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of Science Frontier Research: H

## Environment & Earth Science

Hyper-Spectral Data

Geochemical Assessment of Soils

Highlights

Climate Changes the Man

Analysis of Land Degradation

Discovering Thoughts, Inventing Future

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# Climate Changes the Man

By Oleg Halidullin

*Introduction-* Millions of years on Earth created a favorable climate. The main instrument of this construction was the balance of the circulation of various substances between the atmosphere and the biota. One of the main circuits is the movement of water. Precipitation falls in a given zone in a given volume, with a predetermined sequence. In accordance with the needs of the inhabitants of the zone. Inhabitants of these zones or biota - the community of animal and plant life - returned moisture to the sky with their breathing and transpiration. There was harmony, a certain rhythm and climatic comfort. Heating the soil leads to evaporation and increased cloudiness. Clouds shade the soil and reduce solar radiation - evaporation decreases - clouds decrease - radiation increases. Conversely, intensification of sunlight activates plant growth, development and activity of biota, increases volatility.

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CLIMATECHANGESTHEMAN

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# Climate Changes the Man

Oleg Halidullin

## I. Introduction

Millions of years on Earth created a favorable climate. The main instrument of this construction was the balance of the circulation of various substances between the atmosphere and the biota. One of the main circuits is the movement of water. Precipitation falls in a given zone in a given volume, with a predetermined sequence. In accordance with the needs of the inhabitants of the zone. Inhabitants of these zones or biota - the community of animal and plant life - returned moisture to the sky with their breathing and transpiration. There was harmony, a certain rhythm and climatic comfort. Heating the soil leads to evaporation and increased cloudiness. Clouds shade the soil and reduce solar radiation - evaporation decreases - clouds decrease - radiation increases. Conversely, intensification of sunlight activates plant growth, development and activity of biota, increases volatility. The sun is hidden behind the clouds again. Atmospheric phenomena and biota formed an interdependent symbiosis. It is this symbiosis that created the climate of the whole planet for the weather for every point of the earth. And at every point, in accordance with the needs of its inhabitants. The atmosphere gave out exactly as much water as necessary for this area.

*Figure 1*

The man destroyed and continues to destroy the biota: more than 60% of the land was used for arable land, artificial reservoirs, landfills, asphalted and concrete areas of cities and roads [1].

The area occupied by humanity itself is insignificant, only 4%, but the number of floors of buildings and structures raises it several times. It is enough to understand that every heating of water, every washed cup and object, from body to asphalt, replenishes the atmosphere with evaporation, alien to nature. There are such data that each person spends

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200-300 liters of water a day, but only 2-3 liters of this volume a person uses for the purpose of nature - for drinking.

Even more fumes people produce in the communal and production processes, performed around the clock and year-round. Numerical data are not available, but it is sufficient to imagine these volumes that such water consumption is unnatural, nature is not provided for, and the rate of water consumption increases in proportion to the growth of the world's population, increase of productivity in all spheres, and the release of new goods. The manufacture of each item requires water flow. For example, wheat production requires 1000 liters of water per 1 kg, cheese 2500 liters of water per 0.5 kg, beef 4500 liters of water per 1 steak.

Production is all the things around us from the needle to the brick in the walls, the dishes and the computer on the table and the plane in the sky.

All these expenses are unnatural, alien to nature. After consumption, the water merges into the sewage system and evaporates from sedimentation tanks and oceans.

The volumes are huge and growing every day. And every day in different parts of the world there are floods. This is the reaction of water to the relation of land to it in a single chain of transformations. Unprocessed water, repeatedly falling into a short circuit, anomalous water, shows its unknown to us new qualities. Gathering in huge clouds, it is outrageous with typhoons, cyclones, storms, pours out massive sediments, overflowing rivers, looking for a job - coming out on the ground, warns us. Forms weather and climate.

We have reduced the functionality or the main purpose of water - to feed the biota. One hectare of soil contains 20 tons of underground living creatures [2], each unit that awaits rainwater. The rate of evaporation from the breathing of this creature is quite economical for its existence and reproduction. Biota accumulates water and carefully consumes it to the next precipitation, converts it into blood, juices, moisture from breathing and transpiration. Water, which is taken from nature, is excommunicated from its natural functions. With asphalt, dumps, arable land, artificial reservoirs, flood floods, part of the water goes underground, merging into aquifers, the other evaporates.

If you visualize the rate of evaporation of water from asphalt and the same amount of water from the same area of natural grass cover, you can be sure that water will go to the sky many times faster from asphalt than from the respiration of underground living creatures and transpiration of plants.

Hence the conclusion follows that the volumes of water of artificial fumes far exceed the natural ones, and everything that was raised into the atmosphere, deprived of its meaning, natural functions, can fall out in any place and flood it with floods at any time. This we see almost daily in various parts of the world.

Catastrophically quickly disappears the natural link - the transformation of water in the organic. Mankind evaporates water day and night, all the year round. And the volumes of these artificial fumes increase with acceleration. There is a new cycle of water, of unnatural origin. Water makes a circuit without performing its natural mission - go through food Chains. Everything in our world is interconnected. Each action has its consequences.

The increased volumes of artificial fumes with increased intensity of evaporation create a new regularity, another cycle of the water cycle. But no longer nature, but a cycle of artificial fumes or a cycle of anthropogenic, alien to nature. The mechanism of natural regulation is broken.

The old reference materials show the following ratio of greenhouse gases in the atmosphere:

Water vapor H2O 36 - 72%,
Carbon dioxide CO2 9 - 26%,
Methane CH44 - 9%
Ozone O3 3 - 7%.

Obsolete data, but water vapor more than anything else more than double even on these data and this content is increasing with new technologies. It is not known how fast in terms of speed, how much larger in volume, this growth is, but the increase in cloudy days and the increase in the number and destructiveness of floods speaks precisely for this. This is also evidenced by the abundant rains in Peru, floods in Australia, increased snow cover of the vast steppes of Kazakhstan in recent winters with the flooding of settlements and cities.

Water vapor, condensing into droplets, hangs in the air in a state of clouds and clouds, blocking the arrival of solar heat. These clouds are the main element of the impact on weather and climate. Mankind is taking some measures to influence the greenhouse layer of the atmosphere, according to certain elements of "preservation of the environment," such as reducing CO2. However, carbon dioxide is a private one, one of the elements of the circulation of substances in nature, its content is insignificant in comparison with the volumes of water vapor in the atmosphere. His participation in the penetration of radiation is much less than the volume of water in the clouds. It is assumed that the concept of "greenhouse gas" is not of decisive importance in the formation of atmospheric phenomena. The decisive factors of influence on them are the cloud cover of immense sizes, shapes, stability of existence, abundance of condensation, intensity of growth and emptying. The evaporation cycle involves all other components of the atmosphere, including carbon dioxide, in its process and turnover. It is consumed more by plants on a sunny

day, promotes plant growth and increases the yield of oxygen and moisture.

Thus, a new source of anthropogenic impact on climate is determined - artificial evaporation - a new water cycle. From this point of view, the impact of "greenhouse gases" is strongly questioned. The main cause of climate change is water vapor, concentrated in droplets and forming an impenetrable cloud layer of increased volumes, reducing the passage of solar radiation.

Urgent studies and confirmation of the proposed direction are needed. On their basis - the development of a new global concept, rethinking the entire population of the planet the nature of the destruction of natural phenomena. To preserve the habitat for our descendants, we must begin now to restore the natural evaporation - the basis of the universe. The basis of the new concept can be laid:

- Urgent development of alternative energy in order to stop the construction of dam power stations with the flooding of riverine areas.
- Total saving in water consumption is required. Revise all production and utility processes with the transfer of water consumption into closed cycles.
- Reconstruction of agriculture, transition to drip irrigation, reduction of irrigation systems, and non-plowing.
- Stopping soil contamination with landfills and dumps and reclamation of existing dumps. Creation of non-waste technologies.
- Reduce washing of everything that is washed and dried. There are, and need to develop new, methods for dry cleaning of objects and surfaces, for example, cars, cleaning of asphalt pavements and roads.
- Outdoor landscaping of buildings and structures. The walls and roofs of buildings and all structures can be covered with vegetation. For example, [3].
- Gradual transition to underground and underwater construction, starting from the development of ores, dressing, smelting, obtaining a finished product - all this can be done underground, in the worked out spaces. If it's metals, metal products and other metal-consuming products are exported to the surface. If it is oil, only fuel is output. If it is uranium, then electricity is output. All types of production must be located underground. And then everything else, down to the shelter. There are many shopping areas and metro in many large cities. There are real projects of underwater and underground cities. For example, [4]. There are underground greenhouses, where all the greenery is grown all year round. Only general mobilization in this direction can restore natural evaporation and the natural circulation of water - the basis of the universe. This is the only way to return a comfortable climate.

Of course, all this is not done suddenly, right away. But on a reasonable scale, humanity must gradually come to this. And our duty is to leave our offspring a normal climate and exclude natural disasters.

Hypothesis requires proof, research. I invite the whole world community to cooperate.

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# КЛИМАТ МЕНЯЕТ САМ ЧЕЛОВЕК

Oleg Halidullin



Миллионы лет на Земле создавался благоприятный климат. Основной инструмент этого строительства был баланс кругооборота разнообразных веществ между атмосферой и биотой. Одним из главнейших кругооборотов является движение воды. Осадки выпадают в заданной зоне в заданном объеме, с заданной последовательностью. В соответствии с потребностями обитателей зоны. Обитатели этих зон или биота – сообщество животного и растительного мира возвращало влагу в небо своим дыханием и транспирацией. Была гармония, определенная ритмичность и климатический комфорт. Нагревание почвы ведет к испарениям и повышению облачности. Облака затеняют почву и снижают солнечную радиацию - испарения уменьшаются – облачность уменьшается - радиация увеличивается. И наоборот, усиление солнечного света активизирует рост растений, развитие и активность биоты, повышается испаряемость. Солнце снова скрывается за облаками. Атмосферные явления и биота образовали взаимозависимый симбиоз. Именно этот симбиоз и создал климат всей планеты погоду для каждой точки земли. И в каждой точке, в соответствии с потребностями ее обитателей. Атмосфера выдавала ровно столько воды, сколько необходимо для данного ареала.

Человек уничтожил и продолжает уничтожать биоту: более 60% земли использовал под пашни, искусственные водохранилища, свалки, асфальтированные и бетонные площади городов и дорог [1].

Площадь, занятая самим человечеством незначительна, всего 4%, но этажность зданий и сооружений повышает ее в несколько раз. Достаточно понять, что каждый нагрев воды, каждая вымытая чашка и предмет, от тела до асфальта, пополняет атмосферу испарениями, чуждыми природе. Есть такие данные, что каждый человек расходует 200-300 литров воды в сутки, но только 2-3 литра из этого объема человек использует по назначению природы - для питья.

Еще больше испарений человек производит в коммунальных и производственных процессах, выполняемых круглосуточно и круглогодично. Численных данных нет, но достаточно представить эти объемы, что такое водопотребление неестественно, природой не предусмотрено и темпы расхода воды нарастают пропорционально росту населения планеты, повышения производительности во всех сферах, выпуском новых товаров. Изготовление каждого предмета, требует расхода воды. Например, на производство пшеницы необходимо 1000 л воды на 1 кг, сыра 2500 л воды на 0,5 кг., говядины *4500 л воды на 1 стейк*

Производство – это все окружающие нас предметы от иголки до кирпича в стенах, посуды и компьютера на столе и самолета в небе.

Все эти расходы неестественны, чужды природе. После потребления вода сливается в канализацию и испаряется с отстойников и океанов.

Объемы огромны и нарастают каждый день. И каждый день в различных районах планеты происходят наводнения. Это реакция воды на отношение к ней суши в единой цепи преобразований.

Безработная вода, многократно попадающая в сокращенный кругооборот, аномальная вода, проявляет свои неведомые нам новые качества. Собираясь в громадные тучи, безобразничает тайфунами, циклонами, штормами, выливается массированными осадками, переполняя реки, ищет себе работу - выход на почву, предупреждает нас. Формирует погоду и климат.

Мы сократили функциональность или главное предназначение воды – питать биоту.

Один гектар почвы содержит 20 тонн подземной живности[2], каждая единица, которой ждет дождевую воду. Скорость испарений от дыхания этой живности достаточно экономна для ее существования и размножения. Биота аккумулирует в себе воду и бережно расходует до следующих осадков, преобразовывает ее в кровь, соки, влагу дыхания и транспирации. Вода, которая отобрана у природы, отлучена от своих естественных функций. С асфальта, отвалов, пашни, искусственных водохранилищ, разливов наводнений часть воды уходит под землю, вливаясь в водоносные слои, другая испаряется.

Если мысленно представить скорость испарения воды с асфальта и этого же количества воды с такой же площади естественного травяного покрова, то можно убедиться, что с асфальта вода в небо уйдет во много раз быстрее, чем от дыхания подземной живности и транспирации растений.

Отсюда следует вывод, что объемы вод искусственных испарений намного превышают естественные и, все поднятое в атмосферу, лишившись своего смысла, природных функций, может выпасть в любом месте и затопить его наводнениями в любое время. Это мы наблюдаем почти ежедневно в различных районах планеты.

Катастрофически быстро исчезает природное звено – преобразование воды в органике. Человечество испаряет воду днем и ночью, круглогодично. И объемы

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этих искусственных испарений возрастают с ускорением. Появляется новый круговорот воды, неестественного происхождения. Вода совершает кругооборот без выполнения своей природной миссии – пройти по пищевым цепочкам. Все в нашем мире взаимосвязано. Каждое действие имеет свои следствия.

Повышенные объемы искусственных испарений с увеличенной интенсивностью испарений создают новую закономерность, другой цикл круговорота воды. Но уже не природы, а круговорота искусственных испарений или круговорота антропогенного, чуждого природе. Сломан механизм природного регулирования.

В стародавних справочных материалах показано такое соотношение парниковых газов в атмосфере:

Водяной пар H2O 36 — 72 %,
Диоксид углерода CO2 9 — 26 %,
Метан CH44 — 9 %
Озон O3 3 — 7 %.

Устаревшие данные, но водяного пара больше всего остального более чем в два раза даже по этим данным и это содержание нарастает с новыми технологиями. Неизвестно насколько быстро по скорости, насколько больше по объемам, идет этот рост, но увеличение пасмурных дней и нарастание количества и разрушительность наводнений говорит именно об этом. Об этом же говорят факты обильных дождей в Перу, наводнений в Австралии, повышенной заснеженности обширных степей Казахстана в последние зимы с затоплением населенных пунктов и городов.

Водяной пар, конденсируясь в капли, висит в воздухе в состоянии облаков и туч, закрывая поступление солнечного тепла. Эти тучи и являются главным элементом воздействия на погоду и климат.

Человечество предпринимает некоторые меры по воздействию на парниковый слой атмосферы, по отдельным элементам «сохранения окружающей среды», типа снижения CO2. Однако, углекислый газ является частным, одним из элементов кругооборота веществ в природе, его содержание незначительно по сравнению с объемами водяного пара в атмосфере. Его участие в проникновении радиации намного меньше, чем обложные объемы воды в тучах. Предполагается, что понятие «парниковый газ» не имеет решающего значения в формировании атмосферных явлений. Решающими факторами воздействия на них является облачный покров необъятных размеров, форм, стабильности существования, обильности конденсации, интенсивности нарастания и опорожнения. Круговорот испарений вовлекает в свой процесс и оборот все другие компоненты атмосферы, в том числе и углекислый газ. Он больше потребляется растениями в солнечный день, способствует росту растений и усилению выхода кислорода и влаги

Таким образом, определен новый источник антропогенного воздействия на климат – искусственные испарения – новый кругооборот воды. С этой точки зрения, воздействие «парниковых газов» подвергается сильному сомнению. Главной причиной изменения климата является водяной пар, сконцентрированный в капли и образующий непроницаемый слой облачности повышенных объемов, снижающий прохождение солнечной радиации.

Необходимы срочнейшие исследования и подтверждение предложенного направления. На их основе - разработка новой глобальной концепции, переосмысление всем населением планеты сущности разрушения природных явлений. Для сохранения среды обитания для наших потомков надо уже сейчас начинать восстановление природного испарения – основы мироздания. В основу новой концепции можно заложить:

- Срочнейшее развитие альтернативной энергетики для того, чтобы остановить строительство плотинных электростанций с затоплением приречных ареалов.
- Необходима тотальная экономия расхода воды. Пересмотреть все производственные и коммунальные процессы с переводом водопотребления в замкнутые циклы.
- Реконструкция земледелия, переход к капельному орошению, сокращению ирригационных систем, безотвальной вспашке.
- Прекращение засорения почвы свалками и отвалами и рекультивация существующих отвалов. Создание безотходных технологий.
- Сокращение мойки всего, что моется и высушивается. Имеются и, необходимо разрабатывать новые, способы сухой чистки предметов и поверхностей, например, автомобилей, чистки асфальтных покрытий и дорог.
- Наружное озеленение зданий и сооружений. Стены и крыши зданий и всех сооружений могут быть покрыты растительностью. Например, [3].
- Постепенный переход к подземному и подводному строительству, начиная с разработки руд, обогащения, плавки, получения готового продукта – все это можно производить под землей, в выработанных пространствах. Если это металлы, то на поверхность вывозится металлопрокат и др. металлоемкие изделия. Если это нефть, выводится только топливо. Если это уран, то выводится электроэнергия. Все виды производства должны быть расположены под землей. А потом и все остальное, вплоть до жилья. Известно множество торговых площадей и метро во многих крупных городах. Имеются реальные проекты подводных и подземных городов. Например, [4]. Известны подземные теплицы, где круглый год выращивается всякая зелень.

Только всеобщая мобилизация в этом направлении может возвратить природные испарения и естественный кругооборот воды – основы мироздания. Только так можно возвратить комфортный климат.

Конечно, все это не делается вдруг, сразу. Но в разумных масштабах человечество должно постепенно прийти к такому. И наш долг оставить нашему потомству нормальный климат и исключить стихийные бедствия

Гипотеза требует доказательства, исследований. Приглашаю к сотрудничеству все мировое сообщество.

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# Promoting Cultural Traditions, Social Inclusion and Local Community Participation in Environmental Development Schemes

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*Abstract-* The protection of the environment has been at the heart of local communities. The old sages, in most communities creatively fashioned cultural traditions with the goal of conserving the environment while judiciously using its precious resources. It is regrettable that local people and their time-tested cultural practices are neglected in environmental schemes, especially at the consultation and implementation stages. The thrust of the research was to highlight the benefits of incorporating local communities and their cultural traditions in all activities related to the environment using the classic example of the people of Anyinam in Ghana. Focus group discussions and direct observations were the main instrumentations used for soliciting data from the phenomenological study in a qualitative research approach. The study concludes that developmental planners and policy makers must promote the full participation of local communities in environmental schemes to aid in better infrastructure development schemes for the environment.

*Keywords:* *cultural traditions, community participation, social inclusion, environment, local people.*

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## I. Introduction

The full incorporation of the ingenuity of local communities and their cultural traditions in environmental development schemes is imperative (Adom 2016a). This need is undergird by the powerful conservation ethics that imbue the cultural traditions and the environmental wisdom of local people, especially the elderly sages in the society who through the narration of numerous proverbs and other wise sayings campaigned for the conservation of the environment and its resources (Adom 2016b). A rigorous analysis of the cultural traditions showcases the strong commitment of local communities to the promotion of positive schemes for enhancing the sustainability of the environment and its resources. Due to the significant, but often neglected contribution of local communities and their cultural practices to environmental protection, Kehinde (2013) advises developmental planners and policy makers that, to achieve optimum results in environmental development schemes, there will be the need for them to ensure the full and equal local community participation in the decision making and planning processes of the environment. Recent studies on environmental development have shown that the social inclusion and full local community participation are the strongest predator of successful environmental development schemes (Infield and Mugisha 2013). For instance, Nelson and Chomitz (2011) critically examined and compared the conventional protected areas and community conserved areas and realized that the community conserved areas were less prone to any form of environmental abuse such as fire outbreaks because of the vigilance of all society members.

The truism of the matter is that the success of any form of the environmental development scheme can only thrive via the concerted efforts of all factions of the society (Schultz 2002). Thus, the collective and communal spirit evident in local communities has been the secret behind the great successes of their environmental development schemes. Hawkes (2003) corroborates that unless modern societies learn to develop a culture that engages all its citizens, that embraces and cherishes all its members, including the local communities, no amount of environmental policies and schemes can be successful. This is justifiable because when project managers and developers of environmental project partner with communities and ensures fair social inclusion, it results in greater public support and their massive involvement in the materializing of the programs for better environmental protection (United States Environmental Protection Agency 2002). Craig (1995) concurs that community participation and social inclusion give the community a voice which eventually leads to better quality decision-making and planning of programs that are more closely linked to the needs of the people. Thus, the empowerment of the local communities through full participation and social inclusion results in productive citizens who ensure the full implementation of planned environmental development schemes (UNDP 2007).

Aside from the commitment of local communities to the course of environmental protection and sustainability, they have rich cultural traditions that are embedded with the diverse environmental ethos that offers a lasting platform for every environmental development scheme. Infield and Mugisha (2013) believe that integrating cultural traditions into the planning and management of the environment will provide practical lessons to address current and future

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challenges of the environment and its resources. Adom, Kquofi and Asante (2016), mention of the high impact of cultural traditions such as cosmological belief systems, taboos, myths and folklores in the sustenance of the environment in the face of modernity. Likewise, Adom (2016c) and Avenorgbo (2008) reveal festival commemoration as an indirect means of promoting environmental development and conservation via the environmental sanitation programs and tree planting exercises believed to be a requirement for most of the festival organisation in local communities. Indeed, the practicability of these cultural practices even in this modern generation where the environment has been abused at an abysmal rate cannot be overemphasized. Of course, a culture-led environmental development program that ensures greater social inclusiveness and rootedness, resilience and innovation of local communities is proven as highly successful (UNESCO 2012).

The environmental state of the Anyinam town in the Ashanti region of Ghana clearly picturesque the full participation of local community members, fair social inclusion and implementation of cultural traditions in promoting the development of the environment. As a result, negative environmental challenges such as drought, bush fires and the like have not been recorded in the township. The study was thus carried out to ascertain how the traditional council of the town ensures the full participation and social inclusion of all community members toward a consensus objective of environmental development. Also, the study sought to find out the cultural traditions and its successful implementation procedures that have been the bedrock to the success in all the environmental development projects in the Anyinam town. Moreover, their classic example is to enlighten the world, especially development planners and policy makers of the great essence of ensuring the promotion of cultural traditions, full community participation and social inclusion in environmental development schemes.

*a) Cultural Traditions in Environmental Development*

Culture lends itself to many interpretations. Soini and Dessein (2016) view culture as the customs, arts and social interactions of a particular social group. These customs of the people include the shared knowledge, beliefs, values and norms which are transmitted usually with some modifications from one generation to the other via socialization procedures (Avenorgbo 2008). In a general sense, culture is viewed as the totality of a society's distinctive idea, beliefs, knowledge and practices (Tansey and O'riordan 1999) or the accepted ways a community makes sense of the world around them. The cultural traditions are progressive, dynamic and not static (Willemsen 1992). The cultural traditions have evolved over time through adaptive processes (Berkes 2012). This debunks the assertions made by some early scholars that cultural traditions are static and lack of change syndrome (Finnegan, 1991). However, the cultural traditions do have a normative element and as such exerts a conservative force on developmental change (Rigsby 2006). It is this conservative element that links the past (ancestors) generation to the present (living) and the unborn (future) generations. Therefore, though cultural traditions inherited from the forebears can change in content, the change does not generally affect the spirit or philosophical implications that undergird them. These cultural traditions are rich in the developmental ethos because they are products of countless years of experience borne out of informal experimentations, dynamic insight and skills of the earlier generations of humankind (Warren 1991). Moreover, they have stood the test of time and are reliable and locally oriented (Mapira and Mazambara 2013). Therefore, when they are applied to modern developmental schemes like the environment, they achieve great successes.

The cultural traditions have a great affinity with environmental protection. The International Institute for Environment and Development (1992) concurs that the cultural traditions in most African societies are environmentally friendly and sustainable and have contributed immensely to nature conservation and sustainability. These cultural traditions such as taboos, festivals, myths, folklores, sacred groves, totems and cosmological belief systems have been resilient and strong enough to prevent habitat and species destruction. Cultural beliefs and traditions aids in avoiding resource exploitation (UNESCO and UNEP 2013). The significant roles that these cultural traditions play in environmental protection is due to the wisdom of the forebears that is latent in them (Rigsby 2006). The reasons behind the institution of the numerous cultural traditions by the intelligent forebears were indirectly to conserve the environment and its precious biodiversity resources (Avenorgbo 2008). The sorry state of Ghana's environment coupled with the dwindling numbers of her rich biodiversity resources is attributed to the rejection and abandonment of the cultural traditions due to excessive influence of Western traditions (Adom 2016d). Thus, there is a call for project managers and planners of environmental development schemes to consider the worth of these cultural traditions of local communities and incorporate them fully into the programs and initiatives for the environment (Adom 2016a; Awuah-Nyamekye 2013).

*b) Community Participation and Social Inclusion in Environmental Development*

The term 'community' has been defined and described by many authors. For instance, Breuer (2002) describes it as a group of people within the same geographical confines and/or with similar interests, identity or interaction. Wates (2000) in a similar

description refers to the term 'community' as people within the same geographical area coming together to achieve a common objective even though individually, they may have certain differences. These two definitions reiterate the main concept of community as a people defined by a set geographical boundary that joins forces to work hard in achieving an agreed popular goal irrespective of personal viewpoints. The term is gleamed with the ideology that the larger consensus decision and choice are in the best interests of the entire society and all society members must rally behind and support it wholeheartedly.

On the other hand, the term 'participation' has always been rightfully explained by many authors as the voluntary involvement of all stakeholders in developmental issues. The World Bank (1996) defines participation as 'a process through which stakeholders' influence and share control over development initiatives, decisions and resources that affect them.' Thus, local people who are stakeholders in developmental issues are by this definition and description of the term 'participation' required to partner with project managers and policy makers in the planning and implementation of policies of development in their local communities and nations as a whole. This has not been the case in many instances. This is because most of the local communities are sidelined in decisions of development in local communities. This may have accounted for Breuer's definition of participation as the process of enabling people to be actively and genuinely involved in making decisions on development as well as the planning, formulation and implementation of policies affecting them.

Sometimes developers and project managers may lip say that local people must be involved in decision making but they are just merely consulted and sometimes their views are thrown off board. Thus, the term 'local community participation' ensued calling for the factorization of local people with a higher degree of power to have a greater or equal share in developmental issues with development planners. Njunwa (2010) explains community participation as the process of regarding local people as potential and equal partners in development processes with development collaborates. He justifies Pretty et al. (1995) use of the term 'interactive participation' as the best form of participation that ensures that community members partner in joint analyses and plans in the use of resources in development. Other meager forms of participation that require less community involvement such as manipulative, consultative and functional forms of participation tagged as the lower forms of participations are not the thrust of this research and as such will not be discussed. However, the usage of the term 'community participation' as an end, requiring the empowerment of local communities to fully take decisions and/or have greater part in decisions will be employed in this discussion. The researcher, thus, puts forward this working definition for local community participation as the empowerment and giving of greater power to local communities, promoting their full partnering in developmental schemes with donor agencies and development planners from its inception that is planning to its implementation stages while utilizing the creative local traditional knowledge evident in their cultural traditions in all developmental issues affecting them directly and/or indirectly. This working definition prioritizes the massive involvement of local people and their knowledge systems in development schemes.

There is also the need for ensuring that the involvement and empowerment of the local people would not be in the preserve of the advantaged members of the local communities such as traditional authorities, elders, and the more privileged. This has been the case in most local communities where the less advantaged and marginalized in the society, including the poor, the aged, the disabled, women, and children are ignored and their views abrogated in developmental issues. This brings to the fore the term 'social inclusion'. Westfall (2010) explains that social inclusion involves the society valuing all its citizens irrespective of their gender, age or status in the society and enabling their full participation in developmental issues in the society. This is crucial because these often marginalized members of the society are proud members who are directly affected by any development scheme. They are required to also implement the agreed policies. The marginalized in the society can equally contribute meaningfully to decisions regarding the environment which, when implemented, could lead to successful achievements in the society. The Charity Commission (2010) suggested that social inclusion aids in the promotion of equality of opportunities for the often neglected and marginalized members in the society. This is keen in ensuring the maximization of development as well as the benefits all in the society gain from developmental schemes. World Bank (2013) and Silver (2015) believe that social inclusion would promote shared prosperity in the society with the poor and marginalized, promoting democracy in the society.

The full participation of local communities and the social inclusion of all members of the society deliver numerous benefits in the promulgation of environmental development schemes and as such must be enabled and promoted. Njunwa (2010) contends that it ensures the promotion of the bottom-up approach that proposes for all members of the society to share their views in a democratic fashion and contribute to the decision making processes regarding how to improve the state of the environment. This leads to better, appropriate and more sustainable decisions (Breuer 2002). The full involvement of every faction of the community in environmental development planning makes everyone in

the society responsive and accountable to ensuring that humane practices that enhances the environment and deliver more benefits to the society in its health and economy are undertaken. Craig (1995) adds that full local community participation and social inclusion results in an improved local level communication system between developers and the community. It opens the tenets of information such that ill activities on the environment by any person could be easily relayed to the responsible leadership for appropriate steps to be undertaken to arrest them promptly. More importantly, it gives local community members a sense of ownership to the environmental development scheme and as such deepens the resolve of every member of the society to make the scheme work (Breuer 2002). This is true because when people are not involved in developmental projects, they are likely to oppose or boycott their implementation (Rowe and Frewer 2000). Mostly, such environmental development projects, stepped in local communities are abandoned after project officers leave the local communities. Thus, for a sustainable and continuity of the developmental agenda regarding the environment in local communities, Njunwa (2010) opines that the key is in the promotion of the full participation and social inclusion of all members of local communities.

## II. Methodology of the Study

The researcher carried out a social and cultural oriented phenomenon (Denzin and Lincoln 1994) that delves into the significant roles that cultural traditions, social inclusion and local community participation play in environmental development roles and as such adopted the qualitative research approach. Creswell (2009) adds that the qualitative approach is chosen by researchers who seek to find an understanding and description of phenomena from the angle of participants who have experienced it. The researcher wanted to glean the comprehension on how cultural traditions, and social inclusion and local community participation has aided in the smooth undertaking of environmental development programs from the perspective of the residents in the Anyinam town.

The phenomenology study method was employed for the study. Leedy and Ormrod (2010) describes this method as using varied data collecting procedures in generating data from the perspectives of participants who have experienced the phenomena. This is aimed at gaining a richer interpretation of the phenomena from an insider's perspective. The classic example of the residents in Anyinam in the implementation of cultural traditions and the quintessential roles of social inclusion and local community participation in promoting positive environmental development schemes is exemplary and as such merited rigorous analysis. The phenomenological study approach was seen as the best research method that could yield 'thick' data regarding their approaches to environmental development. Focus Group Discussion interviews, consisting of five (5) elders in the traditional council, Eight (8) elderly members and Six (6) youth of the Anyinam town that lasted for more than one hour for each group were conducted by the researcher. In-depth personal interviews with the Chief of Anyinam and the Chief Linguist of Otumfuo Osei Tutu II were also conducted. Personal interviews were conducted for the chief and chief linguist because of their special positions that they occupy in the society and as such must be accorded the needed respect by treating their inquiry personally. Also, they may not have willingly disclosed sensitive information to the researcher and as such holding a private interview was seen as the most appropriate. The respondents were purposively sampled by the researcher because of their expertise in aiding in obtaining the required data for the study. The focus group discussion interview was adopted by the researcher because it afforded him to generate greater information from the participants in the cohort. This is because some participants recalled greater detail in the group interview format (Pope et al. 2000). A semi-structured interview guide was used in conducting the interviews because it allowed flexibility in the framing of ancillary questions as and when it became necessary all in the quest of generating deeper interpretation of the phenomena under study (Schuh and Upcraft 2001). In addition, direct observations of the promulgation of environmental activities that implements cultural traditions, social inclusion and local communication participation were undertaken by the researcher. This assisted the researcher in gaining first hand information (Kumekpor 2002) on how the residents of Anyinam utilized cultural traditions in environmental activities and included all members of the society in environmental protection activities.

The obtained data were analyzed and interpreted using the Interpretive Phenomenological Analysis approach. In this analytical method, the researcher immerses himself into the participants' perspective to get a sense or generate a deeper interpretation of the experience studied while highlighting and analyzing points by heavily quoting the individual responses of the participants (Fade 2004). Smith and Osborn (2008) opine that the interpretative phenomenological analysis is a dual interpretation process. The researcher makes meaning of the world of the participants and then tries very hard to decode the responses of participants while making sense of the participants' meaning making. The researcher perused the collected data severally to immerse himself in the data. The data were then patiently transformed into emergent themes. Relationships in the strands of data were sought and themes with similar interpretations

were made. The general portrait from the data was finally written in a coherent narrative report.

## III. Results and Discussion

This section presents the presentation of the findings of the study and the various emergent themes that were developed through the implementation of the Interpretative Phenomenological Analysis.

*a) The History and Formation of the Anyinam Township*

The name of the Anyinam town is etymologically traced to the local name for Ceiba (*Ceiba pentandra*) *Onyina* tree. The town earned its name due to the abundance of this flora species in the area. The plural *Anyinam* literally means 'a place of several *Onyina* trees'. The preservation of the history of the town is dear to the hearts of the citizens of this town. As such, the traditional council through local community participation ensures that they conserve the Ceiba species in the town to maintain the cultural essence of its name. The town is not famed just because of the rich Ceiba but also as a result of the town being the birthplace of the first king of the Asante kingdom who is credited to be the founder of the great kingdom, Otumfuo Osei Tutu I (Adom 2016c). This glorious past king is said to have united the seven clans that formed the Asante kingdom. Thus, as a unifier and an advocate for communalism, Otumfuo Osei Tutu I always maintained the inclusion and participation of all members of the society in deliberations of development. This communalism culture has been carefully preserved and mimicked by the current generation of residents in Anyinam. This accounts for the unity and oneness among the people. They also believe that doing things in unison would attract the blessings of the spirits and ancestors. The town is located near Kokofu in the Ashanti region of Ghana under the Bekwai Municipality in the Amansie East District. The forest tract where the king's mother sat and delivered him under one of the *Onyina* trees has been set aside as a sacred forest where the biodiversity resources in it are treated sacrosanct and as such are not abused in any way. This forest tract is called *Kwantakese* or *Tene Abasa ho* sacred grove. It is called *Kwantakese* because the pathway is said to be great. Oral tradition has it that her mother made several promises to the trees and water bodies to assist her reach a safe destination for the delivery of the child, hence the name. On the other hand, the sacred grove is also rightfully called *Tene Abasa ho* (Stretching the shoulders) due to her mother stretching her arms to hold the branches of trees for strength to endure the painful birth pangs she was going through.

Also, the town is famed for another account. It is privileged to have one of their community members appointed as one of the twelve powerful linguists that serve the great Asante king, Otumfuo Osei Tutu II. He is a living repository of the rich cultural heritage of the Asantes of Ghana. Many people tour the town especially during the iconic *Opemso)* festival used in commemorating the birth of the first Asantehene. Also, the *Kwantakese* sacred grove is a potential ecotourism site and is yet to be developed as such. The town is characterized by strong community bond with high moral values especially in relation to environmental protection. The traditional council and elders in the community are very vibrant in their attempts to maintain a high moral standard in the small community, such as spearheading environmental sanitation and tree planting activities. Though the town is not rich in terms of modern social amenities, the community members live in peace and have good health as a result of their exemplary local community participation, social inclusion and utilization of cultural traditions in addressing societal problems such as environmental degradation.

*b) Cultural Traditions in Anyinam That Promotes Environmental Development Schemes*

The environmental schemes of Anyinam are regulated by several cultural traditions. These include myths, folklores, sacred grove establishment, taboo systems, the deifying of biodiversity resources, maintenance of place and historical identity, festival commemoration and cultural education of the youth. These cultural traditions have maintained and ensured the sustainability of their environment and its rich resources.

*c) Institution of Sacred Groves (Kwantakese Sacred Grove)*

The town has a gazette tract of forest that is rich with rare biodiversity species both flora and fauna species. The people hold an ancient myth surrounding the birth of the first Asantehene who is affectionately called *Opemso)* (The Great One). One elderly man in the traditional court told the researcher that *'Since the place was the divine space where the great Asantehene Osei Tutu I was born, the forest must not in any way be abused and/or its resources destroyed.'* This sacred grove known as *Kwantakese* sacred grove has several stories surrounding it. It is believed to be stocked with spiritual beings who constantly reside in the forest tract. As abodes of the ancestors, the place and its rich resources are not to be taken. The place is not supposed to be entered. Entry into the grove is done by only the Asantehene, the Kokofuhene, Chief Linguists and traditional priests who enter the place barefooted to perform libation and offer sacrifices to the spirits of the ancestors. The chief linguist disclosed to the researcher that *'If anyone who is not supposed to enter the sacred place does so, s/he will not return again. Even those who do so out of sheer ignorance are punished with blindness or deafness.'* Various stories narrated and believed by the people serve as traditional checks to curtail anyone from entering the gazette area to even pick any of the biodiversity resources in the reserve. One

woman narrated a true life story of two hunters from Bekwai, a town in the Ashanti region of Ghana who entered the sacred grove to hunt. The chief hunter who narrated the ordeal they went through told the then traditional court, as told by the respondent, *'After running after a big grass cutter we spotted for two hours, we finally caught it alive when it was lying close to a certain tree. As soon as I laid my hand on it, the place suddenly turned into darkness. We heard strange noises and got really afraid. I left the grass cutter to go its way and the place returned to its normal day-time. We hurriedly ran out of the place. After his narration, when he was further interrogated, he couldn't speak again and the same happened to his colleague.'* Residents know these stories of how vengeful the gods and ancestors are and the swift and irrevocable punishments they give to those who enter the grove illegally. Parents and family heads narrate them to warn their wards and lineage members not to enter the place for any reason or whatsoever. This has maintained the place till date.

Moreover, huge fines in the form of money and scarce sacrificial items are paid by the culprit and their family to the traditional authorities so that the angered gods and ancestors could be propitiated by the traditional priest. One of the elders told the researcher that *'The culprit who faces the wrath of the ruling Asantehene, is asked to pay a huge monetary sum which sometimes require the selling of all the possessions of his entire family. He also purchases some sheep, schnapps, cowries, and other sacrificial items which are sometimes difficult to come by to be used for the sacrificial offering.'* Failure to do this would result in the successive death of family members in the lineage of the culprit. Thus, the family head and the elders in the culprit's family do everything humanly possible to provide the items. Also, every family does well to intensify the cultural training of their members regarding the need to leave the sacred grove intact and free from any kind of abuse. In addition, no family within the Asante kingdom would want to be a recipient of the anger of the most powerful ruler Asantehene as was disclosed to the researcher by the elders in the focus group discussions. The findings agree with the views of Taringa (2006) and Hughes and Chadran (1998) who highlighted that spiritual and monetary sanctions have helped in monitoring most sacred groves.

*Fig. 1:* Entrance to the *Kwantakese/ Tene Abasa Ho* Sacred Grove at Anyinam (Source: Photographed by the researcher)

*d) Festival Commemoration (Opemso) Festival)*

The small town of Anyinam is famed because of the place being the birthplace of the first Asantehene. As a result, every year, the *Opemso)* festival is commemorated by the people to remember the iconic event in the history of the people. During the festival observance, most of the practices and events are carried out in the sacred grove as well as some popular river bodies where the mother of the great king gained strength and favor to aid her safely deliver the rescuer of the Asante kingdom, Otumfuo Osei Tutu I. Thus, the river bodies as well as the *Kwantakese* sacred grove, where the sacrificial offerings are made every year, are protected from all kinds of abuse, keeping it away from any form of adulteration.

Particular indigenous flora species like the *Ahomakyem* which the first king's mother held in her hands on the eve of her birth pangs for strength play significant roles in the festival observance. Owing to this, the flora species is not to be abused or wantonly destroyed. Ensuring its sustainability and conservation is at the hearts of the members of the traditional council. One elder told the researcher, *'It will be a great disgrace to us as custodians of the traditions of our ancestors to commemorate the festival without the use of the Ahomakyem. Therefore, we have instituted various laws and taboos to regulate and maintain its sustainable use.'* Particular forests tracts and trees that are part of the festival celebration have been conserved and preserved as a result of the event.

As part of the festival celebration, the entire community engages in a weeklong tree planting exercise to make the community green as the ancestors left it in their care. Also, massive sweeping and sanitation exercises are carried out in all the nooks and crannies of the community to maintain cleanliness. This

is seen by the people as a display of respect to the ancestors and a sure means of gaining their approval as well as blessings. Most of the elderly respondents happily and quite excitingly told the researcher that *'All of us, even on our limping legs and feeble strength, participate in the tree planting and sanitation exercises because we know our forebears are coming to visit us, to bestow upon us a blessing and a seal of approval after our physical passing.'* . Awuah-Nyamekye (2013) noted similar cleaning and sanitation exercises when the people of Brekum in the Brong Ahafo region of Ghana were celebrating the *Yerepra Yare* (Sweeping diseases) festival. Thus, indirectly, the festival observance and its associated religious beliefs help in improving the state of the environment in the vicinity

*e) Deifying of Natural Resources*

The people of Anyinam have a culture of deifying every natural resource in their vicinity. For instance, every river, mountain, big tree and others are associated with particular deities. This is borne out of their belief in animism and nature worship or reverence. They believe that every natural resource is inhabited by a spiritual being or deity who must be respected. This was largely seen in the focus group discussions among the elderly members who recounted histories that led to the naming of the five major river bodies in the town, namely *Supan*, *Akoko-nko-adwae*, *Kaakawere*, *Poto* and *Nunkufia*. They said *'Before our ancestors settled this area, they combed the entire jurisdiction for various river bodies so that they could propitiate to the deities that reside in them for their favour and support. Usually after the sacrificial propitiation with palm wine which was accepted by every deity, the deity revealed himself/herself to the people. S/he pledges his/her support to us only if we heed to his statues and taboos which s/he discloses to us. That is what happened we got to know the names of all the river deities in our town.'*

The purity of the river bodies is perpetually maintained by the people as the researcher noticed through direct observations. Bad practices like fishing with poisonous chemicals, defecating near the water bodies, bathing in the rivers as well as pouring of effluents from homes and small enterprises into river bodies are not engaged in by community members. This is due to the fear that it would anger the spirit believed to reside in the river which may be catastrophic. One respondent mentioned that the punishments could be instant death, madness or blindness. Sometimes, the river deity can even decide to dry up its river so that the community would not enjoy its services any longer. Such was the case of a narration told by the Anyinam chief. He said *'A certain woman abused one of the taboos of a river deity by sending black coal pot to fetch water from the stream. The woman, though, was reported to the traditional court, was spared out of favouritism because of her relations with one of the members in the traditional court. After three days of going unpunished, the river surprisingly dried up. The woman also died some few weeks after the incident through some mysterious ailments'.* The incident, according to the respondent, continues to be a warning to the current traditional court not to bow down to anyone who abuses any of the cultural traditions of their forebears. The deifying of the river bodies has ensured the purity of the water that is drunk by the people and this accounts for the minimal recording of waterborne diseases in the area. If it was not for the deifying of their major river bodies, the outbreak and percentages of waterborne diseases affecting the people would have been high due to the absence of potable water from the water and sewerage companies. The deifying of rivers noted by the researcher resonate with the views of Boamah (2015) when he cited some rivers in Ghana like River *Pra* and *Oda* as revered by the people due to their powers, thus, helping in their sustenance.

There are some big *Onyina* (Ceiba) trees within the vicinity of Anyinam that are seen by the people as possessing spirits and as such they are not abused. Specific arrangements are made by the traditional council to sweep the surroundings of these deified trees to keep them always in a tidy condition. The researcher observed some eggs and other sacrificial offerings at the roots or base of the trees. The periodic sacrifices offered to these trees under the full glare of society members, including the youth have instilled fear in them not to cut them down. Thus, residents of Anyinam will not in any way, under any circumstance, wantonly destroy anything in nature due to the belief in animism and the deifying of natural resources. Ecologically, the positioning of those trees in strategic places in the township protects residents and their property from any potential storms. The greening of their environment has protected the people and their farms from bush fires and other negative implications of the environment.

*f) Maintenance of Place and Historical Identity*

The community earned its name as a result of the abundance of the Onyina (Ceiba) trees in the area. Thus, to maintain the place and historical identity, the traditional authorities and the elderly members in the society, they have put forth stringent measures in the form of taboos and by-laws to curtail the wanton destruction of the Ceiba species in the environment. The chief of Anyinam disclosed the sustainability strategy adopted by the traditional council. He said *'We have adopted the nursing of the seedlings of the indigenous plants, especially, Onyina which is our historic and place identity flora species.'* This nursing of seedlings coupled with tree planting exercises has aided in sustaining the *Onyina* trees in the area. The elders in particular, were so passionate about maintaining the place and historical identity through the maintenance and abundance of the

*Onyina* trees. One of the elders asked a rhetorical question in the focus group discussion that '*How will our ancestors feel in the spiritual world when we destroy all the Onyina trees in our environment that earned this settlement they tirelessly built?'* This response indicates the association of the place identity of Anyinam with the pleasing of the ancestors. The great fear of the elders regarding the punishment they will face after their physical passing is very prevalent in Anyinam. This was seen in a narration shared by the elders. They told the researcher, while sounding quite serious as was seen in their facial expressions and the tone of their voice that *'If we don't ensure that the cultural traditions handed down to us by the forebears are meticulously followed and implemented, we will not be welcomed favourably into the metaphysical world. We will not even be offered a seat as guests in the metaphysical world!'* Therefore, they strive very hard to maintain the abundance of the *Onyina* flora species in the environment.

*g) Cultural Education of the Youth*

The traditional council in Anyinam has instituted weekly meetings with the community where sections of the meeting are used for cultural education of the youth concerning the cultural practices, taboos and other relevant areas on culture. These meetings are convened at the forecourt of the Chief's palace during evenings as well as on taboo days thus, Tuesdays when no one is supposed to go to work whether farming or hunting. Family heads (*Abusuapanyin*) and the elders in the society use narrations such as myths, folklores and proverbs to instruct the youth on their cultural heritage, moral chastity and the need to ensure strict obedience to the laws and taboos in the community. The chief linguist highlighted the essence of this cultural education as *'instilling reverential fear in the youth concerning the ancestors and spirits while bolstering their respect for the elders and the traditional council.'* Therefore, the youth when reprimanded on issues heed to the advice of the elders. They value the orders of the elders and the traditional council. This has brought unity and understanding amongst all the factions of the community. More importantly, it has helped the youth in amassing knowledge on the culture of the people. As a result, they humbly follow the precepts laid down by the ancestors.

However, the members of the traditional council were worried that due to the formal education received by some youth in the vicinity, they do not sometimes partake of the cultural training since some of them are living in boarding schools. When the researcher inquired from them other avenues that could be tapped to carry out the cultural training, the majority of the elders interviewed suggested that *'The schools must intensify cultural training by employing cultural experts (Nananom) who are the elders in the various communities as resource persons in schools to help the youth in grasping the knowledge of our cultural traditions and practices.'* This was seen as imperative for the youth whose perceptive powers are seen as dulled by Western culture and entertainment mostly featured on Television programs and in formal educational institutions. Their suggestion concurs with Ormsby (2013), Awuah-Nyamekye (2013) and Gadzekpo (2013) that the curriculum in schools must be designed to factorize cultural education including reverence for the ancestors and observance of traditional institutions like taboo systems.

*h) Institution of Taboo Systems*

Taboos remain the main tools for prohibiting any inhumane practices toward the environment and its resources in Anyinam. Some of the taboos are associated with the deified resources in nature as well as other acts that are believed to invoke the curses of the ancestors. These taboos were seen as helping in the promotion of environmental schemes that protected the environment and its resources.

The people of Anyinam hold a taboo that frowns on any form of disrespect towards the elderly in the community. One of the youths interviewed by the researcher said that '*The elders are sitting in the seat of the ancestors and must always be respected and listened to. Failure would incur the wrath of the gods and ancestors.*' Therefore, any youth who does not listen to the elders and exhibit any kind of rude behaviour towards them is punished. As a result of this taboo, the elders have high respect and authority. Their words, advice, instruction and orders are seen as the words of the gods and ancestors. The youth highly comports themselves very well and listen to the elders. Thus, when environmental programs are drawn by the traditional council in liaison with the elders in the community, the youth cooperates effectively. This indicates that when respect for the elders in various communities is heightened, they could be used as potential mediums for giving instructions regarding environmental schemes in every society.

Other taboos directly linked to the maintenance of the environment and its resources noted by the researcher included *'Do not defecate, urinate or bath in the water bodies', 'Do not enter the Kwantakese sacred grove and/or pick any resource from it, not even dead wood', 'Do not pour any effluent of food or any other thing into streams and water bodies', 'Do not cut down any deified tree', 'Do not leave your livestock or any animal to wander aimlessly in the environment', 'Do not leave the gutters in front of your house choked or unattended to', 'Do not absent yourself from any communal labour and societal meetings without permission from the traditional council', 'Observe all taboo days- every Tuesday and some Sundays on their calendar', 'Farmers must leave ten yards forest*

*vegetation around water bodies'* and *'Menstruated women should not fetch from any river.'*

Failure to heed to these taboos is believed to attract spiritual penalties from the deities and ancestors. The traditional council has also established monetary fines and payment of sacrificial items for the breach of any of the afore-stated taboos. For instance, Ten Ghana Cedis is paid to the traditional council by any culprit who fails to partake in communal labour without prior excuse. In addition, a work in the society such as the de-silting of choked gutters and sweeping of sections of the society is given as extra punishment. In situations where the culprit has been severely punished by the gods and ancestors, sacrificial items must be paid in addition to reverse the curses. The penalty imposed by the traditional authorities varies greatly depending on the taboo that is breached by the culprit. Other forms of penalty include public mockery or ridicule at society gatherings on Sundays where the culprit is disgraced before society members. Members of the society hoot at the person and the disgrace that ensues labels the member of the society thereafter. All these sanctions cleverly put together by the proactive traditional council of Anyinam helps in ensuring the full participation of community members in environmental development schemes.

The taboo system as noted by Adom et al. (2016) and confirmed by the findings of the study has indeed helped in the conservation of biodiversity. Diawuo and Issifu's (2015) assertion is true in relation to the findings of the study that the taboo systems served as traditional checks and balances regulating the use of the environment and its resources.

*i) The Relevance of Community Participation and Social Inclusion in Anyinam and Environmental Development*

The traditional authorities of Anyinam have implemented various strategies of ensuring full community participation and social inclusion in their environmental development programs. These include regular communal labour, assigning of environmental cleaning tasks among gender, age and social groups, intensive monitoring via communal register and communal forums.

*j) Regular and Mandatory Communal Labour*

Communal labours are organized on every taboo day thus, Tuesdays. Weedy areas in the Anyinam vicinity are cleared collectively by all the members in the community. It is compulsory for every member of the society to partake in the cleaning and sanitation exercises. Choked gutters are also removed and rubbish-filled spots are thoroughly swept. On Monday evenings, drums are beaten from the traditional court to announce to residents the upcoming mandatory communal labour. The collective efforts put in by every member of the society, whether old or young helps in making the environmental development program a success. However, stubborn residents who refuse to participate in the communal labours organized by the traditional council are fined. Ten Ghana Cedis is the penalty sum agreed by consensus with the community for culprits to pay. The strict monitoring and sanctioning measures implemented by the traditional council also accounts for the triumph of the environmental programs in the society.

*k) Assigning of Environmental Cleaning Tasks among Gender, Age and Groups*

The traditional authorities through various committees assign specific and clearly demarcated areas for residents to work in the environmental projects in the society. The heinous cleaning, planting or sanitation tasks are divided according to gender, age and groups. For instance, the elderly women between the age range of seventy years and eighty years act as supervisors of the environmental projects for women, supervising the young women who sweep at various sections of the Anyinam vicinity. On the other hand, the young men who engage in pruning and tree planting exercises are also supervised by the elderly men in the society. The children also search through all the nooks and crannies of the community picking all forms of debris and refuse. They are led by the leader of the Anyinam youth association. The elders of the traditional council, whose primary role is supervisory and monitoring also engage in the environmental tasks as their individual strengths would allow. This inspires the youth and gears them on to work tirelessly till the environmental task initiated is completed.

Also, every first Sunday of the month, the Anyinam society engages in a general cleaning exercise where every household is supposed to tidy their homes and surroundings. On that day, the various social groups attend to the communal work together with their household duties. For instance, a young woman who belongs to the vibrant food sellers association told the researcher *'I wake up early morning around 4 am together with my family on that first Sunday of the month. We work very hard in keeping our homes clean. While the men weed the compound, I work with the other women to sweep, clean and scrub the floors of the various buildings in our household. After that, I join the women in my association to sweep the entire Anyinam community.'*The youth association, the landlords association, and other social groups also have their various tasks that they perform to maintain environmental cleanliness in the Anyinam community. It is an interesting event and the collective effort and team spirit makes every resident to participate voluntarily. This resonates with the view of Breuer (2002) that community participation revamps the resolve of every society member to the work. The researcher observed on one Sunday that only a few members of the society did not

engage in the environmental programs due to ill health. The event was like a communal fanfare due to the full participation of community members.

*l) Intensive Monitoring Via Communal Register*

Traditional authorities have a communal register that contains the names of all the members of the society. The list that is constantly upgraded to include new members of the society that are born is used to monitor those who turn out for the community environmental schemes organized. The chief linguist, together with some elders in the society monitors the environmental tasks being undertaken and marks the names of all the participants. When the researcher asked the monitoring team those whom they mark present, they unanimously replied *'We do not just mark present, the names of residents, we see at the scene of the environmental cleansing work, but rather those who are seen actually participating in the work.'* Thus, everyone present at the scene is not expected by the traditional council to just be at the work scene but to participate in the work. The communal register contains the house numbers of all the houses in the community with the names of members in each house. Those who were marked absent were fined a penalty fee of ten Ghana Cedis each together with other sacrificial items. The intensive monitoring via the communal register aids in ensuring full community participation in all the environmental schemes in Anyinam.

*Fig. 2:* Some Elders of Anyinam ready for the monitoring of the environmental program on a taboo day (Source: Photographed by the researcher)

*m) Communal Forums*

Regular communal meetings and forums are organized by the Anyinam chief and traditional authorities with society members where various issues on development especially environmental issues are deliberated. These meetings are held before decisions regarding the society are made and implemented. Every decision is reached at a consensus with every member of the society participating in the discussion, expressing his/her concerns with greatest freedom with no form of coercion. All factions of the society, age, gender, or status in the community is allowed to share their views and opinions. The views are carefully weighed, deliberated and voted on by the entire community. The agreed decisions are then implemented. This ensures social inclusion and community participation. As a result, the consensus decision's implementation is smooth and every member of the society works toward making them work.

The researcher asked why the traditional council does not imposed their views and decisions on the people. One of the elders in the traditional court told the researcher two popular maxims in the Ghanaian community that have the same philosophical interpretation, *'Ti koro nko agyina'* (One head does not go into counsel) and *'Nyansa nni baakofo tirim'* (Wisdom is not in the preserve of one person). They added that every individual has his/her own unique viewpoint which may be very important for social progression and development. Speaking from a spiritual perspective, the chief told the researcher that *'The ancestors can speak through anyone. They can issue their directions and guidance through everyone, even a child. That is why we don't dissuade views of even children in our communal forums.'* Thus, the culture of the Anyinam community ensures social inclusion and full community participation. The findings authenticates Njunwa (2010) and Breuer (2002) assertions that the bottom-up approach and all inclusiveness of society members in decision making processes results in more sustainable and better decisions.

*n) Challenges Faced by the Traditional Authorities in the Discharge of Their Powers and ensuring the Promulgation of Cultural Practices, Community Participation and Social Inclusion in Environmental Development Schemes*

Despite the vibrant nature of the traditional council of Anyinam, they have various challenges and anticipate other obstacles that can disturb the discharge of their authority and might affect the smooth implementation of the cultural traditions, social inclusion and full community participation in environmental development projects and programs.

The traditional authorities mentioned the abuse of freedom of speech and human rights that is seen more in the urban centres, gradually entering the rural areas due to the influx of formal education and its uncensored liberties. These, according to the elderly respondents, have made most of the youth in various educational institutions disrespectful and act rudely to the elderly in the society. As a result, they no more listen to the elders. Some elite in the society feel that the cultural traditions are mere superstitions and borne out of sheer ignorance. This makes their implementation

very difficult in some societies though they are very stringent with their practices. When the researcher asked what can be the remedy to such a situation, one elder said *'Formal education is important but it should not be tailored to demean cultural traditions and other good heritage of societies. Students must be taught to respect culture, honour the elderly in the societies since this is the key to development.'*

The views and concerns expressed by the elders in Anyinam are not misplaced. Indeed, education must be used to promote the accepted values and culture in the society as Adom et al. (2016) argued. Thus, formal education must not be used as bait in eroding the rich cultural traditions of Ghanaians that ensured the promotion of social inclusion and community participation and more importantly, the respect of elders and authority. Essentially, education should be used to accentuate the rich philosophical values in these cultural practices to promote its relevance in society and national development.

Another great challenge hinted by the traditional authorities and the elders is the advent of Christianity. With the establishment of a Christian church in the town, followers look mean on the cultural traditions and practices. They view it as superstitious and idolatrous buttressing the views of some scholars like Boamah (2015) and Adom (2016d). Many culprits of the taboos in the Anyinam community, according to the traditional authorities, are all Christian followers. Thus, one elderly respondent opined that *'If it is only for the Christians, the environmental projects that have been heightened by the cultural traditions would have been left unattended to, leaving the environment into cold hands to destroy.'* This comment, to the researcher is not true in the case of all Christians as noted in another response by some elders who were Christian converts and from the observations made by the researcher. The elderly Christian converts rebutted the earlier comment that Christians and the Christian faith in general did not campaign for environmental cleanliness. They said *'Christianity does not promote environmental destruction since the Christians share the belief that they would be equally judged by God based on how they treated the environment and its resources'*, as it was argued by some elders who were Christian converts. The chief linguist then instructed the elders who were Christian converts to tell their followers to 'Give to Caesar what belongs to Caesar and give to God what belongs to Him'. As it was noticed by the researcher, some Christians in Anyinam were very instrumental in the environmental projects and honored the taboo days and taboos. The stubborn Christians must be advised not to abuse any of the cultural traditions and practices since they play quintessential roles in protecting the environment. They must understand the creation principle that they must treat the earth and its resources with respect as Brulle (2000) opined.

Moreover, the waning of the powers of the traditional council is a potential threat to the traditional authorities of Anyinam. They narrated an instance when a woman who is not from the town abused one of the taboos in the town. She was summoned before the traditional court, but refused to heed the call. Her husband who is a civil servant in one of the urban centres disrespectfully told the traditional court to take them to court. The members in the community paraded their house and they left the community. Thus, the general waning of the powers of the traditional authorities is a potential threat to the traditional council of Anyinam. They suggested that *'the legislation of the land must grant authoritative powers to the traditional authorities so that their verdict will be final as it was sometimes past.'* The elders believed that this would prevent any court action by displeased members in the society who abuse the powers of the traditional council. However, since some traditional authorities are corrupt and give room for bribery, the government after granting them the legislation to dispatch their powers authoritatively must put in place a monitoring agency to oversee their verdicts.

## IV. Conclusion and Recommendations

The tenet of the research was to investigate into how the cultural traditions, social inclusion and full participation of local people play significant roles in the ultimate success of environmental schemes. A phenomenological study enhanced by focus group discussions, in-depth personal interviews and direct observations of purposively sampled respondents in the Anyinam town located in the Ashanti region of Ghana was used to illuminate the essence of promoting the cultural traditions of local communities while ensuring the full participation and social inclusion of all members of the society in environmental development schemes and programs.

The cultural traditions that were seen to be beneficial in environmental development programs were the institution of sacred grove, the commemoration of the *Opemso)* festival, maintenance of place and historic identity, deifying of natural resources, cultural education of the youth and the institution of taboo systems. The *Kwantakese* sacred grove specifically demarcated and treated as sacred has aided in housing rich rare and endangered species of biodiversity. The Opemso) festival observance that utilizes particular natural resources in its observance as well as its environmentally beneficial activities has enhanced the environment and its resources in Anyinam. To assist in maintaining their place and historic identity, the people of Anyinam have ensured the conservation and sustainable use of the *Onyina* (Ceiba) plant species helping in greening the entire vicinity, rewarding residents of good air, prevention of storms and other

forms of natural disasters. Moreover, the deifying of water bodies and other natural resources has prevented residents from wantonly destroying them for fear of being punished by the vindictive spirits and deities believed to be inherent in the natural resources. Also, the cultural education of the youth on taboo days and on evenings has nurtured the values of conservation, sustainability, sanitation and maintenance of environmental cleanliness in the hearts of the young ones and children. Thus, these youth are more likely and committed to ensuring the upkeep and pursuance of environmental friendly practices. In addition, the institution of the taboo systems where stringent laws and orders with severe spiritual and physical sanctions have helped in curtailing any unbridled behaviour or practice from the people of Anyinam that can abuse and/or wantonly destroy the environment.

On the other hand, the traditional authorities and elders in the Anyinam town who spearhead the environmental development schemes ensure full participation and social inclusion of every member of the community through regular and mandatory communal labours, assigning of environmental tasks among gender, age and social groups, intensive monitoring via communal registers and communal forums. The communal labours, which is all-inclusive and compulsory for every member of the society promotes full community participation. Also, the specific division of environmental activities among the sexes, age and social groups further harness community participation and social inclusion. The use of communal registers and solicitation of opinions of every member of the society ensures fair social inclusion and full community participation.

The classic example of the people of Anyinam succinctly illustrates the immense benefits of promoting cultural traditions, full participation and social inclusion of local people in environmental development schemes. Developmental planners, policy makers and environmentalists must not sideline local people and their cultural traditions in the schemes that they draw for the development of the environment. They must carefully incorporate the rich and environmentally friendly cultural traditions as well as the time-tested and experience of local people in the policies and strategies formulated for the conservation and sustainable use of the environment and its resources. To accentuate the roles of local people and their cultural traditions in environmental schemes, these recommendations have been put forward by the researcher:

1. Local communities must be active participants in every development project for the environment from its planning to implementation stages. They must be seen as having viable experiential knowledge that can contribute to environmental sustainability and conservation.
2. The traditional systems put in place by local communities such as the use of communal registers, institution of communal labour, cultural education of the youth and communal forums must be used efficiently as platforms by conservationists working in local communities to solicit for the views of local people in environmental projects. They must also be used in relaying to the local communities, modern scientific environmental strategies that play quintessential roles in addressing contemporary environmental challenges.
3. Cultural education of the youth must be enhanced through the school curriculum, Television and radio programs and in books. This would inculcate the respect for nature's resources that is constantly featured in the pages of the cultural traditions of local people.
4. The cultural traditions such as taboo systems, deifying of natural resources, festival commemorations, folklores, myths and proverbs of the local communities must be rigorously looked into by environmental policy developers. These cultural traditions are powerful strategies for the promotion of environmental sustainability and conservation as have been illustrated with the case of the people of Anyinam in Ghana.
5. Various governments must heighten the powers of the traditional authorities in local communities for them to continue to discharge their powers in sanctioning culprits of environmental degradation. This would lessen the task imposed on civil courts, reduce the long period for the judgment of abusers of the environment and speedily arrest any form of environmental unfriendly practices at the local levels even without the government direct intervention.

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# Hyper-Spectral Data and Techniques for Land-use Land-Cover Analysis using Two Time Data for Lonar Town, Buldhana District of Maharashtra State

By Arvind Pandey, Smrti Rawat & Neelam Rawat

*Kumaun University*

*Abstract-* Hyper-spectral optical data has been the key for accurate mapping in various field of scientific research to get results in different dimension. Based on this the present study involves two different images classify by different technique to improve the spectral resolution classification for the LULC areas using their unique spectral reflectance. The Optimum bands for the urban, vegetation, agriculture and water features are found using the spectral library is created for different invariant LULC features. The performance evaluation of the Hyperion image is carried out in terms of spatial, spectral and feature based and the results shows Spectral Angle Mapper with n-D visualizer produces a better classification output compared to the Spectral Angle Mapper and Support Vector Machine method for a heterogeneous LULC area. Accuracy assessment also revealed choosing reference pixels for classification using MNF scatterplots and then refining them use n-D visualizer increases classification accuracy.

*Keywords: remote sensing, hyper-spectral, image classification, spectral angle mapper, support vector machine.*

*GJSFR-H Classification: FOR Code: 120599*


*Strictly as per the compliance and regulations of :*

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## I. Introduction

Over the past two decades, Hyperspectral remote sensing from airborne and satellite systems has been used as a data source for numerous applications. Hyperspectral imaging is quickly moving into the main stream of remote sensing and is being applied to remote sensing research studies. Hyperspectral remote sensing are characterized by imaging and spectroscopic property, which differentiates the terrestrial features into unique spectral signature. K. Shahid Khurshid, *et al.,* 2006 carried out work for Advances in preprocessing of hyperspectral remote sensing data have enabled more accurate atmospheric correction and have led to the development of new information extraction techniques in the areas of agriculture, forestry, geosciences, and environmental monitoring. This property is valuable in evidently classifying land use / cover features especially vegetation and water bodies. Hyperspectral remote Sensing has great potential for analysing complex LU/LC scenes. However, operational applications within environments are still limited, despite several studies that have explored the capabilities of using Hyper-spectral data is to increase the accuracy in preparing land-use land-cover maps in various aspects.

Recent developments in hyperspectral remote sensing or imaging spectrometry have provided additional bands within the visible, near infrared (NIR) and shortwave infrared (SWIR) region of the electromagnetic spectrum. Most hyperspectral sensors acquire radiance information in less than 10 nm bandwidths from the visible to the SWIR (400-2500 nm). Hyper spectral remote sensing by virtue of its contiguity and narrow bandwidth is increasingly used to characterize, model, classify, and map agricultural crops and natural vegetation. Schmidt and Skidmore, 2002 attempted hyperspectral studies at the herbaceous and grassland level and showed that 27 saltmarsh vegetations could be discriminated. Hyper spectral applications for vegetation studies (Schlerf, 2011) introduced the red edge phenomenon and red edge inflection point (REIP), which is correlated to the chlorophyll content in the canopy. Hyperspectral remote sensing in vegetation studies include species composition, vegetation or crop type biophysical properties, biochemical properties disease and stress studies, nutrients, moisture, light use efficiency and net primary productivity (Thenkabail, 2012). Hyperion hyperspectral imagery over a given region, when combined with either SVMs or ANNs to classifiers, can potentially enable a wider approach in land use/cover mapping (Petropoulos et al., 2012). An attempt has been made for preparing land-use, land-cover map for Buldhana district of Maharashtra, using various Hyper-spectral mapping techniques and map abundances of certain geographic classes.

### a) Study Area

*Lonar* is a town and a municipal council in Buldhana district of the division of Buldhana of the region of Vidarbha in the Indian state of Maharashtra. It is a Taluka of the district of Buldhana and is located near Mehkar. It is an important place in Buldhana district

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and is famous for Lonar crater and Lonar Lake, which is located at 19°58′N and 76°30′E.

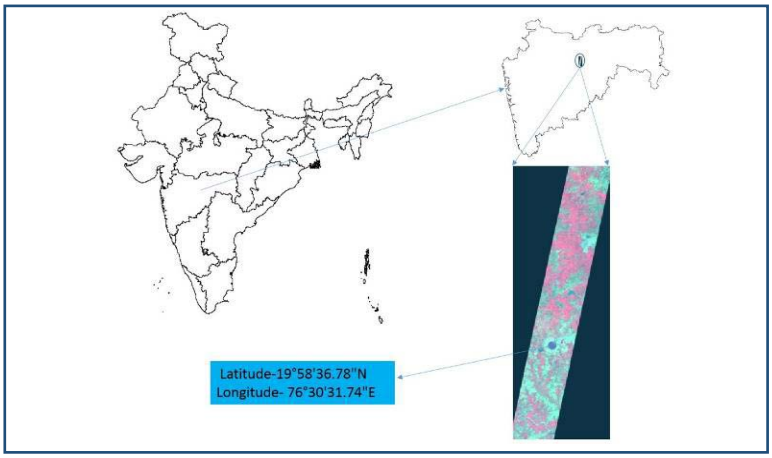


*Fig. No.1:* Study Area Hyperspectral Image

## II. Materials and Methods

Hyperion data of EO-1 spacecraft was used for the present study. Hyperion is a grating imaging spectrometer having a 30-meter ground sample distance over a 7.5 km swath and providing 10nm (sampling interval) continuous band of the solar reflected spectrum from 400-2500 nm. Spectral resize was done for reduced image layers. Each EO-1 Hyperion scene consisted of 242 bands. All the bands were layer stacked using ENVI software. After layer stacking, radiometric correction was done to remove atmospheric attenuation. Then Minimum Noise Fraction transformation was done to determine the inherent dimensionality of image data, to segregate noise in the data and to reduce the computational requirements for subsequent processing. Inverse minimum noise fraction transformation was done to include only the good bands. After all the pre-processing techniques are completed Region of Interests (ROI) were selected which represent various classes, spectral plots were generated to visually analyze severability. Image classification is done using these training samples through Spectral Angle Mapper and Support Vector Machine algorithms. Also training samples were separately selected from MNF scatterplots and refined using n-D visualizer and used for classification. Image classification was also done using a soft classification technique called Linear Spectral Unmixing. The following flow chart shows the steps followed in the study.

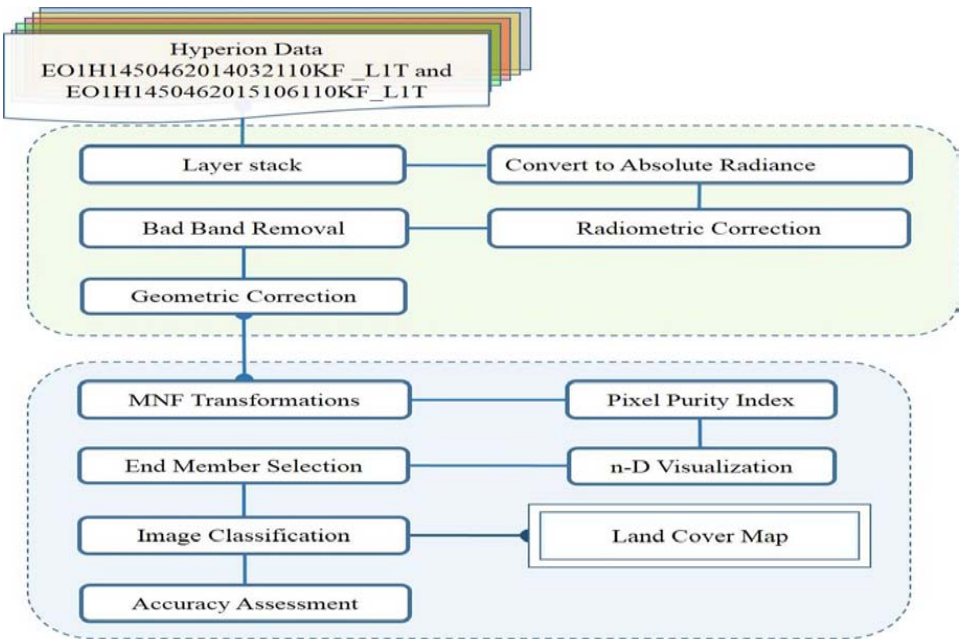


*Fig. No.2:* Flow Chart of the Methodology

*a) Data Mining*

This study involves two different images classify by different technique to improve the spectral resolution classification for the LULC areas using their unique spectral reflectance. The Optimum bands for the urban, vegetation, agriculture and water features are found using the spectral library is created for different invariant LULC features. The performance evaluation of the Hyperion image is carried out in terms of spatial, spectral and feature based and the results are explained further.

*b) Image Processing*

The proposed methodology is tested on EO-1 Hyperion with high spectral resolution of 30m. Since the methodology is proposed on the atmospheric correction is done using FLAASH for Hyperion data (Fig.No.3 ) and vegetation reflectance for cross checking (Fig.No.4) and the bad bands such as absorption bands, noisy bands and bands with no data (Fig.No.5) are removed (Chakravortty Somdatta et al., (2011). After spectral sub setting a sum of (134 bands) 40 bands of VNIR and 94 bands of SWIR are further taken for study.

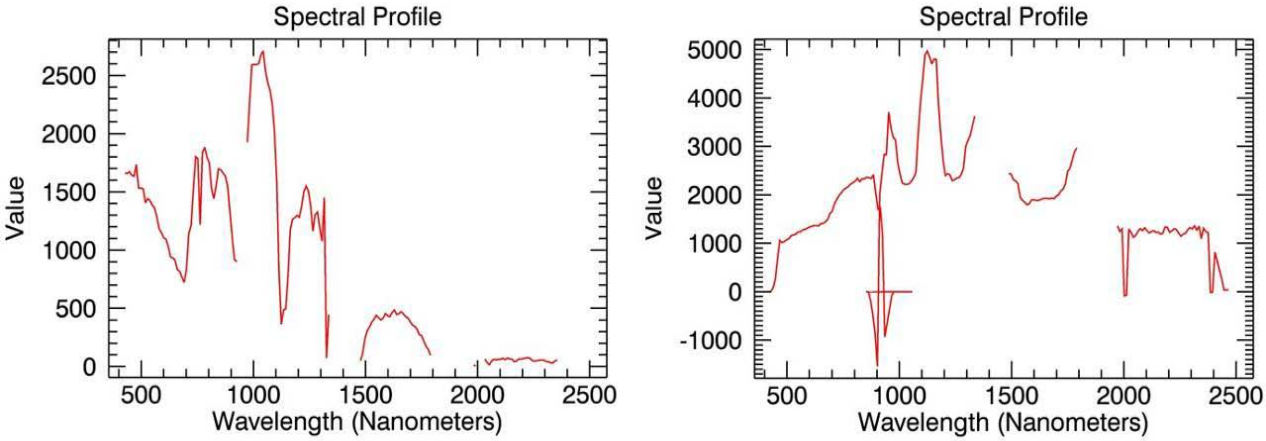


*Fig. No.3:* Left reflectance is before flash and right is after flaash process result

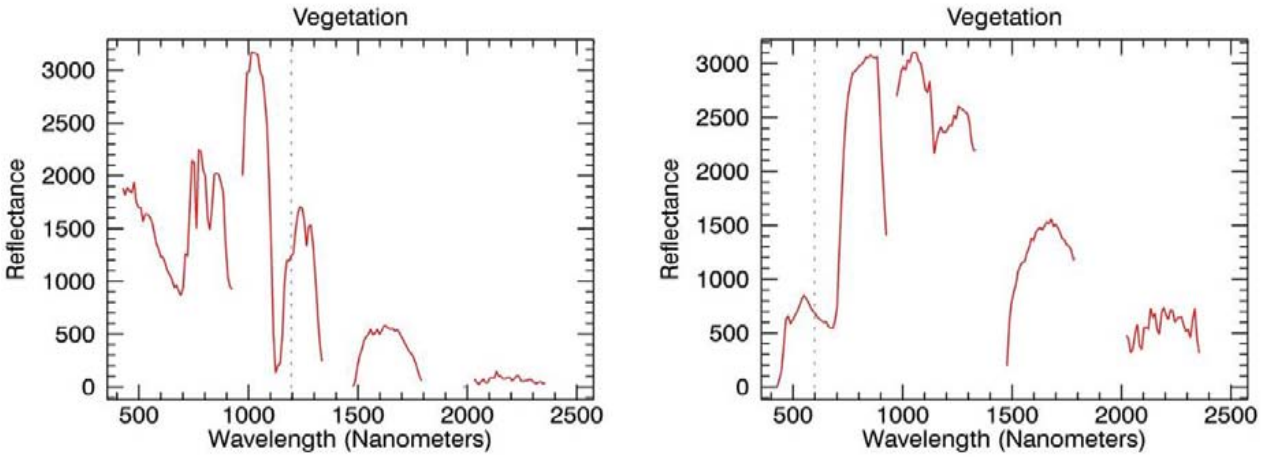


*Fig. No.4:* Left reflectance of vegetation is before flaash and right is after flaash process result of vegetation reflectance

*c) BBL*

BBL is the bad band removal process in ENVI. Below result is the before and after BBL process work. In this result right side is the complete reflectance line without any break in line. This is the real reflectance of the vegetation in our study area.

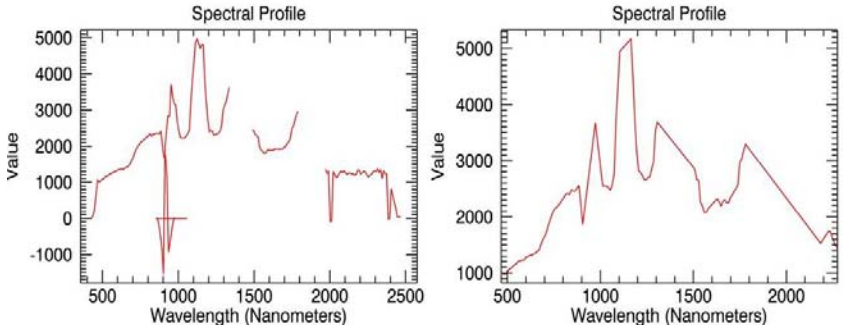


*Fig. No.5:* Left is before BBL Process and right is the after BBL process result

*MNF Rotation* transform is used to determine the inherent dimensionality of imagedata, to segregate noise in the data. The output of the MNF results for the image is shown in the below figure (Fig.No.6).

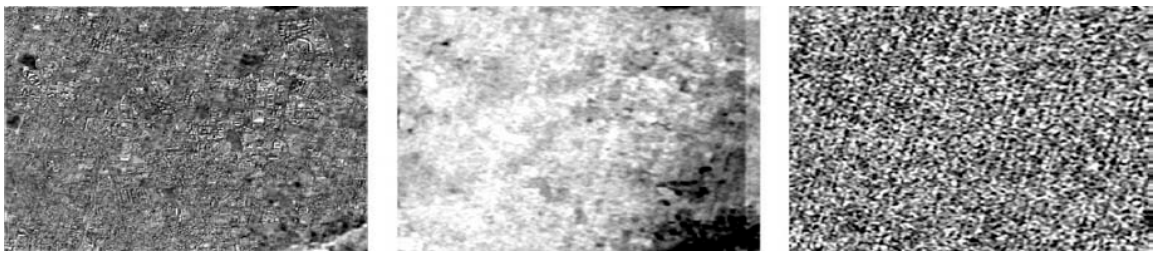

*Fig. No.6:* MNF output bands

The output of MNF Transform is shown in the above image, (a) bands which is having high, medium and low eigenvalues such as 29.231, 9.178, and 1.211 respectively with eigenvalue number as 1, 66 and 134 (b) eigenvalue plot showing the MNF curve of the output bands with respect to eigenvalue number.

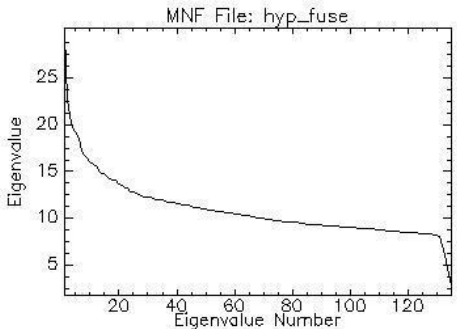


*Fig. No.7:* MNF Eigen Value

*PPI algorithm:* It is done to find the most spectrally pure pixels is typically run on an MNF transform result, excluding the noise bands (Fig.No.8).

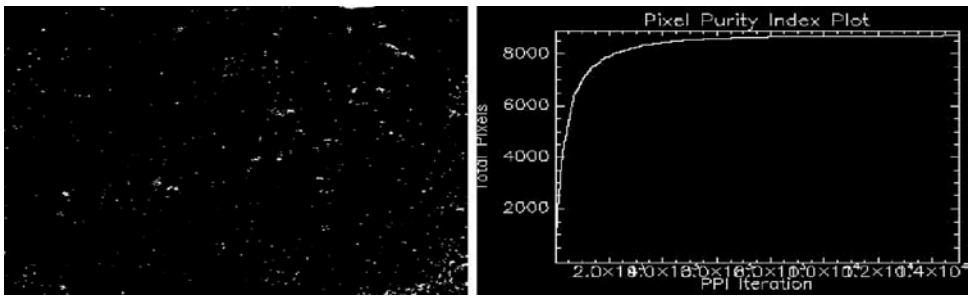


*Fig. No.8:* PPI results with their corresponding Pixel plot

*n-D Visualizer:* It is used to locate, identify, and cluster the purest pixels and the most extreme spectral responses from the given PPI in n-dimensional space. Classes are exported to ROIs and used them as input into Spectral Anger Mapper, Support Vector Machine classification and Matched Filtering techniques (Fig.No.9).


*Fig. No.9:* End Member extraction using n-D visualizer

*End Member*

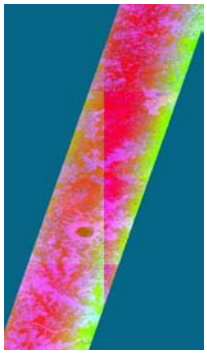

*Fig.No.10:* Bad band Image

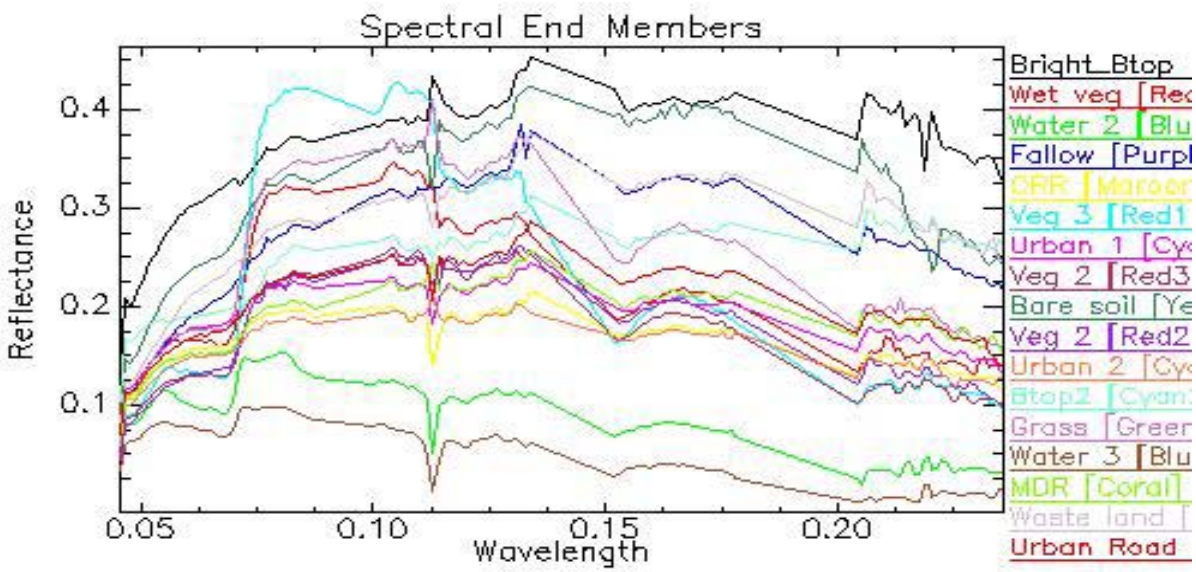


*Fig. No.11:* End Member Spectra profiles

Different end members are extracted from spectrally pure pixels is used for further information extraction and feature identification techniques (Farooq Ahamad and & Qurat-ul-ain Fatima (2012). The major classes taken for classification are Urban, Water, Vegetation, Fallow land, in which different spectra end members. The feature identification techniques are carried out by different classifiers namely SAM and SVM. Spectral Angle Mapper a physical-based spectral classification is used to classify images which take n-D angle to match pixels to reference spectra. SAM classifier algorithm takes the angle between image spectrum and reference spectrum. Smaller angles represent closer matches to the reference spectrum. SAM uses all 17 pure pixel spectral from n-DV as end members and the classification technique is processed using single angle value provided as 0.150. The results are shown in the images are compared visually to interpret the classification of images.

## III. Results and Discussions

*a) Spectral Reflectance*

Electromagnetic energy incident on the surface features are partially reflected, absorbed or transmitted through it. The fractions that are reflected absorbed or transmitted vary with material type and the condition of the feature. It also varies with the wavelength of the incident energy. Majority of the remote sensing systems operate in the region in which the surface features mostly reflect the incident energy. The reflectance characteristics of the surface features are represented using spectral reflectance curves.

*Classification*

The Hyper spectral data acquired over eastern sub-urban region of Bengaluru is transformed into LU/LC map using two different image classification algorithms (viz. SAM and SVM). Accuracy assessment was then carried out to compare the efficacy of the two for a heterogeneous topography. Classification accuracy of SAM method was found to be 59.63% with kappa coefficient k = 0.5597 and SVM was 67.03% with k = 0.6301 when Region of interest were taken directly from image, and the Classification accuracy of SAM method was found to be 64.13% with k = 0.5992 and SVM was 80.43% with k = 0.7781 when Region of interest were taken from scatterplots.

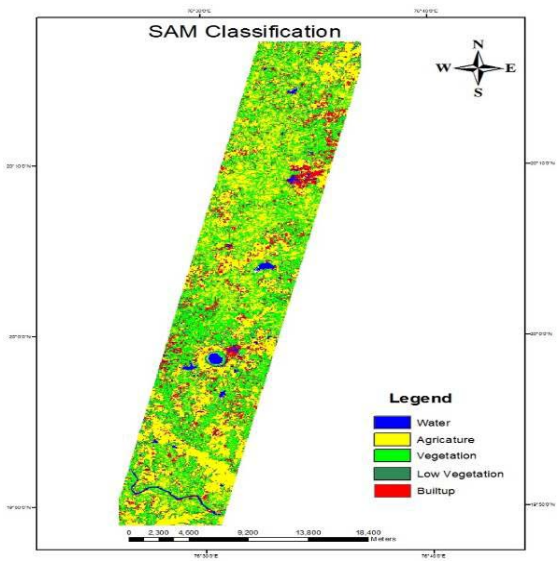


*Fig. No.14:* SAM Classification 2014

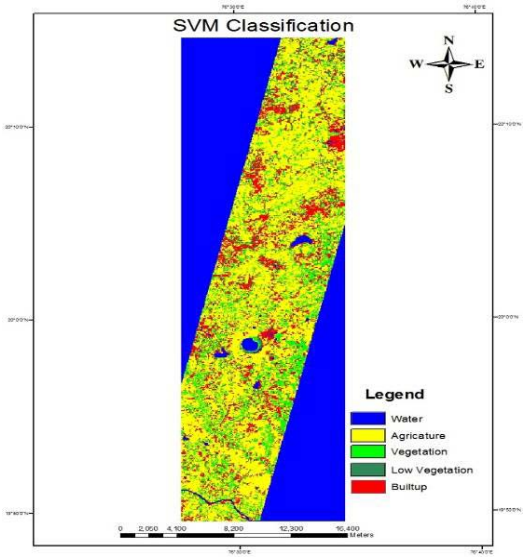


*Fig. No.15:* SVM Classification 2014

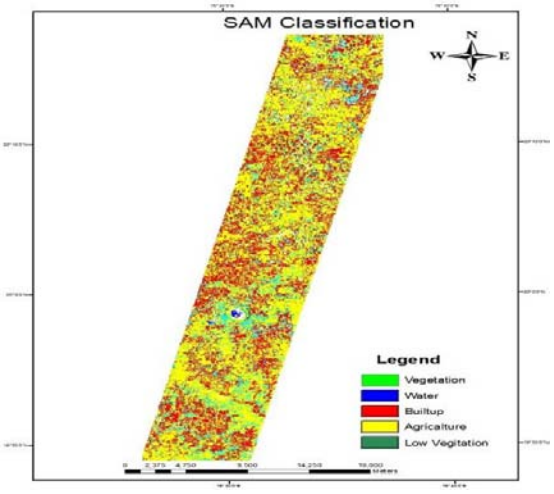


*Fig. No.16:* SAM Classification 2015

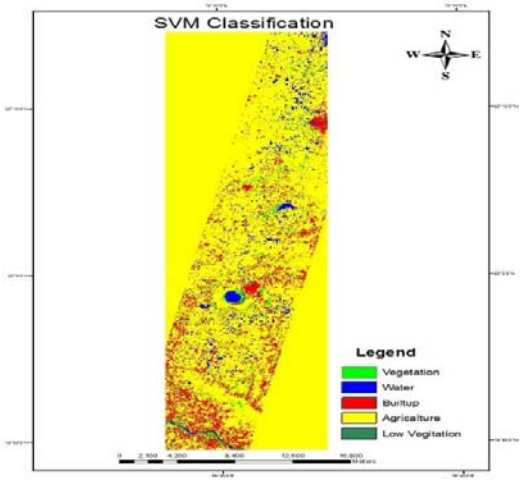


*Fig. No.17:* SVM Classification 2015

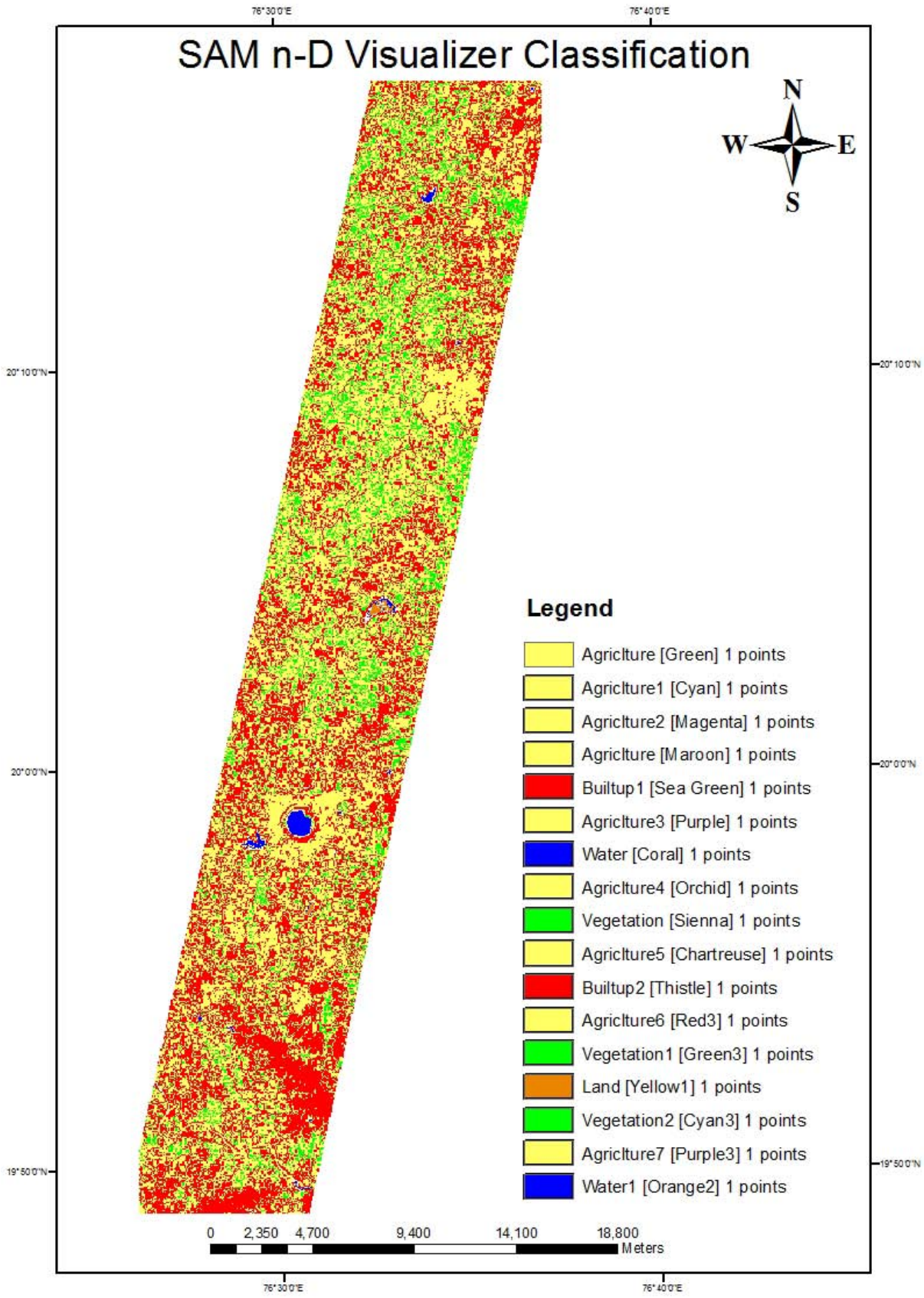


*Fig. No.18:* SAM n-D Visualizer Classification

SVM Classification of year 2015 was not very clear as in this classification. Agriculture area is not showing good results but water and built-up area is quite good classified. In this study overall accuracy= (1326/2025) = 65.4815% and Kappa Coefficient = 0.6249 which is the good classification with this Hyperion data result.

## IV. Conclusion

Results of satellite image classification of using various algorithms shows Spectral Angle Mapper with n-D visualizer produces a better classification output compared to the Spectral Angle Mapper and Support Vector Machine method for a heterogeneous LULC area. Accuracy assessment also revealed choosing reference pixels for classification using MNF scatterplots and then refining them use n-D visualizer increases classification accuracy. In SAM Classification many pixels remained unclassified which is because of the fact that the reflectance of features in an n-dimensional plot exhibits large deviations from the reflectance of reference end member. On the other hand SVM left no unclassified pixel which is because of its generalizing behaviour. This observation helps us to conclude SAM is essentially a mapping algorithm and SVM a classification algorithm.

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# Geochemical Assessment of Soils around Metal Recycling Industrial Areas in Ikorodu, Southwestern Nigeria

By Smart, M. O., Fawole O.A., Isola J. O. & Olatunji O.A

*University of Ibadan*

*Abstract-* Baseline geochemical assessment of an area within latitude 006°43¹N and 003°44¹N and longitude 003°31¹E and 003°37¹E was carried out in other to provide information on the rate of contamination/ pollution caused to the soils by the iron and steel industries` activities around Ikorodu area. 11 soil samples were collected, prepared and analysed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Interpretation of the analysis results was carried out for their metal contents. Lead has the highest concentrations in soils (9945ppm) while Manganese was the most widely distributed metal in the area of study with a mean concentration value of 8414ppm. Further geochemical evaluation of the soils using Geo-accumulation Index, Enrichment Factor, Contamination Factor, and Pollution Load Index, revealed significant concentration of lead and zinc in the environmental media from within the study area while the other elements have minimal concentration in the environmental media studied.

*Keywords:* *ikorodu area; geochemical; geo-accumulation; contamination; enrichment; pollution.*

*GJSFR-H Classification:* *FOR Code: 050399*

# Geochemical Assessment of Soils around Metal Recycling Industrial Areas in Ikorodu, Southwestern Nigeria

Smart, M. O. [α], Fawole O. A.[σ], Isola J. O. [ρ] & Olatunji O. A [ω]

*Abstract-* Baseline geochemical assessment of an area within latitude 006°43¹N and 003°44¹N and longitude 003°31¹E and 003°37¹E was carried out in other to provide information on the rate of contamination/ pollution caused to the soils by the iron and steel industries` activities around Ikorodu area. 11 soil samples were collected, prepared and analysed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Interpretation of the analysis results was carried out for their metal contents. Lead has the highest concentrations in soils (9945ppm) while Manganese was the most widely distributed metal in the area of study with a mean concentration value of 8414ppm. Further geochemical evaluation of the soils using Geo-accumulation Index, Enrichment Factor, Contamination Factor, and Pollution Load Index, revealed significant concentration of lead and zinc in the environmental media from within the study area while the other elements have minimal concentration in the environmental media studied.

The Enrichment Factor calculated also showed extremely high enrichment of lead in the soils of the study area (621). The contamination factor calculated showed that Pb and Zn are the elements contaminating the soils mostly. While zinc moderately contaminated the soil of the study area with a contamination factor of 4, lead extremely contaminated the soil with a contamination factor of 89. The other elements showed less contamination of the soils of the study area. The Pollution Load Index (PLI) showed the soils of the study area are not highly polluted (PLI<1) but highly contaminated.

*Keywords: ikorodu area; geochemical; geo-accumulation; contamination; enrichment; pollution.*

## I. Introduction

Heavy metals are released into the environment by both natural and anthropogenic sources. Soils derived from the physical and chemical weathering of parent materials contain elevated levels of trace elements form the natural sources, the fossil fuel combustion, abrasion of vehicular components and their exhaust emissions, incinerators, power plants and foundry operation. (Jung, 2001, Lee *et. al* 2005, Park *et.al* 2006). Mining, smelting and the associated activities are known to cause contamination and pollution to soils, plants, atmosphere and surface waters through anthropogenic sources. Among the numerous environmental pollutants, an important role is ascribable to heavy metals whose concentration in soils, water and air are continuously increasing in consequence of anthropogenic activity.

According to Adefolalu (1980) and Mabogunje (1980), in developing countries like Nigeria, improved road accessibility creates a variety of ancillary employment which range from vehicle repairs, vulcanizer and welders to auto-electricians, battery chargers and dealers in other facilitators of motor transportation, disposal of industrial wastes, application of fertilizers, metal sheets wire, pipes, unaccessible rocks and burning of coal. These activities send trace metals into the air and the metals subsequently are deposited into nearby soils, which are absorbed by plants on such soils concentration in roadside soil and those in the dust falls. Trace metals in the soils and rocks can also generate airborne particles and dusts, which may affect the air quality human beings breath in (Gray *et al*., 2003). In the ecological environment heavy metals deposition in soils suppresses plant growth by blocking plant cores and disrupting photosynthesis (Choi *et al*., 2008), and is one of the most important contributors to environmental stress (Petrovský and Ellwood, 1999). Soil typically comprises a complex mixture of different elements and compounds (Dallarosa *et al.,* 2008) with heavy metal content particularly significant due to its toxicity and harmful effects on health.

Since trace metals in soils are emitted both from natural sources such as deserts and bared soils (Choi *et al*., 2001; Fang *et al*., 2002; Zhang *et al*., 2010b) and from anthropogenic processes, a challenge to these investigations is to separate contributions from the two primary causes. In urban areas the diversity of possible anthropogenic emissions renders source assignation difficult (Choi *et al*., 2001; Kim *et al*., 2008; Zhang *et al*., 2012b). Although many investigations show that geochemical methods are useful for detecting trace metal sources (Wang et al., 2005; Kim et al., 2007), they are time-consuming and expensive.

## II. Methodology

The study area falls within the tropical rainforest zone of Nigeria with annual rainfall ranging between 1500mm and mean annual temperature distribution of

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27°c with two distinct seasons, the dry and wet seasons. The wet season occurs between occurs between April and October with a break in August, the dry season lasts from November to April with a cold harmattan spell between December and January. The temperature averages about 25°c in the rainy season and about 28°c in the dry season. Materials used for field sampling include the soil auger, generator, Global Positioning System (GPS), stepdown transformer, field boots and notebooks, sample bags, heavy duty elbow length rubber gloves, etc. The sample locations were concentrated mainly on Iron and Steel industries which are located within Ikorodu area covering a distance of about 5km.

The soil samples were taken at a depth ranging from 0-15cm within the topsoil. The samples were collected using a soil auger. The samples were taken at each sample location site and kept inside the sample bags. They were later air dried for three weeks and then brought to the lab for sieving. The soil samples were sieved to a minimal size of 75$\mu$m and analysed for elemental constituents.

## III. Results and Discussion

The results for the geochemical analysis revealed varying concentration for different elements in the sampled media employed in the study. The identified trace element content of the analysed soil samples include Mo, Cu, Pb, Zn, Ni, Co, Mn, V, Sr, Cr and Ba. Other elements like As, Au, Be, Cd, Y, Nb, e.t.c were found to be below the Metal Detectable Limit (MDL) and were screened out.

The descriptive statistical table (table 1) shows that most of the elemental concentrations are enriched in soil. Mean concentration of Lead (Pb) in soils (1782ppm) observed around the factories can be said to be high when compared with Ibadan, Benin and UK soils which have concentration of 95.1ppm, 232.2ppm, and 300ppm respectively (Odewande and Abimbola, (2008), Olatunji *et.al* (2014), Chen *et.al* (1999)). This may be due to the smelting of Pb, disposal of factory wastes especially tyre wears practised in the area and unused metal scraps containing high concentration of Pb. The lowest values of Pb were recorded around less-built areas with roads that have less traffic suggesting that disposal of wastes (which are always close to the industries) has contributed to the high presence of Pb in the area of study.

The mean concentration of Zinc (3887ppm) present in the area of study area shows an average high concentration Zn when compared also with Ibadan and Benin soils with mean concentrations of 22.86ppm and 758.5ppm respectively (Odewande and Abimbola (2008), Olatunji *et.al* (2014)). This could be to due Zn usage in galvanizing of iron practised in the area thereby forming aerosols with the geogenic atmospheric particles present in the area which later settles in the soils.

The average concentration of Copper (474ppm) noticed in the soils of one of the industry could be said to be high when compared to the average mean of copper found in the soils of Ibadan and US soils with concentrations of 4.74ppm and 7.4ppm respectively (Oyeleke *et al.,* 2015, Tahir *et al*., 2007). This may be due to the smelting of copper in the industries and application of agricultural chemicals.

Manganese (Mn) has a high concentration of 950ppm and the highest mean value of 8414ppm indicating that it is the most widely distributed element in the soils of the area of study. This can be due to its geogenic factor in the soil in addition with Mn usage in production of dry batteries, which are later disposed in the area, and its usage as alloy of metal to provide strength and magnetism.

Molybdenum (Mo), Nickel (Ni), Cobalt (Co), Vanadium (V), Strontium (Sr) and Chromium (Cr) all have highest concentrations less than the ASC in the soil indicating little or no significance to the distribution of elements in the area of study.

### *a) Factor Analysis*

The 11 elements (Mo, Cu, Pb, Zn, Ba, Co, V, Sr, Ni, Cr and Mn) were subjected to factor analysis, the computation was done using SPSS computer software package. Four factors were identified from the factor analysis and this accounted for 97.35% of the total factors present in the soil samples (Table 3)

*Factor 1: Mo, Cu, Zn, Ni, and Ba* accounted for approximately 37.11% of the total variance of all the components in the soil. These elements can be said to be derived anthropogenic source especially unused metal scraps and batteries

*Factor 2: Pb and Sr* accounted for approxiamtely for 25.08% of the total variance of all components in the soil. These elements were derived from smelting of metal ores, disposal of sewage, fossil fuel combustion and incineration at waste dumps which are some of the activities present in the area.

*Factor 3: Mn and Co* accounted for 18.11% of the total variance of all components in the soil. These elements were derived from manufacturing of alloys, steel and iron products.

*Factor 4: Ni and Cr* accounted for 17.04% of the total variance of all components in the soil. These were derived from smelting activities going on in the area of study.

### *b) Environmental Assessment*

The quality of the environmental media was assessed using geo-accumulation index, Enrichment Factor (EF), Contamination Factor (CF), and Pollution Load Index (PLI)

*c) Geochemical Accumulation Index*

The Geochemical accumulation index was used to assess the level of pollution in the soil around the study area. It is calculated by using the equation developed by Muller (1969) as used by Olatunji *et al*., (2014) and it is expressed as;

$$Igeo = Log_2(C_n/1.5*B_n)$$

Where Igeo is the geochemical accumulation index, $C_n$ is the observed concentration of each metal in the soil or dust samples, $B_n$ is the background value obtained for each metal while 1.5 is the multiplication constant.

According to Muller's Geo-accumulation index table (table 4) the calculated Geo-accumulation index showed that Pb, Zn and Ba (0-3, 0-1, and 1 respectively) are metals that have mostly impacted the soils in the study. This is also reflected in the geo-accumulation plot (fig 1). Zinc and Barium have moderate geo-accumulation index (0-1) which could be due to Zn usage in galvanizing iron and presence of Ba in the hazardous waste site found in the area. Pb geo-accumulation index ranges from being unpolluted to strongly polluted. Strong pollution of Pb is observed in some of the soils in the study area. This could be due to smelting of recycled lead and heavy traffic congestion. Co, Mn, V, Sr, Cr, Mo, Ni, all have negative geo-accumulation index, indicating they have not attained the status of pollutant.

*d) Enrichment Factor*

The Enrichment Factor (EF) classification, Table 5 (Simex and Helz, 1981) was used to evaluate the status of environmental enrichment of metals in the area. As the EF increases the contribution of the anthropogenic origin also increases.

The calculated Enrichment Factor summarized below, table 6 (according to Simex and Helz, 1981) showed that Cu, Mn, V, Sr, Cr have deficient to minimal enrichment (0-1) in the soil samples. Zn has a minimal to significant enrichment of the soils while (1-6) while Pb showed minimal to extremely high enrichment of the soils (1-621), indicating high influence of Pb associated activities in the area of study. The extreme high enrichment of Pb could be due to combustion of fuel and disposal of tyre wears found in the area. The increment in the enrichment of Cu, Mn, V, Sr, Cr, Zn and Pb in soils of the study area also shows an increase in anthropogenic impact on the soils.

*e) Contamination Factor*

The contamination factor calculation was used to determine the level of contamination of elements in the soil.

Contamination Factor = Mean concentration/ background value of metal

Hakanson *et.al* (1980) classification table (table 7) showed that Sr, Co, Ni and Cr are not forming any form of contamination with the soil of the area. Mo, Mn, Cu and Ba have moderately contaminated the soils (1, 1, 1 and 2 respectively). Zn has contaminated the soil considerably (4) while Pb showed a very high contamination of the soil (89) due to disposal of tyre wears and smelting of recycled lead. These are as reflected in the summarized table below (Table 8).

*f) The Pollution Load Index*

Pollution Load Index (PLI) was used to measure the quality of the area of study. The soils of the area are generalized and the quality is measured using the Contamination Factor and the number of elements studied. The equation for PLI is thus expressed as;

PLI = (CF1*CF2*…*CFn) 1/n, where n is the number of metals and CF is the Contamination Factor of each medium.

Though it was noticed that there have been contamination by metals of some of the soil samples collected, the pollution load index was calculated to check whether the contamination can lead to pollution of the area. Using the PLI classification (Table 6), it can be concluded that individual soil samples shows little pollution in the area of study while collectively, it can be deduced that the area is not polluted but tending towards pollution (PLI=0.50).

## IV. Conclusion and Recommendation

Metal concentration and distribution in soils of Ikorodu metal recycling industrial area using various environmental assessment revealed different levels of contamination. The various evaluation revealed that Pb and Zn are the most enriched in the soils and are also the main causes of contamination in the study area and their major source is from the metal-laden soil generated in the area. The industries (especially those close to the road) are agents of high contamination to the soils of the study area and are also enriching the already present geogenic elemental composition of the area.

Though the pollution level is not high presently, increasing urbanization and industrial activities will increase the contamination rate thereby leading to pollution. The contamination and enrichment of metals (through soils) occurring in the area of study is enough factor to check the activities of these Iron and Steel Industries. The rate of Lead and Zinc concentration they release to the soil is so high and having adverse effect on the livelihood of the area. Consequently, greater

environmental awareness needs to be done to develop ways to reduce environmental contamination. Buildings close to these industries should be evacuated or the industries concerned should be relocated away from the habitable environment.

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*Table 1:* Summary Table for Soil Samples Metal Concentration

| | Soil Samples | | |
|---|---|---|---|
| Metals | Range | Mean | ASC |
| Mo | 0.8-2 | 14 | 2 |
| Cu | 14-84 | 474 | 50 |
| Pb | 13-9945 | 1782 | 20 |
| Zn | 84-776 | 3887 | 90 |
| Ni | 6-17 | 114 | 80 |
| Co | 4-8 | 58 | 20 |
| Mn | 386-950 | 8414 | 850 |
| V | 37-70 | 237 | 130 |
| Sr | 12-309 | 545 | 400 |
| Cr | 20-43 | 324 | 100 |
| Ba | 30-49 | 512 | 25 |

*Table 2:* Total Variance Explained for Metals in Soil Samples

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cummulative % | Total | % of Variance | Cummulative % |
| 1 | 11.610 | 52.775 | 52.775 | 11.610 | 59.612 | 59.612 | 7.522 | 37.110 | 37.110 |
| 2 | 5.685 | 25.840 | 78.615 | 5.685 | 19.003 | 78.615 | 5.662 | 25.082 | 62.192 |
| 3 | 2.392 | 10.873 | 89.488 | 2.392 | 10.873 | 89.488 | 4.400 | 18.114 | 80.306 |
| 4 | 1.550 | 7.862 | 97.350 | 1.550 | 7.862 | 97.350 | 3.654 | 17.044 | 97.350 |
| 5 | .402 | 1.827 | 98.361 | | | | | | |
| 6 | .271 | 1.233 | 99.594 | | | | | | |
| 7 | .035 | .160 | 99.754 | | | | | | |
| 8 | .026 | .120 | 99.874 | | | | | | |
| 9 | .020 | .089 | 99.963 | | | | | | |
| 10 | 1.6E-16 | 7.3E-16 | 100.000 | | | | | | |
| 11 | 5.8E-17 | 2.6E-16 | 100.000 | | | | | | |

*Table 3:* Component Matrix

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Communalities |
|---|---|---|---|---|---|
| Mo | 0.73 | 0.24 | 0.31 | 0.52 | 0.96 |
| Cu | 0.93 | 0.11 | -0.13 | 0.20 | 0.93 |
| Pb | 0.41 | 0.73 | 0.43 | 0.31 | 0.99 |
| Zn | 0.95 | -0.04 | 0.11 | 0.13 | 0.93 |
| Ni | 0.74 | 0.22 | 0.18 | 0.60 | 0.99 |
| Co | 0.17 | -0.94 | -0.08 | 0.25 | 0.99 |
| Mn | -0.38 | -0.70 | 0.60 | -0.03 | 0.97 |
| V | -0.01 | -0.30 | 0.95 | 0.12 | 1.00 |
| Sr | 0.39 | 0.74 | 0.46 | 0.27 | 0.99 |
| Cr | 0.33 | -0.13 | -0.15 | 0.92 | 0.99 |
| Ba | 0.79 | 0.27 | 0.42 | 0.32 | 0.99 |
| Eigenvalues | 4.08 | 2.76 | 2.66 | 1.87 | |
| % variance | 37.11 | 25.08 | 18.11 | 17.04 | |
| %cummulative | 59.61 | 85.16 | 91.57 | 97.35 | |

*The loadings with a value ≥ 0.60 are marked in bolds in the table.*

*Table 4:* Geo-accumulation Index Classification (Muller, 1969)

| Classes | Ranges | Remarks |
|---|---|---|
| 0 | ≤0 | Unpolluted |
| 1 | 0-1 | Unpolluted to Moderately polluted |
| 2 | 1-2 | Moderately polluted |
| 3 | 2-3 | Moderately polluted to Strongly polluted |
| 4 | 3-4 | Strongly polluted |
| 5 | 4-5 | Strongly polluted to Extremely polluted |
| 6 | >5 | Extremely polluted |

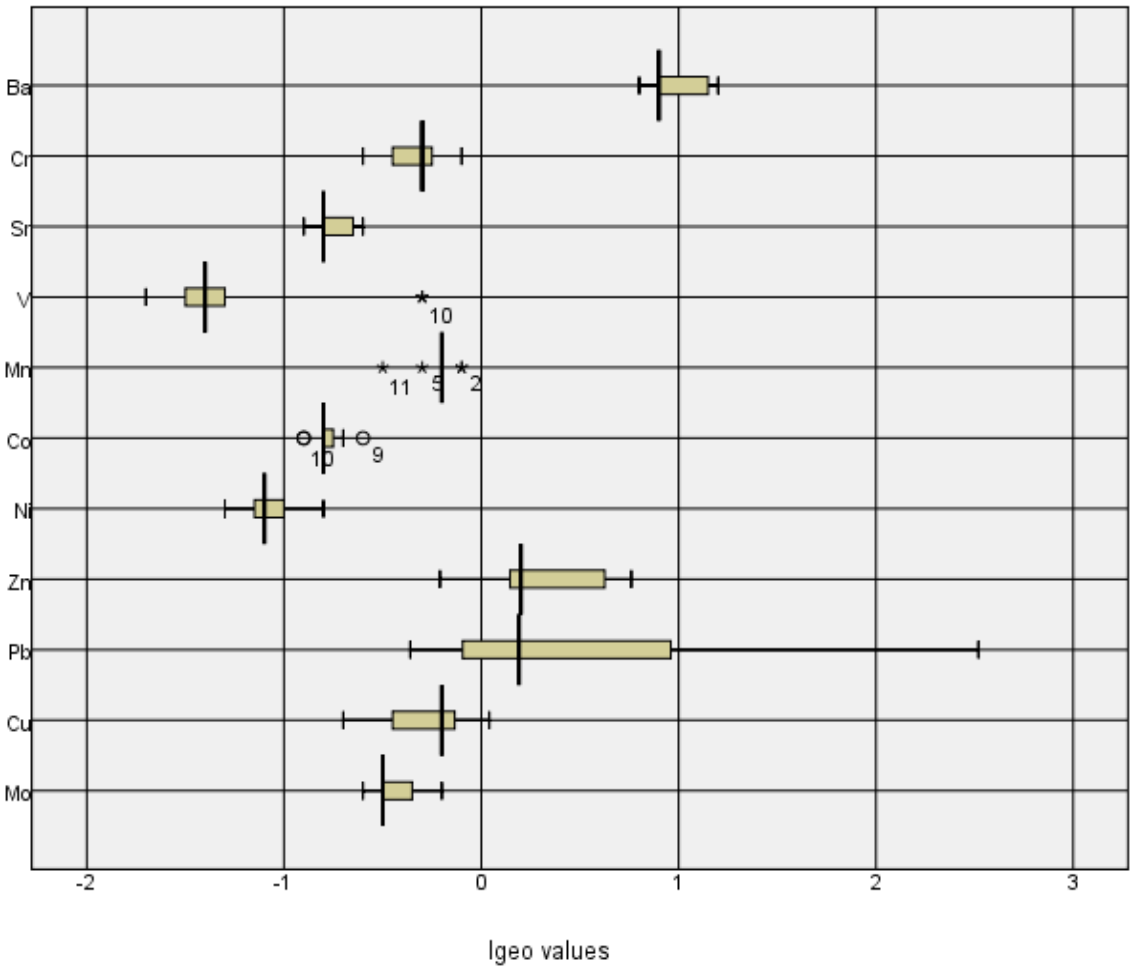


*Fig. 1:* Geo-accumulation Index Plot

*Table 5:* Enrichment Factor Classification (Simex and Helz, 1981)

| Enrichment Factor | Qualification of samples |
|---|---|
| EF<2 | Deficiency to minimal enrichment |
| EF= 2-5 | Moderate enrichment |
| EF= 5-20 | Significant enrichment |
| EF=20-40 | Very high enrichment |
| EF>40 | Extremely high enrichment |

*Table 6:* Summary Table for Enrichment Factor of Soil Samples

| | Soil Samples | |
|---|---|---|
| Metals | Range | Average Shale Content |
| Mo | 0 | 2 |
| Cu | 0-1 | 50 |
| Pb | 1-621 | 20 |
| Zn | 1-6 | 90 |
| Ni | 0 | 80 |
| Co | 0 | 20 |
| Mn | 0-1 | 850 |
| V | 0-1 | 12 |
| Sr | 0-1 | 400 |
| Cr | 0-1 | 130 |
| Ba | 0-1 | 25 |

*Table 7:* Contamination Factor Classification (Hakanson et.al., 1980)

| Classes | Ranges | Remarks |
|---|---|---|
| 0 | $<1$ | Low Contamination |
| 1 | $1 \leq cf < 3$ | Moderate Contamination |
| 2 | $3 \leq cf < 6$ | Considerable Contamination |
| 3 | $cf \geq 6$ | Very High Contamination |

*Table 8:* Summary Table of Contamination Factor for Soil Samples

| | Soil Samples | |
|---|---|---|
| Metals | Contamination Factor | Average Shale Content |
| Mo | 1 | 2 |
| Cu | 1 | 50 |
| Pb | 89 | 20 |
| Zn | 4 | 90 |
| Ni | 0 | 80 |
| Co | 0 | 20 |
| Mn | 1 | 850 |
| V | 1 | 12 |
| Sr | 0 | 400 |
| Cr | 0 | 130 |
| Ba | 2 | 25 |

*Table 9:* Pollution Load Index Classification

| PLI Values | Qualification (Geometric mean) |
|---|---|
| $PLI<1$ | Perfection |
| $PLI=1$ | Only baseline levels of pollutants are present |
| $PLI>1$ | Deterioration of site quality |

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# An Empirical Analysis of Land Degradation Risk from Local Community Knowledge Perspective: the Case of Geze Gofa District, Southern Ethiopia

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*Abstract-* Land degradation is increasing in severity and extent in many parts of the world. Success in arresting land degradation entails an improved understanding of its causes, process, indicators and effects. Various scientific methodologies have been employed to assess land degradation globally. However, the use of local community knowledge in elucidating the causes, process, indicators and effects of land degradation has seen little application by scientists and policy makers. Land degradation may be a physical process, but its underlying causes are firmly rooted in the socio-economic, political and cultural environment in which land users operate. Analyzing the root causes and effects of land degradation from local community knowledge, perception and adapting strategies perspective will provide information that is essential for designing and promoting sustainable land management practices. This study was conducted in Geze Gofa district; southern Ethiopia.

*Keywords:* *land degradation, local knowledge, farmers' perception, conservation measures.*

*GJSFR-H Classification:* *FOR Code: 050399*


*Strictly as per the compliance and regulations of :*

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*Abstract-* Land degradation is increasing in severity and extent in many parts of the world. Success in arresting land degradation entails an improved understanding of its causes, process, indicators and effects. Various scientific methodologies have been employed to assess land degradation globally. However, the use of local community knowledge in elucidating the causes, process, indicators and effects of land degradation has seen little application by scientists and policy makers. Land degradation may be a physical process, but its underlying causes are firmly rooted in the socio-economic, political and cultural environment in which land users operate. Analyzing the root causes and effects of land degradation from local community knowledge, perception and adapting strategies perspective will provide information that is essential for designing and promoting sustainable land management practices. This study was conducted in Geze Gofa district; southern Ethiopia. The main objective of the study was to analyze land degradation risk from local knowledge perspective. The study followed a multistage sampling procedure to select the sample respondent households for study. The sample size of the study was 156 households. The study was conducted using semi-structured interview schedule, key informant interviews, focus group discussions and field observation as a primary data collection techniques. The data analysis for this study was conducted using both qualitative approaches (thematically) and quantitative approach- descriptive statistics, and logistic regression analyses. The results of the study reveals that the local communities' elucidated the following indicators of land degradation in the study area: sheet, rill and gully erosions, soil accumulation around clumps of vegetation, soil deposits on gentle slopes, exposed roots, muddy water, sedimentation in streams and rivers, sandy layers, change in vegetation species, decrease in organic matter, increased runoff, reduced soil water and reduced rooting depth. The local community perceived causes related with direct human activities which were found to be influencing land degradation in the study area include: continuous cropping, overgrazing, deforestation, steep slope cultivation, extreme weather events (flood and drought) improper fertilizer use. Land shortage, poverty and high population density are the underlying causes of land degradation observed in the study area. According to the results, the consequences of land degradation experienced in the study area include; decline in crop yields, increased reduced responses to inputs, reduced productivity on irrigated land, loss of water for irrigation, lower and less reliable food supplies and increased labour requirements. The possibility of farmers' perception of the effects of land degradation effect on agricultural land productivity from slight to severe was primarily determined by institutional and demographic factors as well as weakly by biophysical factors. The study concludes that anthropogenic factors are significantly responsible for land degradation and this degradation has negatively affected livelihood in the study area. Generally, this study recommends that decision-making about land management and land degradation should encompasses factors that may be biophysical (agro-ecological conditions, location), economic (access to credit and markets, non-farm incomes, availability of technologies), social (organizational structure, labor availability, land tenure), historical (environmental history and that of land tenure) and cultural (traditional knowledge, environmental awareness, and gender.

*Keywords: land degradation, local knowledge, farmers' perception, conservation measures.*

## I. Introduction

### a) Background and Justification of the Study

Societies everywhere on the planet Earth are in one way or the other closely and inextricably linked to the natural environment in which they are embedded. Human productive and social activities and thus social structures and relations are shaped to a significant degree by the natural resource mix available, by physical geography, by weather patterns, by the amenability of natural conditions to transformation, and by a variety of other characteristics of the environment (FAO, 2013; Lal, 2012). Land is a vital resource for producing food and other ecosystem goods and services including conserving biodiversity, regulating hydrological regimes, cycling soil nutrients, and storing carbon, among others (Nachtergaele, 2010; Nickerson, 2012). Indeed, the most significant geo-resource or natural capital is productive land and fertile soil (Lal, 2012; FAO, 2010). For those communities that rely heavily on land as their main asset, especially the rural poor, human well- being and sustainable livelihoods are completely dependent upon and intricately linked to the health and productivity of the land (Pingali, 2012). In

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spite of this, for a long time, the true value of land has been underappreciated and in particular the ecosystem services they provide have been taken for granted (Wood, 2013; Samuel, 2012; FAO, 2010).

Land degradation is a broad, composite, and value-laden term that is complex to define but generally refers to the loss or decline of biological and/or economic productive capacity (FAO, 2014; Global Environmental Facility, 2012). Land degradation is a multifaceted event triggered by the interaction of environmental, economic and social factors (Warren, 2002; Geist and Lambin, 2004; Reynolds *et al*., 2007). It is reaching a significant level especially in rural areas of developing countries where its impacts are more ruthless (Safriel, 2007; Bai *et al.,* 2008). Land degradation is all about any diminishment of biodiversity and ecosystem functioning that negatively impacts the provisioning of ecosystem services and ultimately impedes poverty eradication and sustainable development effort. Land degradation is a temporary or permanent decline in the productive capacity of the land or its potential for environmental management. In East Africa, it is the smallholder farming systems on the highlands which are the hardest hit with soil erosion (Kangalawe and Lyimo, 2010; Gewin, 2002; World Bank, 2012). Global land degradation assessments indicate that the percentage of total land area that is highly degraded has increased from 15% in 1991 to 25% by 2011. If the current scenario of land degradation continues over the next 25 years, it may reduce global food production, from what it otherwise would be, by as much as 12% resulting in world food prices as much as 30% higher for some commodities (IFPRI 2012). This at a time when population growth, rising incomes and changing consumption patterns are expected to increase the demand for food, energy and water, by at least 50%, 45% and 30%, respectively by 2030 (FAO 2011; Ramankutty *et al.*, 2012 ). These expected levels of global demand cannot be met sustainably unless we conserve and rehabilitate the fertility of our soil thus securing the productivity of our land. Achieving land degradation neutrality, i.e. when the pace of restoring the already degraded land is at least equals, but preferably exceeds, the rate of new land degradation, is thus essential to achieve the sustainable development goal of reducing poverty (Lal *et al*., 2012). Without zero net land degradation, it would be also very difficult to meet other global sustainable development targets such as preventing further biodiversity loss, or mitigating and adapting to climate change. Despite these dynamics requiring urgent attention to prevention of land degradation, the problem has not been appropriately addressed, especially in the developing countries (Kissinger *et al.*, 2012).

Land is the most vital and heavily threatened natural resource in Ethiopia because smallholder agriculture is the economic mainstay of the overwhelming majority of Ethiopian people and will continue to remain so in the near future (Pender, and Berhanu, 2004; USAID, 2000; Wagayehu, 2003). However, the on-going land degradation has threatened the sustenance of their livelihood. The Ethiopian highlands are affected by deforestation and degraded soils, which have eroded the resource base and aggravated the repeated food shortages caused by drought. Although the Highlands occupy 44% of the total area of the country, 95% of the land under crops is located in this area, which is home to 90% of the total population and 75% of livestock (). Declining vegetative cover and increased levels of farming on steep slopes have eroded and depleted soils in the area, so that soil degradation is now a widespread environmental problem. Farmers also have to cope with nutrient mining caused by insufficient application of fertilizers, shorter fallow periods and low levels of soil organic matter. Land degradation is the major cause of the country's low and declining agricultural productivity, persistent food insecurity challenge, and abject rural poverty (FAO, 2012). The minimum estimated annual costs of land degradation in Ethiopia range from 2 to 3 percent of agricultural GDP (FAO, 2010). This is a significant loss for a country where agriculture accounts for nearly 45 percent of GDP, 90 percent of export revenue, and is a source of livelihood for more than 82 percent of the country's 100 million people (Pender, and Berhanu, 2004; USAID, 2000). So, in Ethiopia, land degradation, low and declining agricultural productivity, food insecurity and poverty are chronic and highly intermingled problems that appear to feed off each other. If urgent measures are not taken to arrest Ethiopia's serious land degradation disaster, the country is headed for a "catastrophic situation" (Getinet and Tilahun, 2005).

Recognizing the threat of land degradation, the government of Ethiopia has made several natural resource management efforts through various interventions such as productive safety net programme( PSFP), Food for Work programme and MERET and MERET PLUS Programme since mid-1970s and 80s (Aklilu, 2006; Shiferaw and Holden, 1998). As a result a range of land conservation practices, which include stone terraces, stone bunds, area closures, and other soil and water conservation technologies and practices have been introduced into individual and communal lands at massive scales. However, studies points out that farmers adoption of SLM practices at lower rate and more often they dis-adopt them (Aklilu and de Graaff, 2007; ELD Initiative, 2013). In most places, implemented SWC Structure was either totally or partially destroyed by farmers (Tesfaye *et al*. 2013; Kassie *et al*., 2009; Tiwari *et al*., 2008; Bewket, 2007). The conventional top-down planned government efforts and programs to conserve natural resources were not

succeeded where they are most needed. This partially could be, because of unbalanced focus towards technical expertise knowledge and perception by external agents and latest technological aids to explain the causes, the process, and effects of land degradation and disregarding the crucial actors' local communities' knowledge, views and perception in assessment of land degradation. Studies undertaken this area attempt to assess the causes of land degradation are often extremely deterministic or tend to present a ''shopping list'' of causes (Tesfa, and Mekuriaw, 2014). In the former case, the driving factors of land resource degradation tend to be perceived from a particular lens or theoretical perspective, such as neo-Malthusianism or neo- Marxism. Such studies tend to present only a half-done picture, as specific data are collected often in an attempt to corroborate or disprove the perspective to the exclusion of other potentially relevant data or perspectives (Jones, 1999). In the latter case, studies lack explanatory power as they fail to identify the specific links and mechanisms between social variables and land degradation. Structuration theory, developed by Anthony Giddens, and operationalized in development research through the actor-oriented approach (Long, 1992) is a sociological framework that may be usefully applied to help overcome these problems encountered in land degradation and soil conservation research. In taking the level of analysis as the ''situated contexts'' and everyday lives of actors and exploring the ''interplay and mutual determination of 'internal' and 'external' factors and relationships'' (WOCAT. 200;), the actor-oriented approach enables the explanation of differential responses to similar structural circumstances and avoids the excessive determinism that plagues social explanation. In so doing it may be better used to understand peoples' interaction with promoted technology and, with respect to the study of land degradation, enables us to attribute a wide range of potential causes from local cultural variables, to more abstract structural influences on people's actions. Furthermore, by placing emphasis on understanding processes in particular places, it helps reveal how ''factors become causes,'' that is, the mechanisms underlying change (WOCAT. 2011).

Local communities' perspective of land degradation risk could be understood from three vantage points. Firstly, local community could perceive land degradation on the basis of their socio-economic interests. In this case, farmers will be more aware and concerned about land changes and degradations that negatively impact agricultural productivity such as soil erosion. Secondly, when these people understand that their farmland is degrading they will attempt to control some of their activities causing their farmplots degradation(Nsiah-Gyabaah,1994), thereby be more enthusiastic to support land management programmes if they are aware that their actions are harmful to the farmlands (Herberlein, 1972). The third perspective is that farmers are concerned about soil and/or land degradation as a general community problem, disregarding the fact that their own holdings are likely to be also at risk. Under such circumstances then no actions may be taken although such people hold positive attitudes towards conservation. However, it is believed that when the farmers themselves involved in fact-finding on their own land they become instrumental in implementing planned courses of action (Critchley, 1991). An effort to achieve zero net land degradation at the local scale appears to require more than technical expertise knowledge and perception by external agents such as agricultural scientists and government officials (WOCAT, 2011). Research has however shown that science has its limitations and cannot always provide an accurate and full. Thus basing on the local people's views and local knowledge then it is possible to develop methods which can allow the people themselves to provide the solutions to their land degradation problems (Nsiah-Gyabaah, 1994; Critchley, 1991). Since understanding the dynamics of land degradation at the village and farm level can enhances the success of policies and programmes to address land degradation, this study was attempted to analyze local community knowledge used in detecting and analyzing land degradation(the real causal factors, process, socio-economic effects and coping strategies) at the community level.

Generally, designing and implementation of successful sustainable land management practices require, among other things, a detailed understanding of the extent, risk and spatial distribution of the problem, including local concerns. So, this study was conducted with the aim to fill the gap in empirical analysis of land degradation risk from local community knowledge perspective. The specific objectives of the study were: 1) the objective of the study was to explore local approaches employed to assess land degradation by farmers of the study area. 2) Secondly, to analyze farmers' perception of the causes of the problem and their coping strategies. 3) To analyze the effects of land degradation from community local knowledge perspective. 4) To analyze the determinants of farmers' perception of the effects of land degradation risks on agricultural productivity in the study area.

## II. Methodology of the Study

*a) Description of the Study Area*

The study was conducted in Geze Gofa district, which is one of the 15 districts located in Gamo Gofa Zone, Southern Ethiopia. The administrative center of Geze Gofa district, Bulki town, is located at a distance of 251 kilometers from the Zonal capital, Arba Minchi town, and 517 kilometers south west of Addis Ababa, the capital city of Ethiopia. Part of the Gamo Gofa Zone,

Geze Gofa is bordered on the south by Oyda woreda, on the west by Basketo special woreda, on the northwest by Melokoza woreda, and on the east by Demba Gofa woreda. It is located approximately between coordinate 10033'06'' to 10050'24'' North latitude and 37042'36'' to 37058'24'' East longitude. Topographically, the area lies in the altitudes range of 690m to 3196m.a.s.l. As a result, the area is characterized by three distinct agro-ecological zones-Highland (*Dega*), Midland (*Woina Dega),* and Lowland (*Kola*), according to the traditional classification system, which mainly relies on altitude and temperature for classification. There are two (bimodal-belg and meher) distinct rainy seasons: the smaller one is the *belg*, from March to May. The main rains are in the *meher* season from July to September. The main system of farming that existed in the past was shifting cultivation, which was practiced because of the low population pressure at the time. As population pressure increased and settlements became more consolidated, shifting cultivation gave way to bush fallowing and land rotation which has now evolved into continuous cultivation. Land degradation manifests itself in the district in the form of low agricultural productivity due to low soil fertility and adverse climatic conditions, soil erosion and loss of vegetative cover. Low production also increases the poverty situation of farmers. High population pressure has forced farmers to cultivate steep areas that used to be earmarked for grazing or tree plots. Multiple cropping practices, such as intercropping and relay cropping, are common, thanks to the longer growing season resulting from the bi-modal rainfall pattern.

*b) Sampling Design of the Study*

This study employed a multi-stage sampling procedure. Fist, Geze Gofa district was purposively selected because it is one of the severely affected highland areas in the country in terms of land degradation and soil erosion. Geze Gofa district covers thirty one rural *kebeles*. A list of these villages was made and three of them were selected randomly, namely *Ale Aykina, Aykina Kasike and Ala Wuzete*. The district is a highland area with steep slopes, intensely cropped hillsides and high population densities. Second, three *kebeles* (*Ale Aykina, Aykina Kasike and Ala Wuzete*) selected from the 31 complete list of kebeles in the District using a simple random sampling technique. A total of 156 households (10% sample size of households in the study area) were interviewed by administering semi-structured interview schedule. The random sample of 10% of the kebeles and households selected for this study is considered to be representative enough for statistical analysis (Clarke, 1986). Under certain circumstances, such as resource constraints, even a smaller sample of 5% is regarded as being representative enough (Boyd *et al*, 1981).

*c) Data Collection Techniques and Tools*

Data for the study were collected from both primary and secondary sources. Primary data were collected by using the following data collection techniques and tools:

i. *Semi-Structured Interview Schedule*

A semi-structured interview schedule was used to collect both qualitative and quantitative data from the respondents. The data collected included information on households demographic and socio-economic characteristics; institutional services; communities views, perception and knowledge about causes and effects of land degradation; various land management practices adopted by farmers (collectively or singly); farmers' attitudes on the effectiveness of land management practices in reversing land degradation and enhancing productivity. Pilot-tests of questions were made by distributing questionnaire to five farmers in each site to assess whether the instruments were appropriate and suited to the study at hand. Necessary adjustments were made based on the comments obtained from pre-test responses from farmers to ensure reliability and validity. On the basis of the results obtained from the pre-test, necessary modifications were made on the questionnaire. Fifteen enumerators, who had experience in data collection, knew the area and the communities languages were recruited and trained for two day by researcher.

ii. *Focus Group Discussion (FGDs)*

Six focus group discussions were conducted to collect information on local knowledge and perceptions about land degradation and its socio-economic impacts. Each group was made up of 12 people, comprising 7 men and 5 women. Participants in the group discussions were also thirty years and above for both sexes. People in this age group were chosen because they will be able to give an account of the environmental situation of the area for the past 15 years. Proceedings of the discussions were recorded. These FGDs was conducted in order to get some in-detail information on land degradation nature, causes and consequences, commonly practiced land management practices, community perceptions towards land degradation and its effects on agricultural activities and agricultural performance in general.

iii. *Key Informant Interview*

The Interview Schedule was complemented by informal surveys that involved discussions with key informants, including village leaders, extension workers, and district agricultural officials. These informal surveys were conducted in order to get some general overview on soil degradation, community perceptions and agricultural performance in general. These surveys also provided a means and direction in crosschecking the responses from formal interviews. The key informants were found in the respective villages and/or at district

level. Information from key informant interviews was analyzed by triangulation with all other sources. To verify the level of awareness of land degradation three exploratory questions were asked. Firstly, whether the study community perceived land/soil degradation as a problem in their villages. Secondly, what criteria are used by this community to determine the quality of land/soil in general. Thirdly, whether they associated land/soil degradation with crop cultivation or livestock management systems of the area. These aspects are addressed in the following sections.18 key informants deliberately chosen because of their extensive knowledge on land management as identified by elders, local administrators and office of agriculture staff.

iv. *Field Observation*

Field visits involved observations of various land degradation features, such as soil erosion and sedimentation, surface runoff, sandiness of soils, crop vigor, presence of indicator-plant species; and agricultural practices, including among others, types of crops grown, cropping patterns and on-farm soil conservation measures. Field observation was conducted throughout the whole process of the research in order to ensure the validity of information obtained from the farmers through interview schedule. To complement the questionnaire and to have a detailed insight into soil conservation practices in the area, a discussion covering different topics with agricultural experts and farmers have been conducted. This helped to capture some points that were not clearly obtained from the interview.

*d) Methods of Data analysis*

The study employed both descriptive and inferential statistics to analyze data collected from the sample respondents. To run statistical analysis, data were coded and entered in to a computer program known as SPSS version 20. The information generated through the informal and focus group discussions was used to substantiate and augment findings from the quantitative analysis of the semi-structure interview schedule. The data was analyzed using statistical measures of central tendency (means), and frequency distribution (percentages). The frequency distribution data was cross-tabulated into contingency tables. Knowledge of land management were examined considering the three major types of land use types (forest lands, croplands and grasslands) using World Overview of Conservation Approaches and Technologies (WOCAT) approach.

i. *Specification of Empirical Model*

Linear Logistic regression model is a widely applied statistical tool to study farmers' perception of land degradation and conservation technologies (Shiferaw, 1998; Neupane *et al.*, 2002). Linear Logistic regression allows predicting a discrete outcome from a set of variables that may be continuous, discrete, and dichotomous or a combination of them. The dependent variable, (i.e., perception of soil and water conservation practices) is dichotomous discrete variable that is generated from the questionnaire survey as a binary response, and the independent variables are a mixture of discrete and continuous. Following the methods of used by Abera (2003) and Mekuria (2005), the logistic regression model characterizing perception of the sample households is specified as:

$$P_i = F(\alpha + \beta X_i) = \frac{1}{1 + e^{-(\alpha+\beta Xi)}}$$

Where *i* denotes the *i*th observation in the sample; Pi is the probability that an individual will make a certain choice given Xi; e is the base of natural logarithms and approximately equal to 2.718; Xi is a vector of exogenous; variables $\alpha$ and β are parameters of the model, β1, β2……, βk are the coefficients associated with each explanatory variables X1, X2, …, Xn. The above function can be rewritten as:

$$ln\ [P/(1-P)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$$

Where the quantity *P/ (1-P)* is the odds (likelihoods); *β0* is the intercept; *β1, β2 …* and *βk* are coefficients of the associated independent variables of *X1, X2…*and *Xk*. It should be noted that the estimated coefficients reflect the effect of individual explanatory variables on its log of odds {ln [P/ (1- P)]}. The independent variables of the study are those which are expected to have association with farmers' perception of soil erosion and conservation practices. More precisely, the findings of past studies on the farmers' perception, the existing theoretical explanations, and the researcher's knowledge of the farming systems of the study area were used to select explanatory variables. The definition and units of measurement of the dependent and explanatory variables used in the logistic regression model is presented in Table 1.

ii. *Conceptual Model and Hypotheses and Identification of Variables*

Smallholder Farmers' perceptions of the effects of land degradation and soil erosion could be influenced by the natural physical factors that influence land degradation, as well as the socio-cultural and institutional factors and household demographic characteristics that affect how physical processes are viewed. Physical factors include village level factors (rainfall, topography and level of land degradation) and plot level factors (soil type, slope, shape of slope, and location of plot) that may intensify land degradation and soil erosion. Institutional factors include contact access to extension service, access to media and other information sources, availability of a sustainable land management interventions in the village, prior public conservation campaign works on the farmer's own land (for demonstration effects), and the current tenure status

of the field. Household characteristics include education, age and gender. The physical factors that aggravate soil erosion, such as higher rainfall intensity, steep slopes and erodible soils, are hypothesized to raise farmer perceptions of soil erosion by aggravating soil loss. Distance of plot from homestead is expected to reduce perception, as distant plots are less frequently observed by farmers. The period of time the plot has been operated by the current owner is expected to raise erosion perceptions for the opposite reason. Field area (size) should raise perception since the absolute amount of soil and crop yield losses may be higher from larger plots. Farmers who have contact with extension services are expected to have higher erosion perception, since extension is expected to serve as a source of technical information to farmers. The availability of a resource conservation SLM intervention in the village is expected to create awareness perception through its demonstration effect on the need for conservation measures. The effect of public campaign conservation work on the farmer's own plot is ambiguous; it may raise erosion perception through its demonstration effect or reduce perception through its effect on soil loss.

*Table 1:* Definition and Units of Measurement of Variables Included in the Model (N=156)

| Explanatory variables | Variable Code | Variable Type | Units of measurement |
|---|---|---|---|
| Age of household head (in years) | AHH | Continuous | Measured in years |
| Family Size(in number | FS | Continuous | Measured in numbers |
| Sex of household head | SHH | Dummy | One if male, 0 if female |
| Education level of household head | ELHH | Continuous | Measured in years |
| Farming experience | FEHH | Continuous | Measured in years |
| Tenure type | TS | Dummy | 1 if the HH certified 0 otherwise |
| Land certificate | LC | Dummy | 1 if the HH certified, otherwise 0 |
| Extension contact | EC | Dummy | 1 if the HH certified, otherwise 0 |
| Participation in conservation campaigns | PCC | Dummy | 1 if the HH involved in conservation, othervise, 0 |
| Availability of SLM project | SLMP | Dummy | 1 if SLM project is available, otherwise, 0 |
| Slop of the plot | SP | Dummy | 1 if the slope of the plot steep, 1 otherwise |
| Type of soil of the plot | TSP | Dummy | 1 if the soil type is sandy, 0 otherwise |
| Distance from residence | DR | Continuous | Measured in kilometer |
| Area of the plot | AP | Continuous | Measured in square kilometer |
| Age of the Plot | AP | Continuous | Measured in years of cultivation |

## III. Results and Discussion

### a) Characteristics of Sample Respondents

Demographic, socio-economic, institutional, bio-physical and psychological characteristics of the households are directly/indirectly related to factors influencing farmer's perception of the effects of land degradation and the adoption of soil and water conservation practices. Therefore, the demographic and socio-economic characteristics of sample respondents in the study areas were presented and discussed briefly in this section as follows:

*Table 2:* Demographic and Socio-economic attributes of the Respondents

| Variable | | Frequency | Percentage |
|---|---|---|---|
| Sex | Male | 96 | 61.53 |
| | Female | 62 | 39.74 |
| Age | 20-30 | 21 | 13.46 |
| | 31-41 | 60 | 38.46 |
| | 42-52 | 42 | 26.92 |
| | 53-63 | 17 | 10.89 |
| | 64-74 | 7 | 4.48 |
| | >74 | 3 | 1.93 |
| Education | No formal | 87 | 55.77 |
| | Primary | 25 | 16.03 |
| | Secondary | 21 | 13.46 |
| | Certificate and above | 17 | 10.99 |
| Farming experience (Years): | 1-10 | 21 | 13.47 |
| | 11-21 | 33 | 21.15 |
| | 22-32 | 41 | 27.93 |
| | 33-43 | 45 | 26.28 |
| | 44-54 | 10 | .6.41 |
| Farm size | <0.5 | 98 | 62.82 |
| | 0.5-1 | 49 | 31.41 |
| | >1 | 3 | 1.92 |
| Extension Service | Access | 102 | 65.38 |

| | | | |
|---|---|---|---|
| | No access | 54 | 34.61 |
| Credit service | Access | 62 | 39.75 |
| | No access | 94 | 60.25 |
| Land holding ownership certificate | Certified | 109 | 69.87 |
| | Not Certified | 47 | 30.13 |
| Participation in public conservation campaigns | Involved in public campaigns | 41 | 26.29 |
| | Not involved in public campaigns | 115 | 73.71 |
| Slope of the plots | Steep slope | 97 | 62.17 |
| | Flat/plain | 59 | 37.83 |

*Demographic and Socio-economic attributes of the Respondents (n=156)*

The average age of household head in the study area was about 42 years. This shows that a majority of the sampled farmers found in the adult category, that is, 44.2 percent of the sampled farmers were aged between 35 and 56 years old. In terms of the level of education attained by the household head, it was found that the average level of education attained was about 3 years of schooling, that is, on average; the household head spent about eight years in school. It was further found that male headed households were more educated than female headed households. The sampled households own an average of 0.526 hectares of land with an average of about two plots per household. This goes to show that most households do not have adequate land on which to farm. In addition, it was found that the farmers had used the land they own for about 33years. This gives an indication that these farmers had used these lands for quite a number of years. Also, it was found that the farmers had an average of 27 years' experience in farming. The experience of 27 years is long enough for one to adapt to the new land management practices used in the area. It was also found that a majority of the households owned livestock. That is, 82 percent of the sampled households owned livestock while 18 percent did not own livestock. Out of the total sample respondents 54.68 and 55.32 % respondents reported that the status of their farm land is steep sloped and flat/plain respectively.

*b) Farmers' Perceived Causes of Land Degradation in the Study Area*

Answer to the inquiry on whether the local community perceived land degradation as a happening and as a problem in their farmland and surrounding landscapes have shown that 86.54% of the respondents considered land degradation as happening and being a serious problem in their locality. The farmers' perceived various causes of land degradation in their farmlands and surrounding landscapes. Table 3 presents the locally perceived causes of land degradation that were mentioned by the respondents as being the cause for the observed land/soil degradation in the study areas.

*Table 2:* Percent responses on Local community knowledge of causes of Land degradation problems

| Farmer's perceived causes land degradation | Frequency (n=156) | Percentages (%) |
|---|---|---|
| Continuous cropping | 63 | 40.38 |
| Deforestation | 56 | 35.9 |
| Overgrazing | 28 | 17.95 |
| Cultivation of marginal lands | 57 | 36.54 |
| Inappropriate tillage practices | 32 | 20.51 |
| Low adoption of SLM measures | 59 | 37.82 |
| Torrential rains and drought(weather extreme events) | 42 | 26.92 |
| Soil erosion | 47 | 30.13 |
| I don't know | 21 | 13.46 |

*Farmers' Perceived Causes of Land Degradation in the study area*

***Note: n is frequency of responses (multiple responses) for each cause except for 'I don't know response'*

About 40.38% of the sample respondent households associated the cause of land degradation to continuous cropping considered to be responsible for the retreating soil fertlity. Continuous cropping without fallowing and/or without nutrient supplementation was perceived by farmers as the most important cause of land degradation in general and soil fertility decline in particular. The farmers elucidate that when the land is cropped every year without rest, the nutrients in the soil are exhausts and therefore the land can no longer provide adequate nutrients required for the vigorous growth of the crops. The reason for continuous crop growing was the increasing land shortage because of high population growth that has led to intensified crop

cultivation and short or no fallow periods (Eyasu, 2002). Most farms are cultivated every season without fallow and are thus subjected to continuous loss of soil fertility. Population growth and the consequent increase in demand, continuous cultivation and farm expansion to feed the growing population, have been outlined as the causes of continuous cropping (Getnet and Mehrab, 2010). Problems of population pressure were also believed to be as an underlying cause of land degradation during the discussion. The growth of population is exacerbating the situation. Thus land is fragmented and farmers are compelled to cultivate on hillsides and steep slopes.

As the survey data result reveals the other causative factors perceived by the local community to be responsible for the land degradation were low adoption of SLM practices (37.82%), cultivation of marginal/steep slopes (36.54%), deforestation(35.9%), soil erosion(30.13%), Torrential rains and drought (26.92%), Inappropriate tillage practices(20.515) and Overgrazing(17.95%). Low adoption of SLM measures is the second driving factor significantly contributed to the land degradation problem elucidated by the farmers. Thus effective extension services are possibly needed to create awareness regarding various mechanisms that may contribute to sustainable farm production, such as on-farm erosion control, agroforestry practices and proper residue management. Proper farmer education would inculcate the culture of conservation among communities. Soil erosion was also negatively impacting on soil fertility as the rich top soils are removed due to the exposure of the land for more than half of the year. Farmers said bushfires were the number one factor that exposes the soil to erosion (Dejene *et al*, 1997). Other factors that expose the soil were overgrazing, land clearing or the gather and bum' practice of land. So, it can be concluded that study area is affected by land degradation by one causative factors or the other and the local communities have generally perceives land degradation as problem in their Villages as it is illustrated in table3.

*c) Farmers' Perceived Indicators of Land Degradation*

Findings from the survey result showed that there are several local knowledge's the communities use to evaluate and to explain the quality of the land and the soils they are cultivating. Three categories of responses appeared to be most outstanding, namely crop vigour and crop yields, presence of strange -plant species/germination of weeds and density of vegetation under fallow (Dejene *et al,* 1997). Result from this study reveals that there are numerous long-established local communities' knowledge use to assess and to explain the quality of their land and the soils they are cultivating. A healthy and vigorous crop growth, reflected by a good crop stand in the field, was usually used as an important indicator that the soil is fertile enough, if moisture and other factors are not limiting. Under such circumstances, even if the weather conditions worsen during the growing season such that final yields are poor, the farmer would have realized the potential fertility of a certain piece of land. A underdeveloped crop with less vigorous growth in the field when other factors such as precipitation are considered not limiting was locally perceived to indicate a high probability that soils on which the crop is growing are of low quality and infertile. Majority of respondents (65.38%) considered crop yields as the best measure to understand farmland status/ condition. It was noted that declining crop productivity could be a clear indicator of declining soil fertility, and hence soil degradation and land degradation. It was noted that declining crop productivity could be a clear indicator of declining soil fertility, and hence soil degradation. The use of this indicator by the local farmers in evaluating land quality is also cherished by experts in land degradation, where crop output decline is regarded as a proxy indicator of soil degradation in farmlands (Dejene et al, 1997; Mitiku *et al,* 2006; Lakew *et al.,* 2000). It is particularly important because it affects people directly in terms of food availability and security. However, this factor only is not enough to conclude that degradation is taking place since cropping conditions vary significantly between years and between individual farmers. The effect of other factors such as crop pests and diseases and climate variability may influence crop yields (Arega and Hassan, 2003; Tesfaye, 2003; Habtamu, 2006; Shiferaw, 2016; Shiferaw *et al,* 2011). In the study kebeles, most of the respondents indicated also that low crop yields could be due to low and/or erratic rainfall.

*Table 4:* Presents the proportions of responses on indicators of farmers' awareness of land degradation processes

| Farmers' Perceived Indicators | Frequency (n=156) | Percentages (%) |
|---|---|---|
| Declining crop yield and land productivity | 92 | 65.38 |
| Germination and expansion certain strange vegetation/grass species/weeds | 63 | 55.77 |
| Gullies and rills formation | 67 | 42.95 |
| Change in the colour of the soil | 16 | 10.26 |
| Sedimentation of sandy materials | 65 | 41.67 |
| Decline in soil fertility | 98 | 62.82 |
| Changes in color of rivers and streams | 17 | 10.89 |

*Farmers' Perceived Indicators of Land Degradation*

**Note: n is frequency of responses (multiple) for each measure.*

Declining soil fertility was perceived as the major indicator of soil degradation in the studied villages. A majority of the farmers (62.82%) attributed such decline to continuous cultivation without resting the fields, whereas 20% ascribed it to inadequate application of manure and/or fertilisers. One explanation to continuous cultivation was the increasing land shortage that has led to intensified crop cultivation and short or no fallow periods. Those who perceived soil degradation as a problem mentioned the generally low but declining soil fertility, soil erosion and runoff, sandiness of soils and sedimentation as key indicators of soil degradation in their villages. Soil erosion and surface runoff featured as indicators of soil degradation as indicated by about 44% of respondent farmers. Physical observation of the landscape in these villages substantiates the local communities' knowledge. All the sample *kebeles* have landscapes cut apart by more evident gullies *table4*). With regard to physical changes in the soil, the local people identified soil erosion and soil compaction as major indicators of land degradation. Analysis of questionnaires indicated that 86% of respondents were aware that soil erosion is taking place on their lands while about 14% did not observe erosion occurring on their lands. Farmers who did not observe erosion on their land said there is no serious run-off on their farms due to the relatively flat nature of the landscape. For these farmers, erosion is only evidenced by rill or gullies and since these processes were not occurring on their farmlands, they concluded that no erosion had taken place. The farmer on whose land gully erosion was found said that it started as a small gutter but is developing into a big river in the rainy season. Sheet erosion was identified through a lot of indicators which include the levelling of ridges and mounts constructed prior to planting, the accumulation of soil particles behind obstacles, the appearance of stones on farms and the washing away of plants or the exposure of plants' roots (e.g. Dejene et al, 1997; Morges and Holden, 2007 ).

During focus group discussions, most fanners indicated that the roots of their crops get exposed or carried away by run-off.Some of the respondents said that after Torrential rains, they have to gather soil around the crops whose roots have been exposed. Farmers residing in valleys stated that soils are usually carried away from upstream and deposited on their farms after heavy down pours, sometimes burying their plots. Other farmers elucidated that though sheet erosion may not be noticeable on their lands, the number of pebbles and stones on their farmlands are increasing, indicating that these stones which were previously buried are now being exposed as the soil is little by little washed away.

As the survey result shows (table 4), the local communities in all the sample *kebeles elucidated* that germination and expansion certain strange vegetation/ grass species/weeds are the predominant (55.77%) indicator of degraded lands. So, previously farmers leave their farm plots for fallowing and/or applications of manure if the plot is homestead plot when these germination and expansion certain strange vegetation/grass species/weeds as soil fertility management measure. Now a days because of land shortage fallowing is impossible for the farmers

Sedimentation of the soil was perceived as a problem by 41.67% of the sample respondent farmers (*table4*). This response was principally obtained from farmers whose fields laid in stabilizing sand fans that have soils with very low organic matter levels, low moisture holding capacity and poor fertility status. Sedimentation was reported to take place in depositional footslopes and valley bottoms where the eroded materials from hill slopes accumulate. Farmers detect soil compaction through the resistance of the soil to work or its failure to support plant life. Soil compaction was observed along footpaths, trekking lines and places where animals usually gather to rest areas. The compacted soils become infertile.

The existence of these indicators could confirm that rural people are aware of their environment and its related problems, and particularly so with those which affect the farm productivity and/or those that resulted into more visible landscape changes such as soil erosion. Land degradation was identified by local

residents through changes in crop yield as well as physical changes in the soil from questionnaire survey analysis. Local people associated reduction in crop yield with depletion of soil nutrients and rainfall variability (*table4*). As shown in the table, the majority (65.38%) of respondents attributed a reduction in crop yield to low soil fertility. The presence of these indicators seem to show that rural people are aware of their environment and its related problems, and particularly so with those which affect the farm productivity and/or those that resulted into more visible landscape changes such as soil erosion. However, the fact that less than half of the respondents indicated that soils are inherently infertile suggests that productivity has declined significantly within living memory and that people were unaware that their yields were probably rather low from the outset.

*d) Effects of Land Degradation from Local Knowledge Perspective*

Land degradation has diverse effects on individual farmers, the community and the environment. Generally, the effects include loss in soil fertility, siltation of water bodies, low agricultural productivity and crop yield, food insecurity and poverty(Arega and Hassan, 2003; Tesfaye, 2003).Natural cycles (carbon, nitrogen, phosphate, and water cycles) and biodiversity were also affected. The survey result shows that 71.15% of respondents perceived that land degradation results in households' food insecurity and abject poverty situation while 69.23% of respondents perceived that it results makes arable lands infertile. 65.38% of respondents perceived that land degradation results in Declining crop yield and land productivity and ecological services are severely affected while 56.41% of the respondents perceived that it results in siltation of water bodies so that socio-cultural services were less affected. But some of the FGD participants argue that agricultural production and water quantity were seen to have declined drastically, whereas water quality was reported to have deteriorated more gradually.

*Table 5:* Presents the proportions of responses on effects of land degradation from Local Knowledge Perspective

| Effects of land degradation | Frequency (n=156) | Percentage (%) |
|---|---|---|
| Reduced soil fertility | 108 | 69.23 |
| Declining crop yield and land productivity | 92 | 65.38 |
| Siltation of water bodies | 88 | 56.41 |
| Food insecurity and poverty | 111 | 71.15 |

*Effects of Land Degradation from Local Knowledge Perspective*

**Note: n is frequency of responses (multiple) for each measure*

Soil erosion causes soil loss, with socio-economic and environmental consequences which vary among the soil types and communities. The most important consequence is a diminution in soil fertility which poses a serious challenge to crop production. As soils are carried away, the nutrients associated with them are also carried away, resulting in a lessening in soil fer1iility which will impact harmfully on crop yield. As shown in Table (5), about 65.38 percent of farmers associated the poor crop yield to a loss in soil fertility. These farmers argued that even years of good rains in recent times do not give them good crop yield as it pertained 10 years ago. The farmers' assertion corroborated studies conducted in the area by (Senayah 1994; Nye and Stephens, 1962; Adu, 1969) which show a declining trend in soil fertility. The low crop yield has affected farmers' income and food security. Most farmers said they could not meet their food requirements, especially in the lean season. Some said they eat twice a day while others eat once a day during this time of the year. This has nutritional implications, especially for pregnant women and children. Low productivity has also affected the farmers' income since agriculture is their most important economic activity. It has also been revealed by Dejene et al (1997) that loss in soil productivity leads to reduced farm income and food insecurity, particularly among the rural poor. The economic hardship is compelling the local people in the study area to migrate to the other parts the country for alternative livelihoods.

*e) Community Participation in Sustainable Land Management Practices ((SLM)*

Lasting productivity and sustainability of the agricultural land entails sound sustainable land management practices in the farming systems that enhance maintenance and/or improvement of soil and land quality in general(Habtamu, 2006;Arega and Hassan, 2003; Tesfaye, 2003). This is an important consideration as it influences agricultural productivity and local livelihoods. In many instances land degradation has stimulated a variety of responses and adaptation mechanisms by local communities. This study conducted an enquiry on whether farmers had undertaken any deliberate efforts to conserve their land holdings from land degradation. Majority of respondents (67%) indicated to have used one or more conservation measures in their farms as a means of adjusting and adapting to land degradation processes. Soil and water conservation measures have been practiced in the study area since the late 1970s (Lakew et al., 2000). SLM measures have been practiced in the study area fall into

three major categories, specifically agronomic (e.g. mulch, organic manure, changing species composition of crops, controlling cropping intensity and fallow period), vegetative/biological (e.g. tree, shrub and grass cover), Structural SWC measures (e.g. terraces, bunds and ditches). Based on the respondents' perception, each of these measures can be applied for specific purpose. According to Table 6 and as shown by responses, agronomic measures are the most popular conservation measures adopted to deal with soil erosion, followed by vegetative measures and then by structural SWC measures in the study area.

*Table 6:* Adopted SLM practices

| Sustainable Land Management Practices implemented | List of Sample *Kebeles* | | | | | |
|---|---|---|---|---|---|---|
| | *Ale Aykina(n=57)* | | *Aykina Kasike(n=53)* | | *Ala Wuzete(n=46)* | |
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| Agronomic measures | 27 | 47.37 | 24 | 45.28 | 21 | 45.65 |
| Vegetative(biological) measures | 16 | 28 | 18 | 33.96 | 17 | 36.96 |
| Structural SWC measures | 14 | 24.56 | 11 | 20.75 | 7 | 15.22 |

*Adopted SLM practices*

*f) Constraints to Community Participation in Sustainable Land Management (SLM) Practices*

Community participation in sustainable land management practices is of great importance as it seeks to guarantee access and control over resources by the communities living in them, but who depend on these resources to satisfy their various needs (ecological, economic, social, cultural and spiritual needs). Community participation ensures more commitment in ensuring that resources are more sustainably managed, where apart from communities depending on these resources for a living and conserving them, they at the same time become their guardians (Arega and Hassan, 2003; Tesfaye, 2003; Lakew et al., 2000; Yilkal, 2007; Habtamu, 2006).The active participation of various stakeholders in decision making is crucial for ensuring the long term sustainability of community-based resource management initiatives. In several occasions however, sustainable land management has not received the expected involvement of local communities. Some of the reasons that have influenced the local people's participation SLM practices in the study area are discussed here.

*Table 7:* Constraints to Community Participation in Sustainable Land Management (SLM) Practices

| Constraints to adoption of SLM practices | Frequency(n=156 ) | Percentage (%) |
|---|---|---|
| Lack of incentives | 72 | 46.15 |
| Labour intensiveness | 66 | 42.3 |
| Land shortage | 69 | 44.23 |
| Financial constraint(Poverty) | 109 | 68.87 |
| Complexity Conservation measures | 76 | 48.71 |

*Constraints to Community Participation in Sustainable Land Management (SLM) Practices*
**Note: n is frequency of responses (multiple) for each measure*

A financial constraint (poverty) was the main reason reported for not being able to implement SLM practices (mentioned by 68.87% of people as presented in table 7). Artificial fertilizer, ranked most highly in terms of their capacity to improve the soil is also the most expensive measures. It does not follow however that is the poorest that degrade the land most (or that it is the wealthiest who invest most in the land, as shown above). The poorest are often eager to sell their labor, as they are desperate for cash income to buy necessities. In so doing they are rarely able to cultivate all their own fields and so these fields benefit from more regular fallowing than those belonging to wealthier people. This defenses Dejene et al's (1997) findings that the poor face financial and socio-economic constraints which seriously impede management practices and innovations.

Lack of adequate incentive was the main reason that people cited for being unable to implement SLM Practices (reported by 46.15% of people as presented in table 7). Land quality is important variable affecting incentives in this area. The FGD data reveals that that 'the more productive or profitable the land use the more farmers will be willing to maintain and invest in better land management and erosion control practices. Relatively flat, irrigable land suitable for vegetable

production generates greater returns to labor and capital, and therefore a stronger incentive to invest. Thus it receives much more attention than steeply sloping fields given to maize and beans.

Land shortage was the main reason that people cited for being unable to implement erosion prevention methods (44.23%) as trees and terraces both absorb land and trees further shade crops. It was also cited as a constraint to improving fertility by 37% of people (referring to the desire for longer and more frequent fallows). Thus population pressure, (as it lowers per capita land availability), could be regarded as a factor contributing to degradation in Study areas but other factors affect whether this results in intensification with soil improvement or degradation. Local people will not convert their ladder terraces into more permanent terraces because they say they would be too labor intensive to maintain (it would involve digging residues into the soil twice annually rather than pulling soil down slope to bury them). With significant rates of out-migration, labor can hardly be said to be a constraining variable to land improvement— thus returns to labor, as outlined above, must be regarded as more significant.

The survey result also revealed conservation measures are so complex that they do not understand exactly how to go about their implementation (noted by 48.71% of people).. This arises due to lack of consultation with the community in enacting the policies. This point is consistent with the view of Rogers (Reed and Dougill, 2009; Reed et al, 2006), that innovations which are difficult to understand and implement are less likely to be adopted than technically simple ill innovations, although the scientifically rigorous indicators used in the top-down paradigm may be quite objective, they may also be difficult for local people to use. It was reiterated that some of these measures require financial investment which they do not have, and therefore they are unable to implement them.. This lowers the productivity and income of the poor and reinforces the "vicious cycle" of poverty and natural resource degradation. This means that if land degradation is to be managed sustainably, and then the communities need to be involved in the planning process and resourced to implement projects introduced by authorities

Also the others the reasons elucidated was the taking too lightly the severity of the land degradation risk by many people in the area. Where the tenure system is not guaranteed individual farmers may not be concerned with problems of land degradation regardless of their holdings being at risk as such land degradation is considered as a general community problem. Such attitudes may result in no action being taken against land degradation even when there are no clear hindrances. The implication of the foregoing is that effective conservation is likely to be achieved when land tenure systems are properly secured and articulated. Thus efforts are needed to ensure integrated community-level planning that could promote individual farmers efforts without undermining community interests. Adoption and/or practicing certain SLM measures are much influenced by the farmer's economic situation, including resource endowments. For instance, farmers with sufficient land holdings can afford to conserve by fallowing and constructing various physical SWC structures, while land constrained farmers may not. Similar experiences would be the case for other conservation measures that require heavy investment by the farmer, for example making of soil erosion control structures that may need additional labour, and using fertilizers and/or manure.

From the in-depth interviews held with FGDs participants on management, institutional barriers were identified as another challenge of community involvement. Poor coordination between farmers, traditional/local authorities and NGOs was seen as a major barrier to land management in the area. Reasons assigned for the lack of coordination were conflict of interest among stakeholders, especially concerning resource use and control, the seemingly entrenched stance of some traditional or local authorities on issues relating to land and its use, and the difficulty in convening meetings of all stakeholders to identify priority projects to be undertaken. The lack of coordination among stakeholders (farmers, traditional authorities, governmental agencies, NGOs, etc) sometimes results in duplication of efforts in some areas whereas other places receive little or no attention at all.

Furthermore, lack of genuine involvement between local communities, NGOs and governmental agencies who undertake conservation projects is holding back sustainable land management in the in the study area. This situation often results in a top-down approach to planning. For example, authorities design conservation plans with the scientific knowledge available and then take them to the people for execution, a process which usually leads to inappropriate execution or to the failure of some conservation efforts. Also, a top-down approach may result in the location of projects at sites that may not be fitting to the inhabitants. The household survey reveals that most projects which did not involve the local people at certain levels of planning failed. 79% of the interviewed farmers held the view that their knowledge is very relevant to any intervention exercise and therefore should be sought before any plan is implemented, whereas 21% held a opposing view. Those who saw the relevance of local participation in land management stated that local people should not only be viewed as a labour pool for conservation projects but as people whose experience in the area as land users has given them enough knowledge to share.

Conservation practices are adopted when local communities have satisfied basic needs. Besides

population pressure, other factors also need to be evaluated, such as the support of public institutions and sufficient cohesion of local communities, especially a strong community organization. The combination of these factors will result in the decision and the capacity of land users to invest time and resources in land conservation. Decision-making about land management and land degradation should encompasses, among others, factors that may be biophysical (agro-ecological conditions, location), economic (access to credit and markets, non-farm incomes, availability of technologies), social (organizational structure, labor availability, land tenure), historical (environmental history and that of land tenure) and cultural (traditional knowledge, environmental awareness, and gender). Socioeconomic and cultural factors should receive crucial attention in policy decision-making. For instance at a time, the attitude of local communities may be more critical than the availability of technology; the latter, although an important issue, may only be a tool to achieve goals in a social context.

g) *Determinants of Farmer Perceptions of the Severity and effects of land degradation on productivity agriculture*

Answer to the inquiry on whether the study community perceived soil degradation as a problem in their villages have shown that 58% of the respondents considered soil degradation as being a serious problem in their vicinities. These perceptions may be influenced by differences in socio-economic characteristics inherent among the local people. Socio-economic characteristics such as endowment of livelihood assets by households determine the ability of a household to use, for example, agricultural inputs like fertilisers or manure as a way of improving soil productivity. In the study area, for instance, wealthy farmers who could afford using fertilisers and/or manure did not perceive soil fertility as a major issue. Logistic regression model was used to analyze determinants of farmers' perception of the effects of land degradation risks on agricultural productivity. The success of the overall prediction by the regression model indicate that the variables sufficiently explained the perception of farmers on conservation practices, and there is a strong association between the perception and the group of the explanatory variables ($R^2$ = 0.802). A positive estimated coefficient in the model implies increase in the farmers' perception of soil erosion and conservation practices with increased in the value of the explanatory variable. Whereas negative estimated coefficient in the model implies decreasing perception with increase in the value of the explanatory variable.

*Table 6:* Logistic regression result for perception of the effects of land degradation risks

| Variable | $\beta$ | SE | Z | Sig | Odds Ratio |
|---|---|---|---|---|---|
| Age of household head | 0.037*** | 0.658 | 0.898 | 0.0890 | 0.040 |
| Family Size | 0.167 | 0.138 | 1.230 | 0.272 | 0.023 |
| Sex of household head | 0.245** | 0.006 | 1.980 | 0.0967 | 0.011 |
| Education level of household head | 0.0847** | 0.726 | 2.500 | 0.048 | 0.131 |
| Farming experience | 0.208** | 0.038 | 0.360 | 0.023 | 0.101 |
| Tenure type | 0.280* | 0.657 | 1.980 | 0.662 | 0.34 |
| Land certificate | 0.078 | 10872 | 1.160 | 0.723 | 0.162 |
| Extension contact | 0.876* | 0.182 | 1.740 | 0.024 | 0.056 |
| Participation in conservation campaigns | 0.087** | 0.086 | 1.420 | 0.0340 | 0.021 |
| Availability of SLM project | 0.062** | 0.467 | 0.440 | 0.0876 | 0.031 |
| Slope of the plot | 2.286** | 0.025 | 2.010 | 0.0965 | 0.023 |
| Type of soil of the plot | 0.834 | 0.100 | 1.070 | 0.0956 | 0.231 |
| Distance from residence | 0.147 | 0.064 | 1.600 | 0.782 | 0.031 |
| Area of the plot | 1.720 | 0.0676 | 0.240 | 0.345 | 0.045 |
| Age of the plot | 0.070** | 0.078 | 0.340 | 0.024 | 0.021 |
| Constant | -1.703*** | .346 | -1.690 | 0.114 | |

Model Chi-square 98.280
Log likelihood function 72.165
Nagelkerke ($R^2$)0.802
Number of observation 156

*Extension contact:* As hypothesized, extension contact is found to have a significant positive Influence on the perception of the severity and effects of land degradation on agricultural productivity. This may be explained by the fact that scientific information and research result reports that farmer gain from extension agents help them to aware and understand the severity and effects of land degradation on agricultural productivity. Therefore, Farmers who had frequent contact with extension agents perceived productivity decline associated with land degradation (Arega and Hassan, 2003; Tesfaye, 2003).

Availablity of SLM project in the village: implementation of SLM project in the village positively influenced and aware farmers about the risk of decline in agricultural land productivity due to land degradation and soil erosion. This could be justified by SLM projects effort of attempt to participate the farmers in processes and awareness creation and capacity building through experience sharing from other successful project areas.

Participation/training on agricultural land management SWC measures and etc. has a positive and significant effect on conservation perceptions. Farmers who participated in training by development agents on SWC works were more aware of soil erosion and conservation than those who did not participated.So, this finding corroborates with Nagassa *et al.* (1997) findings in Ethiopia reported that training of farmers and their participation in extension workshops improves their perception of soil degradation problem and facilitates the adoption of improved technologies.

Age oh household head: The finding of the study reveals that age of the household head has a negative influence on the perception of the risk of decline in agricultural land productivity due to land degradation and soil erosion. This means that aged farmers tended to perceive severe yield loss or productivity decline, in contradiction to other finding that younger farmers perceived higher erosion.

Educational level of household heads: Education of the head of the household significantly and positively determined farmers' perception of the risk of decline in agricultural land productivity due to land degradation and soil erosion. Possible explanation is that educated farmers tend to be better access to research output reports and generally to update information about the risks associated with land degradation and soil erosion and hence tend to spend more time and money on soil conservation. This is because literate farmers often serve as contact farmers for extension agents in disseminating information about agricultural technologies from government agencies. The odds ratio also suggests that if a farmer is educated, other factors held constant, the likelihood of awareness will be two times higher than an illiterate farmers. However, the other variables, such as family size, tenure type, land certification, gender, family members in farm work, as well as physical factors, such as the slope of the terraces and altitude, did not significantly influence the perception of the risk severe yield loss or productivity decline and had only weak explanatory power in the model.

## IV. Conclusion and Policy Implication

The study result showed that farmers perceived land degradation in their physical environment, particularly in soil and vegetation. The changes observed include soil erosion, loss in soil fertility and deforestation. Farmers in the study area were generally aware of and perceived soil erosion as a serious problem and its effect on agricultural land productivity. Their possibility of perceiving its effect on agricultural land productivity as slight to severe was primarily determined by institutional and demographic factors as well as weakly by biophysical factors. The socio-institutional and demographic determinants of the effects of land degradation and soil erosion risks on agricultural productivity decline point to policy implications for public inclusive SLM practices and capacity building programs as well as bringing back indigenous land management practices to research and learning platforms for sustainable and desirable societal betterment. The fundamental forces for these changes are the increasing human and animal population; rising temperatures; and unreliable and declining rainfalls resulting in widespread environmental and socio-economic problems such as overgrazing, fuel wood fetching, land clearance for fanning, and drought. Institutional barriers such as poor coordination, ineffective implementation of policies, lack of data sharing and lack of consultation amongst stakeholders are also militating against sustainable land use planning in the Municipality. The effects of land degradation are diverse and include scarcity of wood products for building and domestic energy supply, less pasture for animals and low crop yield which is increasing poverty and hunger amongst the local people. The coping strategies regarding this environmental challenge include the application of fertilizers, planting of early maturing/drought tolerant crops, dry season gardening/irrigation and mixed cropping. The survey result reveals that sustainable land use management in the community requires the involvement of the local people and integrating local knowledge at both the drafting and implementation stages of policies as these farmers possess rich knowledge about their physical environment that could be tapped to enhance policy formulation and implementation.

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# Global Journals Inc. (US) Guidelines Handbook 2017

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# FELLOWS

## FELLOW OF ASSOCIATION OF RESEARCH SOCIETY IN SCIENCE (FARSS)

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- The "FARSS" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSS or William Walldroff, M.S., FARSS.

FARSS accrediting is an honor. It authenticates your research activities. After recognition as FARSB, you can add 'FARSS' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, and Visiting Card etc.

*The following benefits can be availed by you only for next three years from the date of certification:*

FARSS designated members are entitled to avail a 40% discount while publishing their research papers (of a single author) with Global Journals Incorporation (USA), if the same is accepted by Editorial Board/Peer Reviewers. If you are a main author or co-author in case of multiple authors, you will be entitled to avail discount of 10%.

Once FARSB title is accorded, the Fellow is authorized to organize a symposium/seminar/conference on behalf of Global Journal Incorporation (USA). The Fellow can also participate in conference/seminar/symposium organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent.

You may join as member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. In addition, it is also desirable that you should organize seminar/symposium/conference at least once.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The FARSS can go through standards of OARS. You can also play vital role if you have any suggestions so that proper amendment can take place to improve the same for the benefit of entire research community.

As FARSS, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.


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The FARSS member can apply for grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.
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The "MARSS" is a dignified ornament which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., MARSS or William Walldroff, M.S., MARSS.

MARSS accrediting is an honor. It authenticates your research activities. After becoming MARSS, you can add 'MARSS' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, Visiting Card and Name Plate etc.

*The following benefitscan be availed by you only for next three years from the date of certification.*


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We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The MARSS member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.


Once you are designated as MARSS, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

# AUXILIARY MEMBERSHIPS

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The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

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The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.


The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.


After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

**The following entitlements are applicable to individual Fellows:**


Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.

Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

**Other:**

**The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:**

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

**Note :**

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

# Process of submission of Research Paper

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**(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.**

**(II) Choose corresponding Journal.**

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- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

**You can use your own standard format also.**
**Author Guidelines:**

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

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Complete support for both authors and co-author is provided.

**4. MANUSCRIPT'S CATEGORY**

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

**5.STRUCTURE AND FORMAT OF MANUSCRIPT**

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

**Papers**: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

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*Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.*

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Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

*Acknowledgements: Please make these as concise as possible.*

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

*Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.*

*Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.*

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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*Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.*

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

## TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

**1. Choosing the topic:** In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

**2. Evaluators are human:** First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

**3. Think Like Evaluators:** If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

**4. Make blueprints of paper:** The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

**5. Ask your Guides:** If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

**6. Use of computer is recommended:** As you are doing research in the field of Computer Science, then this point is quite obvious.

**7. Use right software:** Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

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**9. Use and get big pictures:** Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

**10. Bookmarks are useful:** When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

**11. Revise what you wrote:** When you write anything, always read it, summarize it and then finalize it.

**12. Make all efforts:** Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

**13. Have backups:** When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

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**15. Use of direct quotes:** When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

**16. Use proper verb tense:** Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

**17. Never use online paper:** If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

**18. Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

**19. Know what you know:** Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

**20. Use good quality grammar:** Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

**21. Arrangement of information:** Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

**22. Never start in last minute:** Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

**23. Multitasking in research is not good:** Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

**24. Never copy others' work:** Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

**25. Take proper rest and food:** No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

**26. Go for seminars:** Attend seminars if the topic is relevant to your research area. Utilize all your resources.

**27. Refresh your mind after intervals:** Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

**28. Make colleagues:** Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

**29. Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

**30. Think and then print:** When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

**31. Adding unnecessary information:** Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

**32. Never oversimplify everything:** To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

**33. Report concluded results:** Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

**34. After conclusion:** Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

## Informal Guidelines of Research Paper Writing

**Key points to remember:**

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

**Final Points:**

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

**General style:**

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

**Title Page:**

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

**Abstract:**

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

**Introduction:**

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

**Procedures (Methods and Materials):**

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

**Results:**

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

**Discussion:**

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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| Topics | Grades | | |
|---|---|---|---|
| | **A-B** | **C-D** | **E-F** |
| ***Abstract*** | Clear and concise with appropriate content, Correct format. 200 words or below | Unclear summary and no specific data, Incorrect form<br><br>Above 200 words | No specific data with ambiguous information<br><br>Above 250 words |
| ***Introduction*** | Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited | Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter | Out of place depth and content, hazy format |
| ***Methods and Procedures*** | Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads | Difficult to comprehend with embarrassed text, too much explanation but completed | Incorrect and unorganized structure with hazy meaning |
| ***Result*** | Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake | Complete and embarrassed text, difficult to comprehend | Irregular format with wrong facts and figures |
| ***Discussion*** | Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited | Wordy, unclear conclusion, spurious | Conclusion is not cited, unorganized, difficult to comprehend |
| ***References*** | Complete and correct format, well organized | Beside the point, Incomplete | Wrong format and structuring |

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