coordinator of the bureau in

pointing the community elders (Aruha) and government officials who could give genuine information on Erob's indigenous conflict management.

Purposive sampling technique is a sampling strategy that the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study (Creswell, 2007).

Thus, the following participants were included in this research: The Aruha (community elders) and government officials. Accordingly, nine Aruha (community elders), one public prosecutor, one militia officer, one public lawyer and one police officer were the participants of the study. As mentioned above, the selection of the participants was based on purposive sampling technique. This is because the researcher believes that community elders (Aruha) have detailed knowledge and experience regarding the indigenous conflict management that the community practices. Moreover, the four government officials were included intentionally to see the relationship of the indigenous conflict management and the formal legal system.

Sources of Data

Under this study, both primary and secondary sources of data were included. The primary data was collected through interview and focus group discussion from community elders, public lawyers, Woreda prosecutor's, police and militia officers. On the other hand, secondary source of data which included both published (Books and Journals) and unpublished documents (magazines, newspapers and other documents) found in Erobworedaculture and tourism officepertinent to dispute and its management mechanisms were reviewed by using document analysis.

Tools of Data Gathering

To collect the relevant data for the study three instruments were employed. These were semi- structured interview, focus group discussion and document analysis.

Semi-Structured Interview

In this research, interview was used as primary data collecting tool. Interview is among the tools of data gathering that allows for a person to person discussion. Such discussion provides the opportunity to have a deep understanding of one's beliefs, feelings and behaviors on important issues. In line with this, Flick (1995) stated that advantage of interview is that the consistent use of an interview guide increases the comparability of the data and that their structuration is increased as a result of the questions in the guide. If concrete statements about an issue are the aim of the data collection, interview will have a paramount importance so as to get detailed information at individual level. Thus, employing interview hopefully provide more accurate data as the informants appear to be more to discussion issues during the interview.

In doing so, first I prepared an interview guide in English and then translated into Tigrigna. Since taking notes alone is not sufficient to get full information, responses were tape-recorded. Furthermore, prior to data gathering, I established rapport and smooth relation with the informants. The interview guides were prepared for two groups, one for 9 key informants of the community and the other for judges, prosecutors and administrative security

officials of the Woreda.This method, therefore, enables me to explore the nature of conflict and its management mechanisms.

Focus Group Discussion (Fgd)

In order to get full information from the participants of the study about the overall past and present practices of conflict and its management in the area, focus group discussion was utilized. Focus group discussion could provide information about a wide range of ideas and feelings that participants have about certain issues, there by illuminating the differences in perspectives among participants as well as groups. Besides, since it is a face to face conversation, it makes possible to follow up interesting responses and investigate underling motives in a way that questionnaires cannot (Creswell, 2007).

This tool was used to complement the information obtained through interview from the informants. Focus group discussion (FGD) was conducted with groups of 6 community elders (Aruha).Since the participants of the FGD were from the same background i.e. community elders, this in turn help to facilitate the communication among the discussant themselves. Therefore, focus group discussion (FGD) was employed to cross check and supplement the information that was collected through interview regarding conflict and its management with in the study community.

Document Analysis

Apart from interview and focus group discussion, document analysis was also be used to obtain additional data by reviewing different documents and records. Documents that are relevant to the System and its management mechanisms were consulted and analyzed. These documents were drawn from ErobWoreda Culture and Tourism Agency, newspapers and Erob development association (EDA).

METHODS OF DATA ANALYSIS

During data analysis, the first thing was the writing up of the notes and transcriptions of tapes recorded following the data collection process. Then, in order to attain the specified research objectives, the collected data was organized based on the purpose of the study suitable for analysis and discussion. Since the participants were interviewed in Tigrigna language, the transcribed interviews and FGDs were translated in to English. The next step was reading the transcripts and field notes so as to clutch the themes and patterns of the data. After a thorough reading of the raw data, I categorized or coded the data in to manageable and meaningful sets of themes based on the objectives and research questions to be answered. To this end, the responses were categorized as sources and types of conflicts, conflict handling mechanisms, procedures of conflict management, scales of fines and compensations, the relationship of the ”indigenous system” with the formal state law, the status and role of women in indigenous conflict management as well as the observed strengths and weaknesses of the “indigenous system”.

RESULTS OF THE STUDY

Erob's View of Conflict

Regarding to the conception of conflict, the participants of this study have different perceptions. Most of the interviewed Aruhas (community elders) viewed conflict as inevitable and natural which prevails in any society. From the dawn of human history individuals, groups, and communities were competing over resources and this will continue forever. Nevertheless, this does not mean that the disputants are evil and stood against the law of the creator. What makes the disputant evil and deviant is when he/she is not willing to solve the problem peacefully. For instance, "Aruha"1 viewed conflict as follows:

Conflict is natural and ubiquitous in all societies. To support this proposition, the "Aruha" further added the following proverb. *"ZeytetsalaekaetnebrEgziabheraykonkan, tetsaliekaetnebrseytanaykonkan"*. This is to mean that to be free from conflict you must be God; on the contrary, if you refuse to settle the dispute peacefully, you must be Devil. In general, the proverb connotes conflict is regarded as inherent phenomenon. But the key issue here is managing the dispute before it escalates into violent expressions. On the contrary, few interviewed participants of the study conceived conflict as bad and destructive. The respondents revealed that conflict most of the time leads to the destruction of resources and human life. On top of this, they argued that conflict could damage the relationship of individuals, groups and the society at large. For example, "Aruha" 4 outlined like this:

"I do not believe that conflict has any importance. This is because involving into conflict with your relatives, friends and neighbors has no benefit. I, therefore, hate conflict and argue it is unnecessary."

Causes and Types of Conflicts

Causes of Conflicts

In relation to the causes of conflicts, the data gathered from the respondents revealed that conflict is not caused by a single factor. Rather, it is the result of interplay of a number of factors. According to the informants view, the primary causes of conflicts in the study area are resource related factors. In this category, the most common ones are dispute over farm plots, pasture rights and water related factors. The second contributing factor for conflict is drunkenness. In Erob community, intoxication is among the principal causes of most dispute cases especially among the youth. Most youths enter into conflict without any pre-existing differences just because they are intoxicated by local beverages (Malab). The type of conflict emanated from such drunkenness could lead the disputants to physical injury or to lose a body part.

Thirdly, some conflicts in the area are stemmed from the violation of one or more social or cultural values. Insulting an individual or a clan by using specific term is considered as a series offense. For example, insulting a man/woman as "Maleun" (evil eye) is a series offense in Erob custom. Besides, extramarital sexual relationship with married woman, Asabili-Baela (Red enemy which connotes the act

of the offender is very series and can lead the victims' family into revenge) and with unmarried girl, Databeli-baela (Black enemy) are all cultural offenses which result in conflict among the community members. In explaining the causes "Aruha" 2 expressed the following:

The majority of the conflicts which prevail within our community emanate from various factors such as insult, drunkenness, conflict over resource as well as extramarital sexual relationship with married or unmarried woman.

Similarly, "Aruha" 3 expressed the following regarding the major causes of conflicts:

There are many intervening variables that lead the community to conflicts. The variables include dispute over *territory of adjacent plots, pasture lands, theft, drunkenness, insult and abduction are among the principal causes of most dispute cases in our community.*The documents (minutes and previous verdicts given by community elders) revealed the following as the main causes of conflicts:

- Abduction of girls and women
- Insult minute
- Theft
- Conflict over claims of a girl and
- Competition over ownership of land

Moreover, FGD discussants of the study community added the following:

Most of the conflicts observed in Irob community are associated with the question of economic or resource related factors. Violation of social values that is insult and extramarital relationship with married woman and unmarried girls are the sources of conflicts. In addition, drunkenness is also among the potential sources of conflict especially for youth.

In general, despite the theoretical controversies on the causes of conflicts among the scholars, the sources (causes) in Erob community seem to explain worthily through economic, social learning and psycho-cultural theories.

Types of Conflicts in Erob Commnity

The interviewed community elders (Aruha) indicated that one of the most frequently observed type of conflict is inter-personal conflict. Inter-personal conflict could involve conflicts between clans or sub-clans and such conflicts are caused by conflict over grazing land, theft or by insulting an individual or a clan using a socially prohibited word. The other type of conflict reported among the Erob include minor inter-clan conflicts (conflicts with the Erob ethnic group) and conflicts with the neighboring ethnic groups namely, the Afar and Tigrigna speaking neighbors. For example, "Aruha" 5 explained the types of conflicts observed in Erob community as follows:

The majority of the conflicts that have been observed among the community of Erob are interpersonal and enter-ethnic in nature. And these conflicts could be emanated from competition for land, pasture and theft of animals.

Similarly, "Aruha" 3 also stated the following:

The majority of the disputes mostly seen in Erob are inter-personal and enter-group conflicts with the neighboring ethnic groups namely the Afar and Eritrea

people. Both the enter-group and enter-ethnic feuds are caused by cross border claims and due to the competition over farm plots.

FGD discussants of the study community also witnessed that:

The types of conflicts and social tensions mostly observed in Erob community can be categorized into three major types as inter-personal, group (clan) and inter-ethnic conflicts. Inter-personal conflict includes family disputes and neighborhood feuds. Clan (group) conflict refers to the disputes that arise among the clans of the community, while inter-ethnic conflict is the disagreement that prevails between Erob community and its neighboring ethnic groups like Afar and Eritrean communities.

Among the types of offenses, homicide is viewed as a series offense and anti-social act. According to the information obtained from the participants, homicide is rarely occurred as it is a great social tension and sin that is morally reprehensible. The people of Erob consider homicide as the act of terminating some one's life intentionally or accidentally. Consequently, unless the case is not resolved timely, it might plug the disputants into chaos that lead to another death. In general, regardless of the differences of the types and intensities at which conflicts occur, all sorts of conflicts that arise within the study community are resolved through the indigenous system. However, the procedures employed depend on the nature and types of the conflicts.

Procedures of Conflict Management in Erob Community

This section is intended to give the reader a glimpse into how Erob community elders (Aruha) are attempting to bring about peace using the indigenous conflict management mechanisms. The way the Aruha (community elders) handle the conflict involves a series of rules and procedures. In order to have a better grasp of these procedures, one has to differentiate the nature and the type of conflicts to be settled. Hence, the researcher has identified the following procedures depending on the nature and severity of the case under scrutiny.

Criteria For The Selection of The "Aruha" (Community Elders)

Among the Erob, the moot (debate between the two disputants) is composed of victims, offenders and the Aruha (community elders). Moreover, in the case of homicide and other series conflicts, religious leaders and the public at large are also involved in the moot to facilitate the negotiation process. The process of conflict reconciliation among the Erob is headed by a council of elders (Aruha). The community elders (Aruha) are selected mainly after conflicts have broken out. The selection of the community elders is made by the full consent of both the victim and the offender. The community elders are selected on the basis of honesty, impartiality, and ability to influence. Regarding this, "Aruha" 1 disclosed the criteria to be community elder (Aruha) as follows:

The criterion to be "Aruha" is usually based on some unique qualities. The selection of the Aruha is made by the full consent of both the disputants; Aruhas persuasion ability, impartiality and willingness to serve as arbitrator.

Similarly, "Aruha" 4 also added the following:

In relation to the criterion for choosing the "Aruha", hereditary tie, age and wealth (Property possession) are not considered as criterion. Rather, Aruha's are selected based on their impartiality, good knowledge and thoughtfulness in dealing conflicts.

Moreover, regarding the procedures for selecting the "Aruha", the participants revealed that first both parties nominate the "Aruha" whom they think are neutral and would settle their dispute effectively. However, in some cases, an advantage (nominating more elders) could be given for the victim. The council of elders (Aruha) could be three, five or seven. The main reason that determine the number of the community elders (Aruha) to be odd i.e. three, five or seven is to give a majority vote in cases when consensus is not reached among the community elders with regard to the litigation under scrutiny.

Procedures of Conflict Management: The Case of Homicide

The Erob's indigenous conflict management has its own unique procedures which enable the conflicting parties come together and settle their dispute peacefully. The primary task to settle the homicide case is convincing the deceased family to accept offers of negotiation. In cases when the deceased family refused the negotiation process, the slayer's family is obliged to send some amount of money to seven influential relatives of the deceased family. Among the seven relatives four of them are from the victim's father whereas three of them are from the victim's mother family. The money given to the seven relatives of the victim is called Malhina-mangar, which means seven fines or compensations. Usually, after several attempts the deceased family convinces to solve the problem in a peaceful manner. Once a deal is made to settle the dispute peacefully, the Aruha (community elders), Tigdfe-mela (slayer's family), Rabte-mela (deceased family), religious leaders and the assembly at large meets in a place which is a center to both the conflicting parties mainly under a shady of an old tree.

To begin the reconciliation process, the slayer's family ties a cow or an ox (Awr) on a tree which is prepared for the dinner of the disputants, community elders and religious leaders. This process is called Hadalobti, which means a base ground for the reconciliation to be made. Furthermore, the process is very important in heralding the beginning of the reconciliation. Then after, the slayer wear" Koborta'' (Blanket) and gives to the deceased family by his uncle either to kill him or leave him. This time is a time of tension and frustration. Consequently, the slayer's family, religious leaders and the assembly at large pray for their God to forgive the slayer. After a few minutes stay, the deceased family leaves the slayer and asks their fines and compensations. Following the above mentioned procedures, one representative from the deceased family (Mai-negra) stands up and says" Dear religious leaders, gentle men and women, from this time onwards anyone who say Bili-baela (murder) to the slayer will be liable for his/her insult.

Moreover, to strengthen their relationship, the two conflicting parties exchange their daughters for marriage and the girl given to either of the family member is called Bili-badat, to mean the conflict is solved

completely and a new friendship is established. Finally, to wind up the reconciliation process, there are two necessary pre-conditions to be fulfilled. The first pre-requisite is the payment of compensation for the loss of life followed by ceremony purification. The ceremony purification has a special formality and requires shading of an animal's blood (ox). The slaughtered ox is called Kukta which connotes the hostility among the disputants is washed out or resolved. Following this, the community elders, religious leaders and both the disputants' family eat the meat of the slaughtered ox (Kukta). And this herald the killer is pronounced free and ready to mingle with the rest of the society. For more understanding, see the pictures below which depict the procedures of conflict management in case of homicide among Erob community.

Procedures of Conflict Management other than Homicide

Like the homicide case, theft, physical injury, insult and other offenses follow certain procedures and rules. In such conflict settlement process, there are the two disputants and community elders. In the negotiation process, the litigants have an ample opportunity to express their case openly. However, whenever the case is series and possibly sensitive, the community elders employ a strategy of hearing the claim of each litigant in the absence of his/her opponent. Based on the gathered information from the litigants, the Aruha (community elders) would notice the demand of the litigants and each litigant also observes the actual desire of his/her opponent. On top of this, in instances where the disputants refuse to admit their guilty, the elders try to persuade them using different mechanisms. The key method here is persuasion to convince the disputants. In some cases, when the gathered information from the disputants has variation, the community elders (Aruha) could look for witness to testify the issue under litigation.

Once the gathered information from both litigants and rarely from witness is processed and analyzed, community elders (Aruha) would propose a decision that binds the disputants. Further, the mediators would influence the disputants to accept their recommended decisions. Following this, they would reconcile both disputants and make them hug each other. It is common to notice the guilty party would pay the fines and compensations based on the severity of the cases. Finally, the community elders will end the meeting.

Investigating Truth In the Absence of Witness (Emay)

One of the unique features that distinguish the indigenous conflict management from the formal state law is exposing truth in the absence of Emay (witness). In the formal state law, any culprit is punished if and only if it is proved through witnesses (tangible evidences). But, in the case of indigenous system, the Aruha (community elders) employ a very elaborated and systematic mechanism of investigating the truth. In the indigenous system the community elders investigate the truth using different techniques. For example, the information obtained from ErobWoreda Culture and Tourism Agency revealed that:

One of the techniques that the indigenous system uses to investigate a hidden case is

called "Awchach." Awchach refers to the accidental meeting call up on the dwellers of the kebele (kebeles) when homicide or theft is committed where there is no witness.

Here, the victim has suspected individuals or groups, but there is no testimony that proves the case. In such cases, the victim or community elder would present the case to the gathered people and request the public to confess the truth. If no one is willing to confess the truth, the Aruha (Community elders) use different methods to identify the culprit. For example, in case a person is killed where there is no witness, the community elders first measure the footsteps (hoof print) on the surface area in which the accident takes place and then the foot or the shoe of the suspect. This technique helps to detect the suspect by cross checking the measure of the footsteps (hoof print) on the surface area and the foot or shoe of the suspect. Furthermore, the Aruha (community elders) critically observe the area in which the crime has taken place. This is mainly done to check if there is any additional clue that helps to detect the suspect.

The second technique that the "Aruha" use to expose the truth is persuading (influencing) the suspect via his/her clan. The community of Erob believes that relatives of the suspect could effectively investigate the hidden case easily. This basically emanates from the view that any offense is the concern of the relatives (clan). The participants further added, if the truth remains hidden, it may result in supernatural punishments that affect the clan (Mela) in particular and the community in general. The other method of investigating truth in the absence of witness is probing the culprit using the Aruha's own techniques. In seeking to identify the truth of the case and persuading the suspect to confess; the "Aruha" first ask the suspect and his/her families various probing questions. Whenever the community elders (Aruha) found any clue (contradiction) between the speech of the suspect and the speech of his/her children, father and mother or wife, the mediators (Aruha) report the contradiction they found to the clan of the suspect. This is mainly done to influence the suspect via his/her clan. Moreover, in instances where the suspected refuses to accept his/her guilty using the above mentioned techniques, the community elders (Aruha) restore to the last option. In the indigenous system Oath is taken as the last option to investigate the innocence of the suspect. The ritual oath of innocence deserves certain materials like church, gun and newly dug empty hole.

The first kind of ritual oath takes as follows: by closing and opening the door of the church, the suspect says," if I hide the truth, let God close (hide) my life." Likewise, the second type of oath is jumping over a gun. In this case, the suspect jumps over the gun and says;" if I falsely take the oath, let the bullet take my life.'' The other rarely exhibited method of oath is forcing the suspect and his/her seven relatives enter into the newly dug hole and take the oath. Here, the hole represents grave. In other words, if the suspect and his /her families take the oath falsely, the suspect and his/her families would suffer in supernatural punishments and finally lead the suspect to grave. Thus, the victim would be advised to pray for his/her God and look for bad consequences on the side of the culprit in the near future.

Conflict Management Mechanisms of Erob Community

This section reveals the two main conflict handling mechanisms used by the "indigenous system The two mostly used handling mechanisms among the Erob are negotiation (Yemeten) and Arbitration (Wagare).

The indigenous system uses these mechanisms in both minor and series cases based on their applicability. Thus, this section aims at orienting the readers about the conflict handling mechanisms employed by the indigenous system. The first type of conflict handling mechanism commonly used by the Erob community is Negotiation (Yemeten). The Erob culture allows the litigants to manage their case through Negotition (Yemeten). Among the Erob, this kind of negotiation is called Yemeten. In this method the conflicting parties reach agreement through mutual consensus. Such a negotiation is possible when the litigants have no problem in communicating and managing over the issue under discussion. Furthermore, the settlement through negotiation (Yemeten) could be competitive or collaborative resulted in lose-lose, win-lose or win-win depending on the agreement of the litigants. Negotiation (Yemeten) is applicable when the litigants want to keep their case secret or when the case is minor that did not deserve others to intervene.

The second type of conflict handling mechanism practiced among the Erobis"Wagare" (Arbitration). Wagare requires the submission of the case to a third party (Aruha) for a decision. In the Wagare (arbitration), each litigant names his/her own choice of arbitrators. One of the essential features of the Wagare is the free choice of the judges (community elders). Arbitration (Wagare) is used mostly when the litigants are not willing to engage in dialogue or when the issue under discussion is very series and so sensitive. Moreover, in this conflict handling mechanism, the Aruha (arbitrators) play a vital role in guiding the whole process and finally announcing the verdict.

Indigenous Conflict Management and its Relationship with the Formal State Law

The study has noted that the relationship between formal courts and the indigenous conflict management in Erob community is healthy and smooth which complement to each other.

Currently, the formal justice system and the indigenous conflict management systems operate side by side with full overt support or recognition of each other. The formal state law officially recognizes the existence of the customary dispute resolution systems. For example, Article 34.5 of the Federal Democratic Republic of Ethiopia (FDRE) constitution states that" this constitution shall not preclude the adjudication of disputes relating to personal and family laws in accordance with religious or customary laws with the consent of the parties to the dispute.''

Accordingly, formal courts in Erob "Woreda" are usually cooperating and give assistance to the elders' council (Aruha) so as to settle the case through the indigenous conflict management mechanisms. This in turn helps to ease the burdens of the formal courts.

As observed in the study area, the community elders (Aruha) are engaged in the indigenous conflict management process so as to manage cases out of courts.

In such practice, the community elders secure the cooperation of religious leaders, public prosecutors, police force and the public at large. For example, the public prosecutor of the "Woreda" pointed out that:

The relationship of the court and the community elders is good and could be exemplary for other Woredas. Usually, once a criminal case is brought to the attention of the court having jurisdictions, the "Aruha" immediately come to our bureau and ask to settle the dispute through the indigenous system. Based on the consent of disputants, we encourage them to settle their case through the indigenous system. However, the court tends to make distinction between wrongs that injure the entire community and those that injure individuals.

In addition, one police officer of the "Woreda" also added the following:

During my stay in this Woreda, I have observed a good working relationship between the indigenous system and the governmental bureaus especially with formal court and the police forces. When two individuals enter into conflict and submit their case to the court, it is usual to ask the community elders to the plaintiff to withdraw his/her charge formally whenever possible before the police prove the allegation through witness. Based on the Ethiopian penal code, the court frames the charge and allows them to resort to their indigenous mechanisms. Furthermore, the community elders are required to submit their verdict and the fines and compensations given to the victim.

Similarly, "Aruha" 7 witnessed the following:

We have good relationship with court, police force, and the Woreda culture and Tourism Agency. The Woreda prepares training programs for us on conflict and its indigenous conflict management. However, the training programs are not sufficient and continual.

Moreover, FGD discussants of the study community pointed out that:

The governmental judiciary system and the indigenous conflict management mechanism have a strong relationship which complement to each other. Usually, both systems encourage reconciliation using the indigenous system whenever there is consent of the disputants. Moreover, the governmental organs give moral and material support to enhance the capacity of the indigenous system. Customary dispute resolution (CDR) operates with full regard to the claims of the formal system to jurisdiction of the legitimacy. This is to mean that once a criminal case is brought to the attention of the formal court having a hidden agenda that affects the entire community, the perpetrators are usually held responsible for their wrongdoing.

The Role and Status Of Women's in Indegenous Conflict Management

When we see the role and status of women in managing conflicts, different communities have different experiences. In Erob custom, women do not directly serve as community elders (Aruha). Rather, the indigenous system has designed a mechanism for women to participate in the dispute resolution process. Erob women

exercise power indirectly and informally as sisters, mothers and wives within their community. And these shows though women have the right to assist (advise) male members of their lineage in times of hardship, they have little room to play leadership roles (representing as Aruha) in resolving communal conflicts. For example, "Aruha"6 explained the role of women as follows:

In indigenous system women play an indirect role. This is because we inherited a similar trendfrom our ancestors. Despitethe fact that women are indirectly participated in the reconciliation process, there is a parallel role of women i.e. providing ideas and views. Furthermore, in case of homicide reconciliation, women have a special duty in the ritual process so as to prepare food and local drinks for the reconciliation process.

Similarly, "Aruha" 3 added the following:

In our community, it is not common for women to be Aruha (community leader). But in the case of trivial conflicts, women have the right to resolve the feuds arising among themselves without restoring to the male elders council. Moreover, in the indigenous system women are treated equally as men.

"Aruha" 7 also stated:

The indigenous system usually includes men members of the community to lead the reconciliation process. Women are only present if they have conflict to resolve and identified as a suspect for a crime. This is because being an Aruha (Arbitrator) is a challenging task that demands skill and higher commitment. But since women have a burden of task so as to lead the domestic work at home; the community believes women would be incapable to handle such challenges.

Strengths and Weaknesses of The Indigenous Conflict Management System

Strengths

The information obtained from the respondents revealed that indigenous conflict management among the Erob has several advantages over the state law. Some of the advantages are restorative capacity, accessibility, revealing crime committed under cover (crime without witness) and its acceptability. The primary merit of indigenous conflict management among the Erob is its accessibility. In Erob community reconciliation process is conducted in a central place for the disputants, community elders and the population at large. Usually, working at local level through the community mediators avoid the need for litigants to pay for transportation and the cost of pursing a dispute through formal court system with buying sheets of paper and getting the case written. Furthermore, the proximity of customary institutions to the litigants saves the disputants energy that would be lost in tiresome and frequent travels from their locality to Woreda, zone and federal courts.

Secondly, the indigenous system has the capacity to restore harmony within the community when dispute has arisen. This is to mean that indigenous conflict management resolves the cause of the conflicts from its grass root level so that no more conflict will re-emerge on the same issue. Consequently, disputants can live in peace and cooperation and recognize the harm done to the community.

The third advantage of indigenous conflict management among the Erob is revealing crime committed under cover (revealing crime without witness). In the formal state law, any crime is proved only through tangible evidences (witness). Unfair decisions might be made and one party might be punished for the crime he/she had not committed. However, this is not happening in the indigenous system. As indicated earlier, in the indigenous system a hidden case is investigated through four interrelated mechanisms. These mechanisms are "Awchach" (accidental meeting call up on the dwellers of the kebele/s), influencing the suspect via his clan, probing the suspect using the community elders own technique and through ritual oath. But, though the defendant could try to resist his clan and the community elders, taking oath while denying something wrong is a taboo in Erob custom. This is because the community believes that something bad would happen to the wrongdoer, his family, his clan and to the community at large. This in turn shows how the indigenous system is powerful than the state law to reveal the crime committed without witness.

Finally, acceptability of the Aruha's (community elders) decision could also be considered as a merit. The one mostly noticed reason for the preference of indigenous conflict management among the Erob is the acceptability of the decision passed by the Aruha (community elders). Since the decisions passed by the "Aruha" are trustworthy in their local contexts, failure to comply can result in social ostracism and being left alone in good and bad times. As a result, every decision is respected among the EIrob.

Weaknesses

According to the information obtained from the community elders (Aruha), police officers and public prosecutors, indigenous conflict management among Erob's has its own limitations. One of the glaring weaknesses that the participants reported is the exclusion of women in the system. In Erob custom, though women are the right advisors of their husbands, brothers and their clan, still they are not allowed to be members of the council of elders (Aruha). They lack representation and this could be taken as a primary limitation of the system.

The second deficiency of the indigenous system is its economical extravagancy. Though the indigenous conflict management among the Erob does not demand cost of transportation or to hire experts, but in the resolution process of homicide case, the slayer's family (clan) are forced to provide food and locally prepared drinks. Furthermore, animals are slaughtered during the time of reconciliation. The point here is that this practice has its own economic effect on the side of the slayer's family. Therefore, from economic point of view, this practice can be considered as a limitation of the institution (indigenous system). The other limitation that the researcher observed in the system is that its time consuming nature or prolongation of appointments and meetings. Though different research findings in many Ethiopian ethnic groups show indigenous conflict management mechanisms are timeliness which respond immediately or very quickly, the reverse is true in the indigenous system.

In general, the study has shown that indigenous conflict management among Erob has some weaknesses that ought to be transformed.

SUMMARY, CONCLUSIONS AND SUGGESTIONS

Summary

The principal aim of this study was to explore the nature of conflict and its indigenous management practices of Erob community, which is found in Tigray Regional State, Eastern zone, ErobWoreda. To achieve the objectives of the study, the researcher employed qualitative approach particularly phenomenological. Moreover, to obtain in-depth information regarding the issue under scrutiny, various instruments (tools) were used. The data gathering instruments employed in the course of the study were in-depth interview, document analysis and focus group discussions conducted with the key informants of the community. In the case of Erob community, the main cause of conflict seems to be in the area of economic interests, drunkenness and violation of social values (Insult). Moreover, extramarital sexual relationship with married woman and unmarried girl is also a contributing factor for conflict. The major types of conflicts observed in the study area could be divided in to three categories as inter-personal, inter-clan (group) and inter-ethnic conflicts.

Regardless of the theoretical controversies on the causes and types of conflicts, consensus seems to exist among scholars on how individuals, groups, communities or nations handle their differences. Scholars divided peaceful mechanisms of conflict management in to various categories as negotiation, mediation, arbitration and adjudication (discussed under 2.4.1). But concerning the Erob community, one may came to the conclusion that these dispute handling modes are not equally important. Instead, negotiation and arbitration are the major ones that mostly practiced by the study community. Currently, there are two forms of administration of justice operating among the Erob: the indigenous mechanism and the formal court system. However, most of the dispute cases are settled by the indigenous mechanism. In Erob, indigenous system is the most widely used institution for conflict management. The institution is run by three, five or seven voluntary community elders who manage the conflict either on their own initiative or when solicited by the litigants. Erob community has a high regard for their culture and their elders. Consequently, the community elders are entrusted with the responsibility of searching the truth, mediating and resolving all kinds of conflicts.

Regarding the procedures of conflict management, the findings of the study showed that the Aruha (community elders) largely depend on the type and nature of the conflicts to be solved. In the indigenous system, conflict management procedures are classified into three categories. These are procedures of conflict management in the case of homicide, procedures of conflict management other than homicide (trivial offences) and the procedures used to settle conflicts without witness (hidden conflicts). Erob's believe that all conflicts with in their community should be solved peacefully according to the long-standing indigenous mechanism. The system consists of specified guidelines and rules regarding the fine and compensation payments that correspond to the severity of the offenses. Accordingly, the compensation payments (kasha) ranging from 30,000 birr for murder to 165 birr for insulting someone as "maleun" (evil eye).

The smooth relationship between the indigenous system and the formal state law is also confirmed in this study. The public prosecutors, judges, police and militia

security officers are supportive and appreciative of the indigenous mechanism roles in conflict management. The support of the Woreda administrative and security office is mainly giving training program that could create awareness among the public in general and the community elders in particular. Moreover, it is important to mention that the judges and public prosecutors help the indigenous system by registering the verdicts given by community elders (Aruha).

Besides, this research attempted to find out the status and roles of women in indigenous conflict management. It can be concluded that women do not directly serve as arbitrators rather they exercise their power indirectly and informally by advising their husbands, brothers and their clan.

The findings of this research also showed that indigenous mechanisms for conflict management have different advantages over the formal court systems as follows:

- They give access to the litigants to settle their case with in their locality. This in turn helps the disputants avoid the need to pay for transport and other related expenses.
- They contribute to the restoration of peace and order among the disputants. Formal courts apply the already developed law to the case at hand regardless of the future consequences. On the contrary, indigenous conflict management resolves the cause of the conflict from its grass root level.
- They reveal crime committed under cover (revealing crime without witness). In the case of formal courts the allegation is proved only through witness. However, this is not the case in the indigenous system. In the indigenous system, a hidden case is investigated through four interrelated mechanisms that is through "Awchach", influencing the suspect via his/her clan, probing the suspect using the community elders own technique and through ritual oath.
- Fourthly, acceptability of the Aruha's (community elders) verdict could also be seen as the other merit of the indigenous system. On the other hand, the findings of this study also exhibited some weaknesses of the system. The limitations of indigenous system such as exclusion of women, economic extravagancy, time consuming or prolongation of appointments and meetings were mentioned by most of the participants.

CONCLUSIONS

From the above findings, the following conclusions were drawn.

- ✓ Indigenous institutions can provide a solid framework for building a community's conflict resilience through strengthening indigenous conflict management institutions.
- ✓ The System ("Sugsa System") is deeply intertwined with the cultural and spiritual practices of the community. Furthermore, the system utilizes a great variety of handling modes and approaches for the management of communal conflicts.
- ✓ Indigenous conflict management mechanism ("Sugsa System") is more preferred to legal system in managing conflicts occurred among the study community.

- ✓ Forgiveness, which is often the outcome of conflict resolution, is superior to the results of modern law not only because the latter emphasizes punishment but also because through forgiveness the seed of resolving possible future conflict according to the Irobtradition is sown.
- ✓ Respect for and loyalty to these values facilitates the role of community leaders ("Aruha") to prevent, manage and resolve conflicts.

Suggestions

Based on the findings of the study, the following recommendations were made regarding effective prevention and conflict management mechanisms in the study area.

1. *Sharing experiences with other communities and ethnic groups on indigenous conflict management systems*

The protracted and complex nature of conflicts made the ways of reconciling communal and ethnic groups different. For example, the Abegar system (divine father) in south Wollo, Gada System in Oromia, "YejewokaSengo" in the Gurage Zone and the "Mad'aa" (Customary law) in Afar have their own experiences with regard to the handling mechanisms, advantages and risks. Hence, sharing experiences among these ethnic groups could give a greater chance to promote the efficacy and efficiency of the system. Therefore, the researcher recommends to the governmental and non-governmental organs should provide these ethnic groups or communities with workshops, exchange visits that help them and update their customary law so as to compute with the state law.

2. Gender inequality must be challenged through public education

While the" Sugsa System" is very useful and have much comparative strengths, one should also note some limitations. One of the major weaknesses observed and reported is exclusion of women. Thus, gender equality and participation must be attained through persistent public education.

3. *Allowing the indigenous systems to have their own financial source (budget)*

Conflicts in Erob community are preferably handled by the indigenous conflict management mechanisms (Sugsa system). This is because the "Sugsa system" has a greater role than the court in maintaining social order. Despite this the system has no permanent financial source (budget) that could cover expenses of training programs, meetings and transportation costs of the peace makers (Aruha). Allowing the systems to have its own financial source could be a solution to cover the expenses of local peace makers (community elders).Therefore, establishing conflict management fund (budget) that can be used to cover the cost of the activities of local arbitrators is very crucial.

4. *Encouraging reform of the system regarding economic extravagancy and prolongation of appointments and meetings*

Despite the already mentioned strengths, the study has shown that the indigenous conflict management among Erob's has some limitations that ought to be transformed. Accordingly, economic extravagancy and time consuming or prolongation of appointments and meetings are the main ones. Hence, the researcher suggested that the community should be encouraged reforming these limitations.

5. Building institutional linkages between the formal court and the indigenous Institutions

A linkage between the formal court and the indigenous conflict management systems is vital to facilitate the cooperation between the systems. Linkages can be built from

sharing information, through sharing jurisdiction and responsibility. By doing so, the legal system can take advantage of the benefits of indigenous system while ensuring that they respect the concern of international and national human rights and those of women and children**.**

6. Strengthening the system through further research

Though the researcher attempted to understand the nature of the conflicts that arise among the community of Erob as well as the conflict handling mechanisms, but it is hardly possible to say the study is comprehensive enough. Therefore, the researcher would like to underscore the need for further research.

REFERENCES.

AmbayeOgato (2008). *Traditional Conflict Resolution Mechanisms: the case of Sidama.* *In Hannan, T &Tarekegn, A. (eds) making peace in Ethiopia: Five cases of traditional mechanisms for conflict resolution*. (pp. 101-120): Addis Ababa, peace and Development committee.

BerheZigta (2008). *The Origin and History of Erob People*. Mekelle: Zemenawi P.P. (In Tigrigna)

Best, S.G. (2004). *The Methods of Conflict Resolution and Transformation.* In Best, S.G.(ed.). *Introduction to Peace and conflict studies in West Africa* **(**pp**.**93-115**)** (PP. 93-115. Ibadan: spectrum Books ltd.

Chandan,J.S.(1995). *Management: Theory and Practice*. New Delhi:VBIKS publishing House Pvt.Ltd.

Creswell,J.W.(2009). *Research design: Qualitative, quantitative and mixed approaches* (3rded.).Los Angeles: Sage

Eshleman, J.R. & Wilson, S.J. (1995). *The Family* (Canadian edition).Ontario:Allyn and Bacon.

FDRE (1995). *Proclamation of the Constitution of the Federal Democratic Republic of Ethiopia***.** (FDRE) Addis Ababa: Berhana Salem.

MesfinWoldemariam (1999). *The horn of Africa: conflict and poverty***.** Addis Ababa: commercial printing press OSSREA.

MesseleMadda (2008). The role of Elders in resolving conflicts: The case of walayta people of southern Ethiopia. *In Hannan, T &Tarekegn, A. (eds) making peace in Ethiopia: Five cases of traditional mechanisms for conflict resolution.* (pp. 21-47) Addis Ababa, Peace and Development Committee.

Olsen, D.H &Defrain, J. (2000).*Marriage and Family: Diversity and Strengths* (3rded.).California: Mayfield Publishing Company.

Rahim, M. (1992). *Managing conflict in organizations*.2nd ed. West port: Hall India Pit.

Shellemberg,J.A.(1996). *Conflict Resolution: Theory, Research and practice*. Albany: State University of New York press

TarekegnAdebo (2008). Traditional mechanisms of conflict resolution (TMCR) in Ethiopia, meaning, values, structures, procedures and outcome. *In Hannan, T &Tarekegn, A. (eds), Making peace in Ethiopia: Five cases of traditional mechanisms for conflict resolution*. (pp. 9-20) Addis

Ababa, Peace and Development committee.

TsegaEndalew (2005). LubaBasa and HarmaHodha: Traditional mechanisms for conflict Resolution in Metekel, west Gojam**.** *Proceedings of the national workshop of the Ethiopia chapter of OSSREA* (pp. 130-155): Addis Ababa.

TsegayeBerhe (1998). The peopling of Tigray: An Ethnographic and Historical survey. *In first interdisciplinary seminar of the institute of Ethiopian studies.* (pp. 218-335): Nazareth, Ethiopia

UthmanHassen (2008). The role of Abegar (Divine Father) in conflict Resolution: The case of Northern Wollo. *In Hannan, T &Tarekegn, A. (eds.), making peace in Ethiopia: Five cases of traditional mechanisms for conflict resolution.* (pp.78-100) Addis Ababa, Peace and Development committee.

Unpublished sources

BirhanuMekonnen (2010).Conflict Management and Peacemaking at Community level: the case of Negede-Woyto. MA thesis,Addis Ababa University(Unpublished).

KifleGashie (2007). Traditional mechanisms of conflict transformation among the rural Hadiya community: A social psychological analysis. MA Thesis, AAU (unpublished).

Yasin Mohammed (2010). An exploration of the "Abegar system" A traditional resolution mechanism in southWollo**.** MA Thesis, AAU (Unpublished)

Internet sources

EDA (2006). Description of Erob and Erob Development Association. http://www.irrob.tswebsites.com/f/EDA-workingdoc.pdf

Fisher, R. (2000). Source of Conflict and Methods of Conflict Resolution. International Peace and Conflict Resolution school of International Service**:** The American University. Retrieved on September, 2010, from http:// www. Aupeace.org /

TsegayBerhe (2003). An Etho-Historical survey of the ErobAgri-pastorialists of North-Eastern Tigray (Ethiopia). Retrieved on October 2010 from http://www.irrob.org/articles-on-irob.html

Level of Selected Precedence Pollutants in Soils of the Industrial Regions of Welmera District (Oromiya Special Zone around Finfinne), Ethiopia

Melkamu Biyana
Wollega University, College of Natural & Computational Sciences, Department of Chemistry, P.O.Box 395, email: malkako2011@gmail.com

Abstract

Melkamu Biyana, Level of selected precedence pollutants in soils of the industrial regions of Welmera district (Oromiya Special Zone around Finfinne), Ethiopia, Journal of Scince & Development 2(2) 2014, 123-135

Farm soils of Oromiya special zones around Finfinne in general, Welmera district in particular are recently become polluted through the continuous and intensive applications of pesticides apart from contamination by heavy metals from various sources. In the present study, soil samples collected from different sites of industrial regions in the Welmera district were tested for organochlorine pesticides (OCP) and heavy metals concentration and distribution using GC-MS and AAS respectively. The result shows that the value of heptachlor ranges from (ND-0.88±0.014), methoxychlor (ND-2.14±0.06), chlordane (0.07±0.002-0.98±0.023),DDT(o,p'-DDT+p,p'-DDT)(ND- 0.88±0.02), endosufan(α) (0.53±0.01-3.05±0.07)mg/kg and As (0.436±0.022-7.29±0.008), Co(ND-15.13±0.022), Cr(ND-107.44±0.17), Ag(ND-1.06±0.008), Cd(ND-52.08±0.046), Ni(0.99±0.005-121.23±0.021)mg/kg in dry soil. The present result reveals that the farm soils contain a significant amount of these chemicals. The polluted soils can act as a secondary source of pollutants which makes the problem more complex. The current work provides new information regarding the levels of both selected persistent organochlorine pesticides and heavy metals in soils of Welmera district and therefore, it is very important to work on reducing the impact of these chemicals upon the environment. Based on the study result, specific regulations and restrictions upon pesticide use, making agricultural policies reform in order to encourage patterns of land use, farming practices, monitoring anthropogenic sources of heavy metals and uses of inputs which are in better concord with the environment are strongly recommended.

Key words: Floricultural industry, Oromiya special zone, pollutants, pesticides, heavy metals.

INTRODUCTION

Worldwide industrialization and agricultural activities have an effect on environmental pollution and the global ecosystem. The pollution of soil by highly persistent pollutants from various sources like anthropogenic sources is a serious environmental issue nowadays in many parts of the world. Soil is a complex medium which both responds to and influences, environmental processes and conditions. Consequently, it is subjected to a number of pollutants due to different anthropogenic activities (industrial, agricultural, transport etc.) (Facchinelli *et al.*, 2001 and Jonathan *et al.*, 2004). The chemical composition of soil, particularly its metal content is

environmentally important, because toxic metal concentration can reduce soil fertility, further along with organochlorine pesticides, it increases the input into food chains, leading to accumulation of these pollutants in food stuffs, and finally endangers human health. Because of its environmental significance, studies to evaluate the risk caused by metals and pesticides in soil on human health and forest ecosystem have attracted attention in recent years (Denti *et al.*, 1998; Sandaa *et al.*, 1999; Arantzazu *et al.*, 2000 and Krzyztof Losk *et al.*, 2004).

Persistent organic pollutants (POPs) such as organochlorine pesticides (OCPs) and heavy metals are ubiquitous contaminants in different compartments of the environments including soil (Hong *et al*., 1999; Doong *et al*., 2002a; Martin *et al*., 2003; Fu and Wu, 2005, 2006). These compounds are generally generated by anthropogenic processes and can be introduced into the environment through various routes. Due to their toxic, mutagenic, and carcinogenic characteristics, these persistent compounds are considered to be hazardous to the biota and environment. As soil pollution by pesticides can affect many biological systems, the widespread use of potentially harmful pesticides has recently become under scrutiny in Africa (Kaminska *et al.*, 2004 and Thrupp, 1996). Once contaminated by non-degradable chemicals like pesticides and heavy metals, the soil may take a long time to clear (Prenazzi and Ziglio, 1995) and there is always the danger of bioaccumulation (U.S.EPA, 1985; Fergusson, 1990; Younas *et al*., 1998; Krishna and Govil, 2006).

Heavy metal and organochlorine pesticides contamination of the environment caused by parent materials in soils or anthropogenic activities, including fertilization, application of pesticides and traffic have been a worldwide concern to both the governmental and regulatory bodies that are anxious to prevent further environmental deterioration (Srivastava, 2001; Vidhya, 2001; Feng, 2003; Li *et al*., 2004; Vidal *et al*., 2004; Wong, 2004; Luo, 2006; Song, 2006; Hao, 2008; and Fang, 2010) and many studies revealed that industrial areas are highly polluted with these chemicals. Therefore, due attention must be given to proper environmental monitoring because they do not degrade naturally and can retain in soil even after thousands of years. Furthermore, the ultimate fate of these chemicals is that either they leach into ground water or surface water thereby contaminating them or can enter the food crops (Guo-li *et al*., 2008; Suciu *et al*., 2008; Madjouma et al., 2012). In addition to this, there is no scientific work carried out previously on soil quality in Welmera district. Hence, the objective of this study is to determine the levels and distribution of pesticides (Heptachlor, Methoxychlor, Chlordane, DDT (o,p'-DDT + p,p'-DDT) and Endosulfan (α)) and trace metals (As, Cd, Ag, Ni, Cr and Co) in soils from selected industrial regions in Welmera district, Ormiya special zones around Finfinne (Addis Ababa) in order to evaluate the pollution prospective of these pollutants.

Experimental

Study site

Welmera district (Fig.1) was selected as the study area due to the rapid increase of various industries in the Oromiya special zones around Finfinne.

Reagents and solvents

High purity grade solvents, Acetone (Abron chemicals), n-hexane (Nice chemicals Pvt. Ltd cochin-682024) and HPLC grade acetonitrile (Fisher Scientific, UK) were used in this work. Analytical reagent grade of HNO_3, H_2SO_4 and H_2O_2 from UNICHEM were used. All pesticide standards such as DDT (mixture p,p' DDT 92.2% and o,p' DDT 6.2%), endisulfan(α), Heptachlor, Methoxychlor and Chlordane were purchased from Dr. Ehrenstofer Gmbh, Germany and metal standards were obtained from UNICHEM.

Analytical Methods

The soil sampling, preservation, transportation, preparation and analysis were performed following the standard methods. Soil samples were collected from adjacent soils of floricultural industries in Welmera district. Four cut-flower plantations were selected from the mentioned district. Totally six composite soil samples labeled S1, S2, S3, S4, S5 and S6 were collected from different selected sites as shown in Fig 1. For each composite soil sample, about ten core samples were obtained from up to 30 cm depth. Random sampling technique was employed using soil auger for soil sample collection in the selected sites of cut-flower industry farm regions and adjacent soils found between the industries and the Holeta River. The 10 core soil samples mixed, homogenized, and its subsamples were placed in a clean polyethene plastic bag, labeled, transported to laboratory, air dried and sieved to pass through 2 mm sieve.

Sample preparation for pesticides analysis: extraction, cleanup and pre-concentration

Pesticides in sub-soil samples were extracted using the shake flask method in acetonitrile-water (70:30, v/v) mixture (Wolfgang, 2001 and Tadeo, 2008). 25g of soil sample, 70 mL of acetonitrile-water mixture were added in 250mL volumetric flask, capped and then shaken for one hour using mechanical shaker. The two phases formed were kept in contact for 6 hours and the supernatant was filtered using filter paper (Astme 832-81, 12.5cm, China). The extraction was repeated three times for a single sample with fresh solvent (20mL acetonitrile). The soil extracts were combined and then loaded on C18 sorbent which was conditioned using consecutive addition of acetone-hexane (20:80, v/v)., at a flow rate of 10 mL /minute under vacuum and the sorbent was rinsed using 10mL distilled water and then dried by aspirating air for 30 minutes. The analyte was eluted by addition of acetone-hexane mixture. The final extract was concentrated to about 0.5mL using rotary evaporator and then diluted to 2mL by the addition of hexane, prior to GC-MS analysis.

Sample preparation for heavy metals analysis

All materials used during these experiments were soaked in 10% HNO_3 (v/v) for 24 hour and rinsed three times with deionized water and all reagents used in this study were analytical grade and prepared stock solutions with deionized water. Acid digestion of soil sample was carried out by taking about 0.2g of each soil samples into 25mL conical flasks and digested overnight with 5mL of conc. H_2SO_4 and then heated at 128^oC until the evolutions of brown fumes ceased. 2mL H_2O_2 was added in the sample and heated at 125^oC for one hour with the evolution of intense white fumes. Again

2mL H_2O_2 was added, made up to the mark with 2% HNO_3 and kept for AAS analysis. The determination of target metals was made by AAS equipped with graphite furnace, hydride and cold vapour generator and Hollow cathode lamp (Zhang and Wang, 2010).

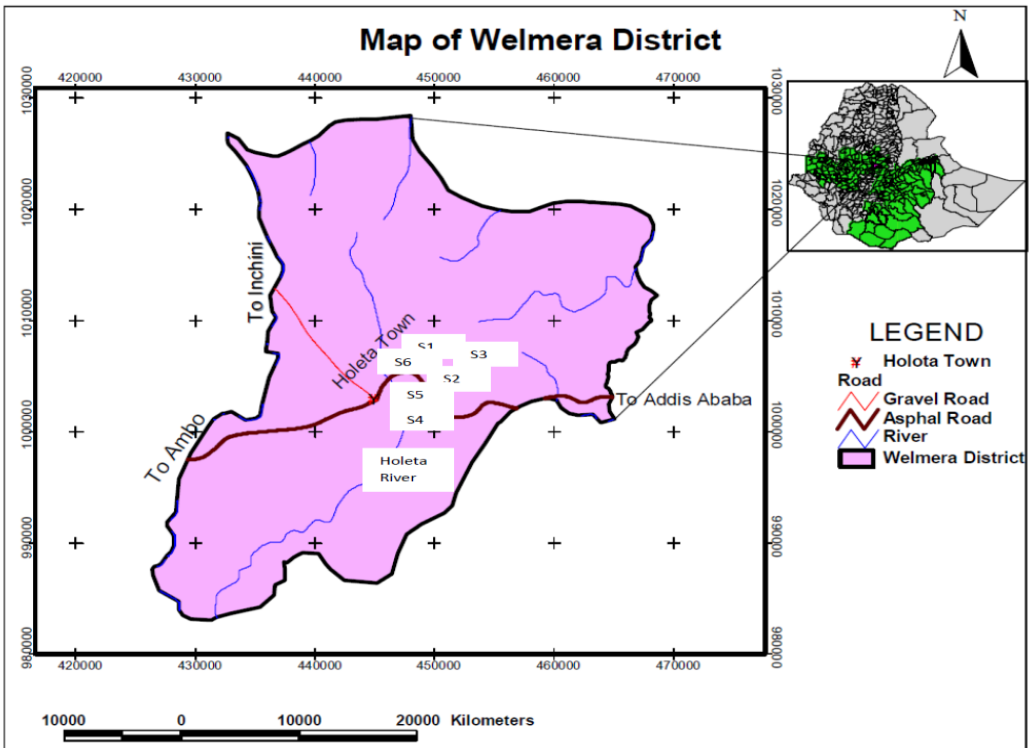


Figure 1: Map of Welmera district

Analytical curves

During the determinations of the pesticides and metals, external standard method (using analytical curves with five concentration levels in five replicates) was used.

Recovery studies

The efficiency of the extraction method used in this work was evaluated by analyzing the spiked soil samples using the developed method and obtained the percent recovery of 81-102 in both cases.

Method validation

The method used in this study was validated by carrying out criteria such as minimum detection limit (MDL), linearity, linear range, sensitivity, limit of quantification (LOQ), accuracy, inter and intra-assay precision using the standard concentrations of 0.001, 1, 3, 5, and 7 ppm for all target pollutants.

Gas Chromatography-Mass Spectrometry (GC-MS) Conditions

The determination of selected OCPs was carried out by gas chromatograph (GC-MS, PerkinElmer 600, USA) equipped with mass-selective detector (MS, PerkinElmer Clarus 600T, USA). The features and operating conditions of GC/MS system were as follows: GC, equipped with programmed temperature vaporizing (PTV) injector, DB-5MS 5% phenylmethylsiloxane fused silica capillary column (30m length, 0.25m i.d. and 0.25 μm film thickness), and helium (purity 99.999%) as carrier gas at constant flow-rate of 1.9mL/min. The injection volume was 2 μL and PTV was operated in splitless mode. PTV program was as follows: 80^{o}C, 12^{o}C/s to 350^{o}C and hold at 350^{o}C for 2min. The temperature of the ion source and MS transfer line were maintained at 170^{o}C and 280^{o}C, respectively. The oven program for OCPs was 60-280^{o}C temperature, 5-6 min holding time and rate of 15^{o}C/min-end. MS detector was operated in selected ion monitoring (SIM) mode.

Atomic Absorption Spectrophotometer (AAS) conditions

The determination of target metals was made by AAS equipped with graphite furnace, hydride and cold vapour generator and Hollow cathode lamp. Standard solutions of all the metals were prepared by diluting AAS standard solutions (1000 ppm) of As, Ni, Cd, Cr, Co and Ag. From each stock solution, 0.1mL was taken into 100mL flask, filled upto the mark with 2% HNO_3 and after the measurement of absorbances linearity was achieved in each calibration curve. After checking the working conditions of the AAS, soil samples were subjected for metal determinations.

RESULTS AND DISCUSSIONS

In many parts of the world, contamination of soil with pesticides and heavy metals from agriculture is still a problem of primary disquiet. In the region of Indian sub-continent, particularly in the vicinity of Sundarban mangrove environment of Hugli estuary, common organochlorine pesticides DDT, DDD, DDE, HCH and aldrin were found in soil with following level: γ-HCH is detected in term of 0.0474ppm while the concentrations of α-HCH, β-HCH, ρ, ρ-DDE, o, ρ-DDT are 0.0388, 0.0179. 0.0710 and 0.01330 ppm, respectively present in the soil (Nawab et al., 2003). Soil acts as filter, buffer and degradation potentials with respect to storage of pollutant with the help of soil organic carbon (Burauel and Bassmann, 2005) but it is recognized that the soil is a potential pathway of pesticide transport to contaminate other segment of the environment including food-chains.

Pesticides residues in soil

The level of organochlorine pesticides identified in soil samples and selected physico-chemical properties of the soils were summarized in Table 1. Half of the soil samples were slightly acidic while the rest are nearly neutral and they fulfill the pH requirements for most plants growth. Generally, the soils texture is clay (Table 1).

Heptachlor

The soil contents of heptachlor were S5 (0.88) >S1 (0.51)>S3 (0.33)>S6 (0.13)>S2 (0.09) mg/kg and ND for S4. The highest level was detected at sites S5 and S1 while the lowest value was measured for S2. All soil samples have contained above the maximum permissible limits for individual pesticides (0.01 mg/kg) and total pesticides (0.05mg/kg) in soil set by European Union.

Table 1: Levels of pesticides in soil (mg/kg) as a mean of five replicate measurements (±SD)
(P = 0.05)

Target pesticides	S1	S2	S3	S4	S5	S6
Heptachlor	0.51±0.012	0.09±0.021	0.33±0.002	ND	0.88±0.014	0.13±0.022
Methoxychlor	0.29±0.16	ND	0.63±0.03	0.02±0.001	2.14±0.06	0.73±0.023
Chlordane	0.35±0.01	0.07±0.002	0.17±0.012	0.98±0.023	0.46±0.02	0.36±0.014
DDT(o,p'-DDT+p,p'-DDT)	0.88±0.02	0.91±0.04	ND	0.03±0.001	0.66±0.03	0.18±0.011
Endosulfan(α)	0.53±0.01	0.78±0.015	3.05±0.07	1.58±0.12	0.87±0.05	1.99± 0.022
pH	6.3	6.8	5.1	7.2	6.5	7.1
Texture (%)	67.12 (clay)	59.76(clay)	62.03(clay)	56.98(clay)	60.19(clay)	64.38(clay)

Methoxychlor

All soils detected for methoxychlor concentrations gave significant level except site S2 (ND). Highest level was recorded at site S5 (2.14 mg/kg) followed by S6 (0.73mg/kg), S3 (0.63mg/kg) and S1 (0.29mg/kg) while lowest level at S4 (0.02 mg/kg) and S2(ND). Except for S2, all samples contain far above the permissible limits for both individual and total pesticides in soil. Therefore, looking for better alternatives and reducing the use of this pesticide is very important**.**

Chlordane

Chlordane was found in all soil samples tested with high concentration at S4 (0.98mg/kg) and low concentration at S2 (0.07mg/kg). This pesticide is persistent and can undergo bioaccumulation in food chains. Apart from this, in all soil samples, it was found to be far above the recommended value in soil. This result indicates that great attention must be given to the reduction of further use of this chemical in the future.

DDT (o,p'-DDT + p,p'-DDT)

Except for S3, DDT was found in all soil samples with considerable concentrations ranging from ND-0.91mg/kg. S2 (0.91 mg/kg), S1 (0.88mg/kg), and S5 (0.66mg/kg) have recorded relatively high level while S4 (0.03mg/kg), S6 (0.18mg/kg) and S3 (ND) have recorded relatively low levels. The cumulative level of o,p'-DDT and p,p'-DDT in all soil samples was found to be above the standard values for individual and total pesticides in soil. Thus, preventive action is required so that it is possible to minimize its further effects on water systems and food-chains for human consumptions.

Endosulfan(α)

Endosulfan-alpha was found in all soil samples from different selected sites of industrial regions of Welmera district with range of 0.53-3.05mg/kg. Three sites, namely, S3, S4, and S6 contain above 1mg/kg, 3.05, 1.99 and 1.58mg/kg respectively. The other sites: S1 (0.53mg/kg), S2 (0.78mg/kg) and S5 (0.87mg/kg) contain less than 1.0mg/kg. The

present result is less than the concentration of endosulfan(α) (25mg/kg) reported in soil sample from Awash basin, Ethiopia (Ahmed, 2007) while it is greater than the values reported from other countries (0.003-0.067mg/kg and 1.8mg/kg) (Jean M.Cobb et al., 2007). Endosulfan-alpha was evaluated to be above the maximum permissible limits in farm soil and counter-actions are essential.

Heavy metals in soil

The fate of metals in the soil environment is dependent on both soil properties and environmental factors. The concentrations of metals in soil solution is influenced by the nature of both organic and inorganic ligand ions through their influence on metal sorption processes (Naidu *et al*., 2001).The concentration of available trace metals in the soil was presented as mg/ kg of dry soil in Table 1.

Table 2: Levels of trace metals in soil (mg/kg) as an average of five replicate measurements (±SD) (p = 0.05)

Soil sample	Soil trace metals content (mg/kg)					
	As	**Co**	**Cr**	**Ag**	**Cd**	**Ni**
S1	0.841±0.09	15.13± 0.022	98.01±0.006	0.931±0.014	18.33±0.015	121.23±0.021
S2	0.436±0.022	0.89±0.011	107.44±0.17	0.793±0.004	3.46±0.025	71.97±0.092
S3	0.921±0.012	ND	104.02±0.056	ND	41.11±0.008	128.45±0.033
S4	0.611±0.034	3.01±0.005	76.25±0.054	0.492±0.007	ND	0.990±0.005
S5	7.29±0.008	6.53±0.031	ND	1.06±0.008	52.08±0.046	89.77±0.006
S6	4.18±0.018	2.09±0.024	17.91±0.066	ND	30.85±0.029	12.38± 0.009

Arsenic (As)

The level of As in soil sample was found to be in the range between 0.436-7.29 mg/kg. The highest level was detected in S5 and S6 while the minimum concentration was found in S2. Arsenic is notorious as a toxic element; however, its toxicity depends on its form of existence.

Cobalt (Co)

The concentration of Co in soil ranged from 0.89-6.53 mg/kg. Co metal concentration in the soil samples is as follows: S1>S5>S4>S6>S2>S3. The concentration of Co at site S1 is higher than those of other sites followed by S5. The present result indicates that the amount of Co found in the soil samples was within the normal range for agricultural soils.

Chromium (Cr)

The level of Cr in the soil samples obtained from different sites in decreasing order is S2 (107.44) >S3 (104.02) >S1 (98.01) > S4 (76.25) > S6 (17.91) mg while it was not detected in S5. The highest Cr content recorded in the soil samples S2 and S3, which was above the permissible level (100 mg/kg) in agricultural soil, may be attributable to constant discharge of effluent from the floriculture enterprise and other anthropogenic sources. The Cr mean value reported in this study was higher than those reported by Mico *et al*. (2006), and Kabata-Pendias and Pendias (2001). All soils have high clay contents, which seems to suggest high Cr adsorption by this soil component. The presence of high clay content and human activities from the industrial enterprise can increase the normal content of Cr in the soils.

Silver (Ag)

Ag levels found in different soil samples were ranged from 0.492-1.06 mg/kg. Soil sample from site S5 contains high amount of this metal than others and it was not detected in S3 and S6.

Cadmium (Cd)

Cd concentrations accumulated in the soils from different sites were S5 (52.08) >S3 (41.11) >S6 (30.85) >S1 (18.33) >S2 (3.46 mg/kg) while it was detected in site S4. High level is recorded for site S5 and low level for S2. The soil concentration of Cd in the present study is greater than the permissible limit (0.8mg/kg) of Dutch standards. The application of agricultural inputs such as fertilizers, pesticides, and biosolids (sewage sludge), the disposal of industrial wastes or the deposition of atmospheric contaminants increases the total concentration of Cd in soils, and its bioavailability. Cadmium is very biopersistent but has few toxicological properties and, once absorbed by an organism, remains resident for many years.

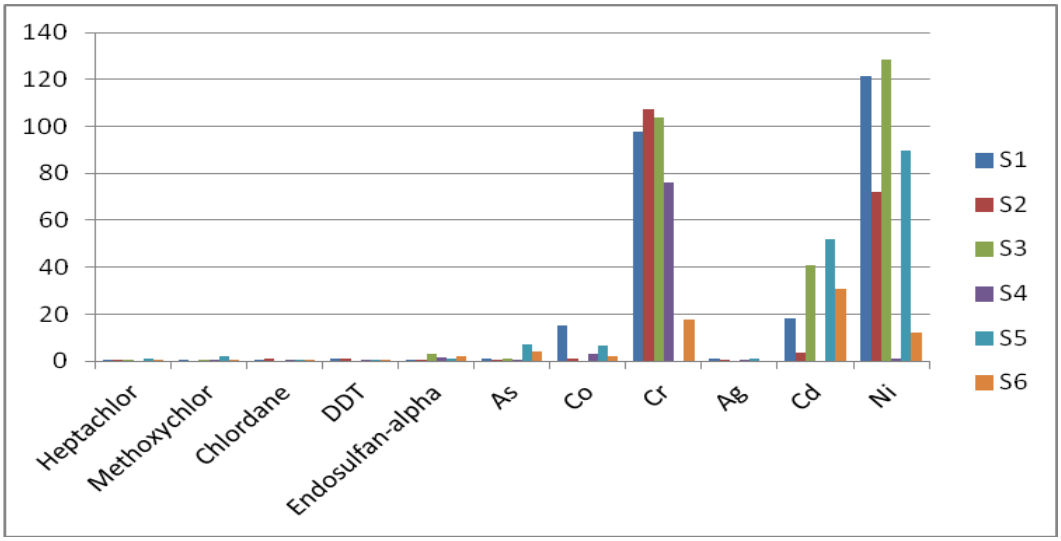
Nickel (Ni)

The Ni contents of the soils of selected sites in floricultural industry regions of Welmera district ranged between 0.99-128.45 mg/kg. High and low contents of Ni, 128.45 and 0.99 mg/kg were determined in S3 and S4 respectively. The Ni content reported for S1 and S3 in this study was higher than those reported by Mico et al (2006) and Campos (1997) in agricultural soils and also exceeded the reference value (100mg/kg) of Kabata-Pendias and Pendias (2001). The permissible limit for Ni in soil is 35mg/kg according to Dutch standards. Hence all soil samples subjected to trace metal determination contained above the recommended level except sites S4 and S6. The larger part of all Ni compounds that are released to the environment will adsorb to sediment or soil particles and become immobile as a result. In acidic soils, however, Ni becomes more mobile and often leaches down to the adjacent groundwater. Also, the mobility of the metal depends on soil pH and also depends on the organic matter and granulometric.

Comparison of OCP and Heavy Metals in Soil Samples

According to the report by Jyothish and Sujatha(2013), heavy metals (Fe, Ni, Mn, Mg, Co, Zn, Cu, Cd) as well as Organo chlorine pesticides in soil were analysed concurrently in Kerala, India. The observation resulted from the study signifies that, most of the area is contaminated by Ni and Co in addition to, the concentration of endosulfan α (0.977 mg/kg). Similar pesticide and heavy metal residues were found in soil samples from flower industry region in Holeta town, Ethiopia. A comparison of residual pesticides and heavy metals level is shown in Figure 2.

Figure 2: Comparison of level of pesticides and heavy metals in soil samples



The level of heptachlor, methoxychlor, As, Co, Cr and Ni in soil sample S1 is relatively high. Soil samples S1, S2, S3, S4 contained high concentration of Cr while S1, S2, S3 and S5 contained maximum level of Ni. From the present study result, the level of heavy metals is by far higher than that of organochlorine pesticides. This may be due to the organic matter content of the soil which can trap and degrade pesticides and reduce the time of their persistence in it than heavy metals.

CONCLUSIONS

The present study result reveals that the levels of both organochlorine pesticides and heavy metals in soil were on the average above the maximum permissible limits set for farm soils by different countries. The level of organochlorine pesticides: heptachlor (ND-0.88±0.014), methoxychlor (ND-2.14±0.06), chlordane (0.07±0.002-0.98±0.023), DDT(o,p'-DDT+p,p'-DDT) (ND-0.88±0.02), endosufan (α)(0.53±0.01-3.05±0.07)mg/kg and heavy metals: As(0.436±0.022-7.29±0.008), Co(ND-15.13±0.022), Cr(ND-107.44±0.17), Ag(ND-1.06±0.008), Cd(ND-52.08±0.046), Ni(0.99±0.005-121.23±0.021)mg/kg dry soil were detected. This may attribute to the continuous discharge of effluents containing various agrochemicals from the agricultural industries resided in the study region. The above detected chemicals are persistent and bioaccumulate in the environment. On the other hand, the polluted soils can act as a secondary source of pollutants which makes the problem more complex. Therefore, it is an important role for policy makers in reducing the impact of pesticides and heavy metals upon the environment. In addition to specific regulations and restrictions upon pesticide use, it is also necessary to reform agricultural policies in order to encourage patterns of land use, farming practices, monitoring the anthropogenic sources of heavy metals and uses of inputs which are in greater harmony with the environment are strappingly recommended.

ACKNOWLEDGEMENTS

The author is thankful to Wollega University for financial support for this research and the Chemistry laboratory of Ambo University for their materials support.

REFERENCES

Ahmed Hussen. 2007. Sample preparation based on pressurized liquid extraction for the determination of organochlorine pesticides residual status in soil samples of Awash Basin state Farms in Ethiopia, unpublished PhD dissertation submitted to Addis Ababa University, Ethiopia, 34-98.

Arantzazu U., Vega M. and Angul E. 2000. Deriving ecological risk based soil quality values in the Barque country. The Science of the Total Environment 247(2-3) 279-284.

Burauel, P. and Bassmann, F. 2005. Soils as filter and buffer for pesticides-experimental concepts to understand soil functions. Environ Pollut. 133, 11-16.

Campos E.1997. Estudio d e la contaminacion y fraccionamento quinico de metalis pesadoensueols de la Vega de Granada, Doctoral Thesis, University of Granada, Granada, Spain.

Denti B, Cocucci SM and Di Givolamo F. 1998. Environmental pollution and forest stress: a multidisciplinary approach study on alpine forest ecosystems. Chemosphere 36(4) 1049-1054-1056.

Doong, R.A., Sun, Y.C., Liao, P.L., Peng, C.K., Wu, S.C. 2002a. Distribution and fate of organochlorine pesticide residues in sediments from the selected rivers in Taiwan. Chemosphere 48, 237–246.

Facchinelli A, Sacchi E and Malleri L. 2001. Multivariate statistical and GIS-based approach to identify heavy metal sources in soils. Enviromental Pollution 114(3) 313-324.

Fang L, Feng Y, Liu H, Wu Z. 2010. "Determination of organochlorine pesticide residues in soil/sediment using isotope dilution gas chromatography-mass spectrometry", Se Pu., vol**.** 28, pp. 476-482.

Feng K, Yu B.Y, Ge D.M, Wong M.H, Wang X.C, Cao Z.H. 2003. "Organo-chlorine pesticide (DDT and HCH) residues in the Taihu Lake region and its movement in soil-water system I.Field survey of DDT and HCH residues in ecosystem of the region", Chemosphere., vol.50, pp. 682-687.

Fergusson, J. E.1990. The Heavy Element Chemistry, Environmental Impact and Health Effects, 2nd edition, pp. 7476. Pergamon Press: New York.

Fu, C.T., Wu, S.C. 2006. Seasonal variation of the distribution of PCBs in sediments and biota in a PCB-contaminated estuary. Chemosphere 62, 1786–1794.

Hao H, Sun B, Zhao Z. 2008. "Effect of land use change from paddy to vegetable field on the residues of organochlorine pesticides in soils", Environmental Pollution., vol**.**30, pp.1-7.

Hong, H., Chen, W., Xu, L., Wang, X., Zhang, L.1999. Distribution and fate of organochlorine pollutants in the Pearl River Estuary. Mar. Pollut. Bull. 39, 376–382.

I. Suciu, C. Cosma, M. Todică, S. D. Bolboacă, and L. Jäntschi. 2008. "Analysis of soil heavy metal pollution and pattern in central transylvania," International Journal of Molecular Sciences, vol. 9, no. 4, pp. 434–453.

Jean M. Cobb. 2007. Pesticide Residue in Soil and Water from Four Cotton Growing Areas of Mali, West Africa, The Journal of Agricultural, Food, and Environmental Sciences, Vol. 1, Issue1, 367-379.

Jonathan MP, Ram Mohan V and Srinivasalu S. 2004. Geochemical variation of major and trace elements in recent sediments of the Gulf of Mannar the southeast coast of India. Environmental Geology 45(4) 466-480.

Jose L. Tadeo. 2008. Analysis of pesticides in food and environmental samples, CRC Press, Taylor & Francis Group, Milton Park, UK, 207-219.

Jyothish Kumar T1 and Sujatha CH. 2013. Characterization of heavy metal and pesticide contamination in soils of kasargod district, kerala, India. International Journal of Geology, Earth and Environmental Sciences ISSN: 2277-2081.

Kabata-Pendias and Pendias, H. 2001.Trace elements in soils and plants, 3rd ed. CRC Press,Boca Raton, Florisda, 413pp.

Kamińska, I.A., A. Oldak and W.A. Turski. 2004. Geographical Information System (GIS) as a tool for monitoring and analyzing pesticide pollution and its impact on public health. Ann. Agric. Environ. Med., 11: 181-184.

Krishna A.K. & Govil P.K. 2006. National Geographic Research institute Hyderabad, India.

Krzyztof, Loska, Danutta, Wiechua and Irena Korus. 2004. Metal contamination of farming soils affected by industry. Environment International 30(2) 159-165.

L. Guo-li, L. Da-xue, and L. Quan-ming. 2008. "Heavy metals contamination characteristics in soil of different mining activity zone Trans," Transactions of Nonferrous Metals Society of China, vol. 18, no. 1, pp. 207–211.

Li X.D, Lee SL, Wong S.C, Shi W.Z, Thornton I. 2004. The study of metal accumulation in urban soils of Hong Kong using GIS based approach. Environ. Pollut., 129: 113-124.

Luo X, Zhou D, Liu X, Wang Y. 2006. "Solid/solution and speciation of heavy metals in the contaminated agricultural soils around a copper mine in eastern Nanjing city, China", Journal of Hazardous Materials., vol. 131, pp. 19-27.

Martin, M., Richardson, B.J., Lam, P.K.S. 2003. Harmonisation of polychlorinated biphenyl (PCB) analyses for ecotoxicologucal interpretations of southeast Asian environmental media: what's the problem? Mar. Pollut. Bull. 46, 159–170.

Mico, C., Peris, M., Sancez, J. and Recatala, L. 2006. Heavy metal content of agricultural soils in a Mediterranean semiarid area:the Segura River valley (Alicante, Spain);

Spanish Journal of Agricultural Research.4(4), 363-372.

Naidu, R., Krishnamurti, G.S.R., WenZel, W., Megharaji, M. and Bolan, N.S.2001. Metals in the Environment:Heavy Metal Interactions in soils and Implications for Soil Microbial Biodiversity. USA: Marcel Dekker, Imc.

Nawab, A., Aleem, A. and Maiik, A. 2003. Determination of organochlorine pesticides in agricultural soil with special reference to γ-HCH degradation by seudomonas strains. Biores. Technol. 88, 41-46.

Prenazzi, G. and Ziglio G. 1995. Regulations and Management. In: Pesticide Risk in Ground water. M Vighi, E Funari., editor. Chapter 10. Boca Raton, CRC Lewis Publishers, pp:203-240.

Sandaa RA, Enger O and Torsvik V. 1999. Abundance and diversity of archae in heavy-metal- contaminated soils. Applied Environment Microbiology **65**(8) 3293-3297.

Song Y.F, Wilke B.M, Song X.Y, Gong P, Zhou Q.X, Yang G.F.2006. "Polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and heavy metals (HMs) as well as their genotoxicity in soil after long-term irrigation", Chemosphere., vol. 65, pp. 1859-1868.

Srivastava V.S. 2001. "Correlation of metal-organic fractions in industrial sludge amended soils", Indian Journal of Environmental Protection., vol**.** 21, pp. 428-430.

Thrupp, L.A.1996. New partnerships for sustainable agriculture. Washington DC, World Resources Institute.

U.S. Environmental Protection Agency.1985. Risk Assessment Guidance for Superfund, Human Health Manual, Office of Emergency and remedial response, Washington D.C. 20450.

Vidal J, Perez- Sirvent C, Martinez-Sanchez MJ, Navarro MC.2004. Origin and behaviour of heavy metals in agricultural calcaric fluvisols in semi arid conditions. Geoderma, 121:257-270, 26: 343-357.

Vidhya V, Babu R, Kale C.K, Kothandaraman V.M, Manivel U, Jayabalou R, Subramaniam Y.V. 2001. "Irrigation waters and soils quality with reference to operation of a small scale chemical industry", Indian Journal of Environment Protection., vol**.**21, pp. 409-415, 2001.

Wolfgang Kleibohmer. 2001. Handbook of analytical separations, Vol. 3, Elsevier, Amsterdam-London-New York-Oxford-Paris-Shannon-Tokyo, 163-182.

Wong F, H.A. Algeria, L.M. Jatunen, T.F. Bidleman, M. Salvadour-Figueroa, Gold-Bouchot. 2004."Organochlorine pesticides in soils and air of Southern Mexico: Chemical profiles and potential for soil emissions", Atmosphere and Environment., vol.42, pp. 7737-7745.

Younas, M., Shahzad, F., Afzal Khan, S., and Ali, M. I.1998. Assessment of Ni, Cu, and Pb pollution in Lahore Pakistan. Environ. Int. 24, pp.761-766.

M. K. Zhang, Z. Y. Liu, and H.Wang. 2010. "Use of single extraction methods to predict bioavailability of heavy metals in polluted soils to rice," Communications in Soil Science

and Plant Analysis, vol. 41, no. 7, pp. 820–831.

Madjouma Kanda, Gbandi Djaneye-Boundjou, Kpérkouma Wala, Kissao Gnandi, Komlan Batawila, Ambaliou Sanni and Koffi Akpagana. 2012. Assessment of pesticide residues and trace element contamination in market gardens of Togo. African Journal of Environmental Science and Technology Vol. 6(10), pp. 380-390.

Journal of Science and Development
Guide to Authors

Manuscripts are submitted electronically using the addresses:
jsd.hu.et@gmail.com

For details of manuscript submission, please refer to the guide below, or visit the university website; **www.hu.edu.et**

Scope of the Journal
The Journal of Science and Development is a multi-disciplinary, peer-reviewed bi-annual journal published by the Research and Development Directorate of the University. It publishes articles on a wide range of disciplines, including natural sciences, technology, health sciences (human and animal), natural resources, forestry, agriculture, food sciences, business and economics, social sciences, and education. *JSD* publishes research articles, review articles, short communications and book reviews. The aim of *JSD* is to expand knowledge in basic and applied scientific and empirical research output and development, by providing access to research publications to a broad national and international readership, including researchers, practitioners, and students in science and development. Articles are peer-reviewed by at least two referees. Reviewers will remain confidential. The Editor may reject, before submission to referees, those manuscripts that do not conform to the 'Guide to Authors', or that do not fall within the scope and purpose of *JSD.*

General requirements
Upon submission of a manuscript, the authors are required to state that the paper has not been submitted for publication to any other journal or will not be submitted to any other journal. Manuscript submission implies that the author or authors agree to assign copyright to *JSD*. Manuscripts should be written in English, with spelling according to recent editions of the Advanced Learner's Dictionary of Current English (OUP). The font size for the text is 11-point Times New Roman, at exactly 1.5 point line spacing throughout (TNR 11/1.5).

Types of article
Research articles
Research articles should report original research. They should not exceed 6000 words in length, including title, abstract and references; 3-4 tables and 5-6 figures are permitted.

Review articles
Review articles cover recent advances in an area in which an author has been actively engaged. Maximum permissible length is 6000 words, including title, abstract and bibliography, or proportionately shorter if the review includes illustrations.

Short communications
Short communications contain news of interest to researchers, including progress reports on ongoing research, records of observations, short comments, correction and reinterpretation of articles previously published in JSD, *etc*. Maximum permissible length is 1500 words, including title, abstract and references; they may contain not more than two figures and/or two tables.

Book reviews
A critical evaluation of recently published books in all areas of science and development will be published under this column. The maximum permissible length of a book review is 1500 words, including any references.

Format of manuscripts
Research articles intended for submission to the Journal of Science and Development (JSD) should have the following basic structure.

Research articles
Title: The title of the paper, the name (s) and affiliated institutions. Full postal, telephone and email address of the corresponding author should be clearly indicated.

Abstract: The abstract must contain (a) the author's or authors' name(s), (b) the full title of the manuscript, (c) an abstract of not more than 250 words indicating the major aims and findings of the paper.

Keywords: 3-6 keywords should be set below the abstract, arranged in alphabetical order and separated by commas.
Introduction: A brief background of the subject, statement of the problem and the aims of the paper.

Materials and methods: Describe the materials and sites used in the study, the procedures, methods or tools used in data collection and analysis.

Results: Describe the results obtained, cross-referencing between text, tables and figures. When applicable, describe the statistical significance of the results.

Discussion: Give interpretations and implications of the results obtained. Compare your findings with related previous studies. The results and discussion sections may be presented together or separately.

Conclusions: Describe the contribution of the study to knowledge, and indicate future research needs (if any). The conclusion may also be included in the discussion.

References: All literature referred to in the text should be cited as exemplified below.
Acknowledgements: (if required). These should be brief, *e.g.* five lines of text.
Short communications
Short communications should essentially follow the structure given for research articles.

Review articles, book reviews
The structure of these articles will largely be determined by their subject-matter. However, they should be clearly divided into sections by an appropriate choice of headings.

Methods of submission
1. Electronic submission
Manuscripts should be prepared by means of Microsoft Word or an equivalent word-processing program. They should preferably be submitted electronically, by means of the style sheet **JSD_stylesheet.doc**, which can be downloaded from the journal's website. This style sheet consists of two sections:

(1) an *Input section*, into which your final manuscript is pasted from another Word document, and
(2) a *Help section*.

The Help section contains detailed instructions for preparing a manuscript for *JSD*. Please read it before you begin to prepare your manuscript.
Electronic files containing manuscripts should be named according to the following convention:

Authorname_Brief_title.doc, *e.g.* Bloggs_Podocarps_in_southern_Ethiopia.doc,

Where Brief_title is the first 4-5 words of the manuscript's title.

Diagrams should be lettered in a sans-serif font (Arial or Helvetica-at least 12-point), for final reduction to single-column (6.9 cm) or double-column (14.3 cm) width. Single column figures are preferred. Black-and-white diagrams should be submitted as uncompressed TIFF (.tif) files or as .jpg files, at a resolution of 300 dpi. Diagrams created in the default mode of Microsoft Excel (frame, colored background, *etc*.) are not acceptable for publication in *JSD.*

Files containing diagrams should be named according to the following convention: Author name _Figure No xxx.tif, *e.g.* Bloggs_Figure 006.tif

Photographs should be submitted as high-resolution (at least 600 dpi) greyscale (8-bit).jpg or uncompressed .tif files. The desired final size ('1-col', '2-col' or 'landscape') should be indicated. Always send photographs as separate files, using the same filename convention as above.
Photographs as described above are preferred, but clear, glossy black and white photographs (100×70 mm) on photographic paper may also be submitted. They should be clearly numbered on the back in **soft** pencil.

Tables should be prepared in MS Word's Table Editor, using (as far as possible) 'Simple1' as the model:

(Table … Insert … Table … Auto format …Simple 1),

(see JSD_stylesheet.doc for illustration). Tables taken directly from Microsoft Excel are not generally acceptable for publication in *JSD*.

Use Arabic (1, 2, 3 …), not Roman (I, II, III …), numerals for tables. Footnotes in tables should be indicated by superscript letters beginning with 'a' in each table. Descriptive material not designated as a footnote maybe placed under a table as a Note.

Footnotes should be avoided. Wherever possible, incorporate such material in the text, within parentheses.

2. Submission in paper form

Manuscripts may also be submitted on A4paper, subject to the same limits regarding number of words, tables and figures as above. Separate the manuscript into three sections:

(1) **text section**, with figure and table texts at the end;

(2) **figure section** (one figure per page, for reduction to 6.9-cm and 14.3-cmcolumn width); and

(3) **table section** (one table per page). Type the text itself at double line-spacing on one side of the paper only, with top, left and bottom margins set at 2.5 cm. The right margin should, however, be set at 7.5cm, to leave space for reviewers' and editors' comments. Number all pages in sequence, including figures and tables.

The order of headings and sub-headings should be indicated as shown in the style sheet JSD_stylesheet.doc. Keep all levels of heading as short as possible.

Tables, figures and illustrations should be submitted each on a separate page. When a manuscript is submitted in paper form, a CD containing all sections of the paper, including diagrams, is also required. Diskettes ('floppy disks') are not admissible.

Conventions

Scientific names must be italicized. At first mention, the author (*e.g.* (L.)) should be given, but must not be italicized.

Use single quotation marks ' ', unless you are giving a quotation within a quotation, in which case use " ' ' " .

Insert … Symbol … Special characters

All data should be given in the metric system, using SI units of measurement.

Use '.' (point) as the decimal symbol. Thousands are shown spaced, thus: 1 000 000.Use a leading zero with all numbers <1, including probability values (*e.g.* $p < 0.001$).

Numbers from one to nine should be written out in the text, except when used with units or in percentages (*e.g.* two occasions, 10 samples, 5 seconds, 3.5%). At the beginning of a sentence, always spell out numbers (*e.g.* 'Twenty-one trees were sampled...').

Use the 24-hour time format, with a colon'**:**' as separator (*e.g.* 12:15 h). Use day/month/year as the full date format (*e.g.* 12 August2001, or 12/08/01 for brevity in tables or figures).Give years in full (*e.g.* '1994–2001', never '94–01'). Use the form '1990s', not'1990's' or '1990ies'.

Use the en-dash – for ranges, as in '1994–2001'

(Insert … Symbol … Special characters En dash).

In stating temperatures, use the degree symbol ' º ', thus ' ºC', **not** a superscript zero ' 0 '.(Insert … Symbol … Normal text),

Define all symbols, abbreviations and acronyms the first time they are used, *e.g.* diameter at breast height (DBH), meters above sea-level (m asl). In the text, use negative exponents, *e.g.* g m-2, g m-2 sec-1, m3 ha-1 as appropriate. Use 'h' for hours; do not abbreviate 'day'.

If possible, format mathematical expressions in their final version (*e.g.* by means of Equation Editor in MS Word or its equivalent in Word Perfect or Open Office); otherwise, make them understandable enough to be formatted during typesetting (*e.g.* use underlining for fractions and type the numerator and denominator on different lines).

References

Please inspect the examples below carefully, and adhere to the styles and punctuation shown. Capitalize only proper names ('Miocene', 'Afar', 'The Netherlands') and the initial letter of the title of papers and books, *e.g.* write 'Principles and procedures of statistics', **not** 'Principles and Procedures of Statistics'. Do not italicize Latin abbreviations: write 'et al.', **not** '*et al.*'

References in the text should use the 'author-year' (Harvard) format:

(Darwin and Morgan, 1993) or, if more than two authors, (Anderson et al., 1993)

(Hartman and Kester, 1975; Anderson et al., 1993; Darwin and Morgan, 1994) chronologically.

References in the list should be in alphabetical order, in the following formats:

Journal article
Kalb J.E. 1978. Miocene to Pleistocene deposits in the Afar depression, Ethiopia. *SINET: Ethiop. J. Sci*. 1: 87-98.
Books
Whitmore T.C. 1996. *An introduction to tropical rain forests*. Clarendon Press, Oxford, 226pp.

Steel R.G.D. and Torrie J.H. 1980. *Principles and procedures of statistics*. 2nd ed. McGraw-Hill Book Co., New York. 633 pp.

Contribution as a chapter in books (Book chapter)
Dubin H.J. and Grinkel M. 1991.The status of wheat disease and disease research in warmer areas. In: Lange L.O., Nose1 P.S. and Zeigler H. (eds.) *Encyclopedia of plant physiology. Vol. 2A Physiological plant ecology*. Springer-Verlag, Berlin. pp. 57-107.

Conference/workshop/seminar proceedings
Demel Teketay 2001. Ecological effects of eucalyptus: ground for making wise and informed decision. Proceedings of a national workshop on the eucalyptus dilemma, 15 November 2000, Part II: 1-45, Addis Ababa.
Daniel L.E. and Stubbs R.W. 1992.Virulenceof yellow rust races and types of resistance in wheat cultivars in Kenya. In: Tanner D.G. and Mwangi W. (eds.). Seventh regional wheat workshop for eastern, central and southern Africa. September 16-19, 1991. Nakuru, Kenya: CIMMYT. pp. 165-175.

Publications of organizations
WHO (World Health Organization) 2005. Make every mother and child count: The 2005 World Health Report. WHO, Geneva, Switzerland.
CSA (Central Statistical Authority) 1991. Agricultural Statistics. 1991. Addis Ababa, CTA Publications. 250 pp.

Thesis
Roumen E.C.1991. *Partial resistance to blast and how to select for it*. PhD Thesis. Agricultural University, Wageningen, The Netherlands. 108 pp.
Gatluak Gatkuoth 2008. *Agroforestry potentials of under-exploited multipurpose trees and shrubs (MPTS) in Lare district of Gambella region.* MSc. Thesis, College of Agriculture, Hawassa University, Hawassa. 92 pp.

Publications from websites (URLs)
FAO 2000. Crop and Food Supply Assessment Mission to Ethiopia. FAOIWFP. Rome. (http://www. fao.or~/GIE WS). (Accessed on 21 July 2000).

Proof correction
Page proofs will be sent to the author, shortly before publication, as an Adobe Acrobat portable document format (PDF) file attachment to an e-mail message. This is essentially the final form in which the paper will appear. Minor alterations may be made, to conform to scientific, technical, stylistic or grammatical standards.

Although proofs are checked before they are sent to the author(s), it is the responsibility of the author(s) to review page proofs carefully, and to check for correctness of citations, formulae, omissions from the text, *etc*. Author(s) should return their corrections within seven (7) working days from the date on which the proofs were sent to them. Failure to do so will cause the paper to be printed as in the page proofs.

Contents

ISSN (Online): 2789-2123; (Print): 2222-5722