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Studies on Nature

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Salinity Across Globe

Assessing Socio-Econmic Impect

Discovering Thoughts, Inventing Future

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Building on Sand! Can Environmentally Unfriendly (Economic) Development Sustains?

By Fesseha Mulu Gebremariam
Jimma University

Abstract- This paper aims to show the closer link exists between the natural environment and economic development. It argues environment is a foundation for economic development. It is obvious that nature provides us with natural resources by which we humans can satisfy our desires. But, the problem is, humans go beyond a limit, and intervene in nature. The concentration of carbon dioxide has increased since the pre-industrial era primarily due to the combustion of fossil fuels and deforestation. Environmental degradation and environmental change have, therefore, threatened people's health, physical security, material needs and social cohesion. Therefore, improper exploitation of natural resources and unlimited intervention in the natural environment jeopardizes the sustainability of any development.

Keywords: *economic development, environmental degradation, intervention, sustainability.*

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Building on Sand! Can Environmentally Unfriendly (Economic) Development Sustains?

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Abstract- This paper aims to show the closer link exists between the natural environment and economic development. It argues environment is a foundation for economic development. It is obvious that nature provides us with natural resources by which we humans can satisfy our desires. But, the problem is, humans go beyond a limit, and intervene in nature. The concentration of carbon dioxide has increased since the pre-industrial era primarily due to the combustion of fossil fuels and deforestation. Environmental degradation and environmental change have, therefore, threatened people's health, physical security, material needs and social cohesion. Therefore, improper exploitation of natural resources and unlimited intervention in the natural environment jeopardizes the sustainability of any development.

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I. INTRODUCTION

Naturally, humans are endowed with the capacity of mastering nature and its habitats, and nature supplies humans with resources by which they can satisfy their needs. But, irrational, egoistic and unlimited human interventions in to the natural environment results in disturbing nature and its order. In other words, unethical human interventions in to nature make nature a dangerous place to live in. And, this attracts attention from scholars, politicians and environmental activities. For instance, environmental activists and scholars such as Callicot (1994) and Leopold (1949) argue that the western environmental thinking which is anthropocentric mainly and largely responsible for the destruction of biodiversity and environmental degradation that the world is experiencing these days. For these scholars, the problem is deeply rooted in the Christian tradition. In other words, in Genesis 1:26-28 you may read the following verses:

> *Then God said, "Let us make mankind in our image, in our likeness, so that they may rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals, and over all the creatures that move along the ground…So God created mankind in his own image, in the image of God he created them; male and female he created them. God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish in the sea and the birds in the sky and over every living creature that moves on the ground.*

This indicates man has more value than other creatures in this world. In other words, man has more value than the other beings created by God. So, man is next to God in the hierarchy of values.

However, Leopold (1949), in his book entitled "A Sand County Almanac" argued that the ecosystem has intrinsic value. This is to note that "you can't exploit nature as you want." You can't advise humans not to use any resources from nature. But, the feasible thing is to use and exploit nature in a very sustainable way. In this way the idea of sustainable development comes in to fore. The World Commission on Environment in its Brudtl and Report (1987), defines sustainable development as follows:

Development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

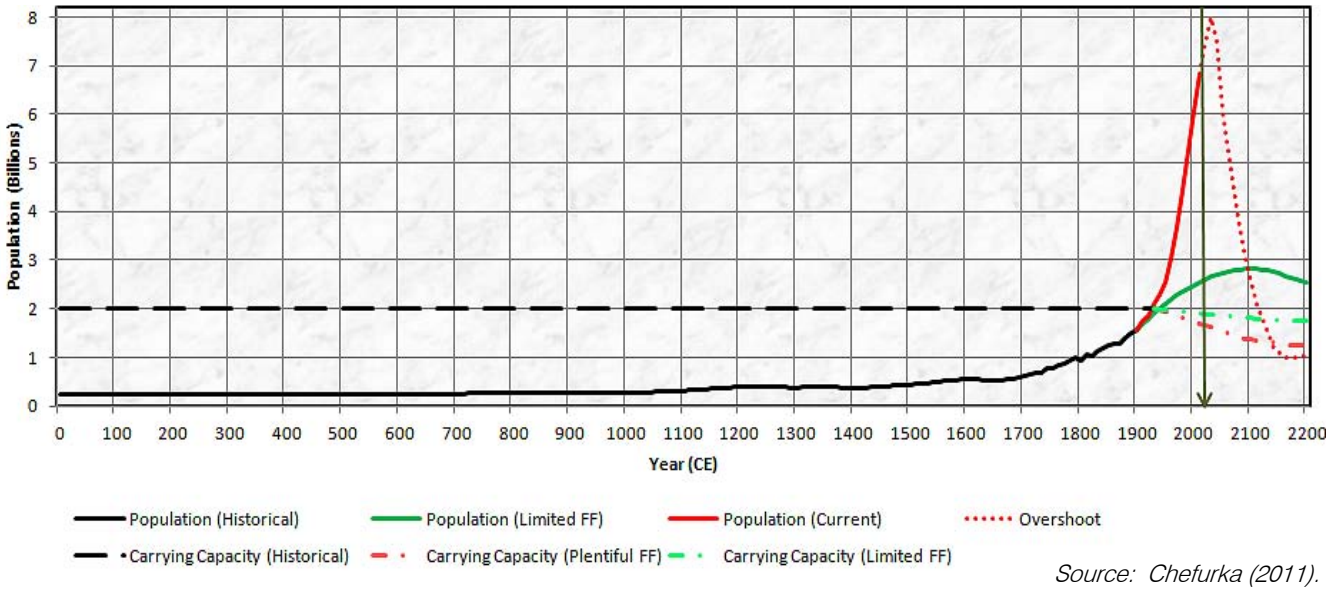
According to this report, although natural resources are means by which human beings fulfill their needs, there is a limit by which man can't go. In other words, every man has a certain responsibility towards nature in which his/ her activities shouldn't endanger the interest of future generation. This responsibility can be manifested by "not to endanger nature and not to disturb the natural order."

Besides, international environmental conferences such as the 1992 Johannesburg environmental summit, Rio 20+, the Kyoto protocol, the Copenhagen UN's environmental summits and The 2015 United Nations Climate Change Conference (COP 21 or CMP 11) held in Paris call every nation should bear the responsibility of protecting the natural environment. Part of this, Ethiopia launched green economy policy and climate Resilient Economic Growth in the year 2011 (Bass et al, 2013).

Above all, various studies show that the earth's carrying capacity decreases dramatically in the last 40 from 1961-2010 years (Steffan, 2005), and is expected to degrade significantly in the coming 500 years (Cohen, 1995). This is due to the increasing number of human population has directly affecting the carrying capacity of the earth (see the figure below).

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Source: Chefurka (2011).

Figure 1: Trend of population growth in relation to earth's carrying capacity

II. Understanding Sustainable Development

Before defining what sustainable development is, it is better to have a clear understanding of its constituting terms: So, what is development? What does it meant by sustainability?

There is no universally agreed and binding definition of development. Different organizations, international institutions and scholars have defined the term differently. For instance, Todaro & Smith (2012) stated that in strictly economic terms, traditionally, ''development meant achieving sustained rates of growth of income per capita to enable a nation to expand its output at a rate faster than the growth rate of its population.'' But this definition is too narrow and out dated.

While other scholars such as Sen (1999), argues that the "capability to function" is what it really matters for status of being poor or non-poor. For Sen, economic growth isn't an end in itself. Development has to be more concerned with enhancing the lives citizens lead and the amount of freedoms they enjoy. This is new trend and paradigm shift in the definition of development. Other international organizations such as UNDP define development as human development consists of education, health, and adjusted real income per capita as the component of indicators of development (Todaro & Smith, 2012).

But, whatever the debate is, there is one working definition at least most scholars agree, if not all. That is "Development is the process of improving the quality of all human lives and capabilities by raising people's levels of living, self-esteem, and freedom (Ibid: 775)."

If this is all about development, the next question is 'what does sustainable mean?' Unlike development, scholars agree on the meaning of the term 'sustainable.' According to Merriam-Webster dictionary (2017), the word 'sustainable' means 'to exist, to continue.' So, what is sustainable development? Despite various definitions are available regarding this term, United Nations World Commission on Environment and Development (1987), coined a definition of sustainable development which is probably the most known in all of sustainability literature. It defines the term as follows:

[Sustainable development] is development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.

Here sustainable mean development that continues for a long period of time. Behind this definition, there is one clear meaning. Any development, mainly economic development, continues/ or sustains so long as It wisely use natural resources at its hand. Unless otherwise, if you don't use your natural resources wisely, nature will stand against you-"ecological debt." In other words, these days it is common to see wild fire, desertification, raising sea level, melting of Arctic Snows, excessive flooding and so many natural calamities. These are the manifestations of unrestrained human intervention in to nature.

However, the 2002 Johannesburg Earth Summit on Sustainable Development incorporates three pillars/approaches to sustainability to the existing definition of sustainable development as part of further modification to the term (Holmberg, 2012). The pillars are:

a) Economic Approach

This approach to sustainability is supported by a group of 77 developing countries that the developed countries should invest in protection of the environment

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while the developing countries shall invest their capitals in some other areas other than protection of the environment. This is for the fact that developing countries can't afford the costs to protect the environment.

b) Environmental Approach

This approach calls for a strict and clear environmental rules that forced countries to protect the environment. Traditional approaches to development create problems to the natural environment. This position was propagated strongly by the European Union.

c) Social Justice Approach

According to this approach to sustainability, sustainable development is all about social justice and protection of the environment. It asserts ecological stability plays great role in overall human welfare. It calls for social stability, security and equality. This approach was propagated by Japan, Canada and Norway.

These three new elements of sustainability connote that the sustainability shall be in all aspect of life. Environmental sustainability is not enough in itself. Sustainability has to be holistic, all-encompassing and comprehensive. For the purpose of one, we shouldn't in danger the other. All these 3 pillars are interdependent one with the other, unless in the absence of one, we can't talk sustainability in its robust sense.

III. Environment-a Foundation for (Sustainable) Economic Development!

Before the *Brundtl and* Commission, "development" was clearly associated with industrialization, urbanization, and increase in per capita measured solely by economic terms (Todaro and Smith, 2012). In other words, environmental protection was perceived by many as an obstacle to development. However, World Commission on Environment and Development (1987), pinpointed that dichotomizing ''environment' from ''development" is wrong. Rather, these two terms are inseparable-two sides of the same coin. We can't think one without the other. Thus, a paradigm shift is made from the old dichotomy to "environment and development," and then to "environment for development, accordingly.

Though, past development discourses consider protecting environment as a hindrance to development, the reality is the opposite. A healthy environment helps development to sustain (Rahnema, 1997). Contrary to this claim, some argued that, naturally, development is destructive, violent and anti- nature (Shiva, 1991). In other words, development and nature are two opposite concepts. Meaning, if you develop, you go against nature; if you protect nature, you hinder development. So, how is it possible to sustain development while protecting nature?

The following Box clearly summarizes the relationship between environment and development. According to the Box, environment is the foundation for development. Any economic development is deeply rooted on the environment. The environment is the source of all the resources we need to satisfy our desires. But use wisely, and not by threatening nature.

Box 1. Environment as the foundation for development

Development is the process of furthering people's well-being. Good development entails:

- ✓ *increasing the asset base and its productivity;*
- ✓ *empowering poor people and marginalized communities;*
- ✓ *reducing and managing risks; and*
- ✓ *Taking a long-term perspective with regard to intra- and intergenerational equity.*

The environment is central to all four of these requirements. Long-term development can only be achieved through sustainable management of various assets: financial, material, human, social and natural. Natural assets, including water, soils, plants and animals, underpin the livelihoods of all people. Sustainable development provides a framework for managing human and economic development, while ensuring a proper and optimal functioning over time of the natural environment.

Sources: World Bank, (2006).

Besides, the MDG-7 calls to ensure environmental sustainability (UN, 2009). It suggests countries need to integrate environmental protection agenda in to their policies and programs. It noted the way we are acting, the way we are exploiting nature is not right unless it is too threatening to sustain the stability, biodiversity, health and productivity of the ecosystems.

IV. Economic Growth and Protecting the Environment: Two at Once- A Contradiction?

''There is tradeoff between economic growth and environment due to the desire to high growth and excessive use of resources that cause environmental pollution (Haq, 1999). In other words, the income and consumption level of the poor is directly proportional to level of environmental degradation (Mensah & Castero, 2004). Poor countries are technologically backward. They need a lot of natural resources to secure certain economic growth. This would results in environmental degradation (Awan, 2013).

The existing global system makes life difficult to the Least Developed Countries (LDCs). In this regards, Awan (2013) and Haq (1999), claims that the so called economically advanced nations which develop at the expense of the Least Developing Countries (LDCs) shall

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protect the environment. This position is similar to the economic approach of the Johannesburg 2002 summit. This duty can be demonstrated in different ways. Among others: inventing new environmentally friendly technologies and transferring to the 3rd world countries (Awan, 2013); and, a paradigm shift in the notion of development is needed-'the current quantity of growth should be replaced by quality' (Haq, 1999). These are among the mechanisms by which environment can be protected without jeopardizing economic development.

V. Conclusion and Recommendations

There is close and direct link between the natural environment and sustainable (economic) development. Climate change, global warming, greenhouse effect, drought, poverty, conflicts, flooding, wild fire and so on are some of the hazards results from irresponsible and egoistic human intervention and exploitation of the natural environment which disrupts its natural order and ecosystem. These environmentally linked problems are increasingly affecting the planet and its inhabitants. Thus, governments, policy makers, environmental activists and any other concerned bodies shall take actions before the worst day comes. We shall build green economy and invent ecofriendly technologies unless the planet would pay us equivalent what we are doing against it (-ecological debt).

Green Energy in the Blue World!!!!!!

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"The environment is where we live; and development is what we all do in attempting toimprove our lot within that abode. The two are inseparable." World Commission on Environment (WCED, 1987).

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Wild Mountain Ungulates of Rakchham-Chhitkul Wildlife Sanctuary in Trans-Himalayan Baspa (Sangla) Valley, District Kinnaur, Himachal Pradesh, India

By Rakesh Kumar Negi
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Abstract- Biodiversity is the essence and manifestation of evolutionary history of life on earth and species is the most conspicous form of the biodiversity. Ungulates are the hoofed mammalian species of vertebrates. Exploration of Rakchham- Chhitkul Wildlife Sanctuary present in the Baspa (Sangla) valley, district Kinnaur in Himachal Pradesh, India revealed the presence of three species of wild ungulates, belonging to three genera and two Families Moschidae and Bovidae of Order Artiodactyla. It was further observed that no wild member of Order Perissodactyla was present in the study area. It was found that the Bharal or Blue Sheep is the most populous ungulate in the sanctuary area.

Keywords: *biodiversity, ungulates, trans-himalaya, musk deer.*

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Rakesh Kumar Negi

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Keywords: biodiversity, ungulates, trans-himalaya, musk deer.

I. Introduction

Himalaya the youngest mountain systems in the world had originated as a result of tectonic movements of the continental plates and are believed to be still growing. The formation of Himalayas resulted in new barriers and corridors, which influenced the dispersal of flora and fauna. Being the meeting point of two biogeographic realms, viz., the Oriental and Palaeartic (Mani, 1974) it provides various habitat that harbours certain unique and endemic taxa thus being designated as a global biodiversity hotspot (Mittermier *et al.*, 2004). The Trans-Himalaya landscape is a high elevation land lying north of the Greater Himalayan range characterized by extreme cold, low precipitation and rugged terrain of mountains. The global mammalian fauna is represented by 5416 species belonging to 154 families and 29 orders (Wilson and Reeder, 2005). Of these, 428 species i.e., 7.81% of the global mammalian species are reported from India, representing 48 families and 14 orders (Sharma *et al.,* 2014). The Indian Himalaya harbours about 291 species belonging to 39 families and 13 orders in which the Trans-Himalayas contributes 40 species (Sharma *et al.*, 2015 [A]). Himachal Pradesh despite being a smaller state with only 1.7% of total geographical area of the country, contributes 27% of mammalian species with 107 species belonging to 77 genera, 25 families and 9 orders (Chakraborty *et al.,* 2005). A total of 21 species of mammals from Himachal Pradesh figure in Schedule I of the Indian Wildlife (Protection) Act, 1972. An updated information on mammalian fauna of Himachal Pradesh reports the presence of 111 species (Sharma and Saikia, 2009). The Ungulates which means having hooves, is a group of mammals in which the terminal phalanx is encased in a sturdy hoof and includes the mammals of order Perissodactyla and Artiodactyla. Majority of large herbivores on this planet are ungulates. With the exception of Antartica, they are found in nearly all biomes and zoogeographical regions. There are about 257 species belonging to 95 genera of ungulates worldwide, while India is home to 41 species belonging to 28 genera (Sharma *et al.*, 2015[B]). Ungulates form major component of the Himalayan mammalian fauna. In total, 19 ungulates species belonging to four families viz. Mocshidae, Cervidae, Bovidae and Equidae inhabit the Himalayas (Bhatnagar, 1993). They form the major prey base for the large carnivores of the area like snow leopard and Himalayan black bear. In Himachal Pradesh, nine species of ungulates are present. They are goral, Himalayan musk deer, Himalayan tahr, barking deer, wild boar, sambhar, serow, Himalayan ibex, and blue sheep or bharal (Vinod, T.R. and S. Sathyakumar, 1999)

a) Study Area

Present study has been conducted in Rakchham- Chhitkul Wildlife Sanctuary located in the Baspa (Sangla) valley with geo-coordinates of latitude $31^0$14'22" N - $31^0$28'37"N and longitudes $78^0$17'31"E - 78^0 31'30"E covering an area of about 304 Km^2 in the northeast corner of Kinnaur, a tribal district in Himachal Pradesh, India (Fig. 1). The Baspa River is the main river of the valley and accordingly the entire valley is also known as Baspa Valley which is characterized by mountains covered with perpetual snow cover (Deota et al., 2011). These rugged, precipitous peaks represent two of the world's greatest mountain ranges namely Great Himalayan range and Dhauladhar ranges on the right and left bank of Baspa river respectively. The altitude of Baspa valley ranges from 2,800 masl to 5,486 masl. The temperature varying from -15°C to 18°C, mean rainfall 463 mm and annual snowfall 1,130 mm.

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The ecological characteristics changes very sharply in the mountains due to steep gradient. Thus there is a great variation in climatic conditions in the valley. The parts of the sanctuary up to altitude 3,400 m get good precipitation in the form of rain or snow but beyond that the precipitation is scanty and mainly in the form of snow (Negi and Banyal 2015). The forest type of this sanctuary includes Lower Western Himalayan Temperate Forest, Upper Western Himalayan Temperate Forest and Sub-Alpine Birch-Fir Forest.

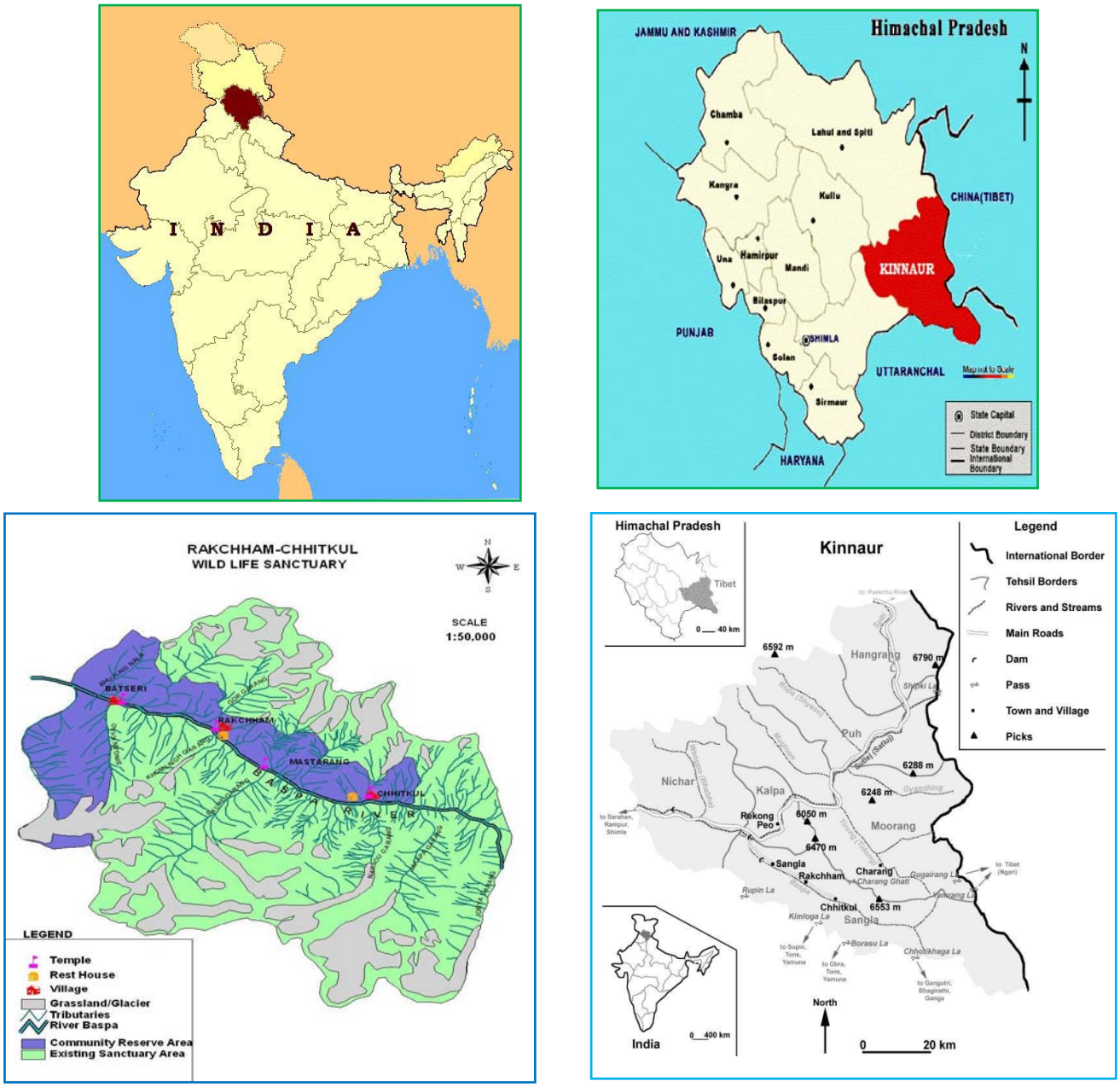


Figure 1: Map of Baspa valley, the study area in District Kinnaur, Himachal Pradesh, India (Source: mapsofindia.com and diagrammatic map of Baspa Valley).

The vertebrates of Himalayas in general and ungulates in particular has engaged the attention of many distinguished investigators since long, who have conducted studies on various aspects of ungulates in different parts of the Himalaya including Himachal Pradesh (Jerdon 1867, Blanford 1888-1891, Pocock 1907, Wynter-Blyth 1951, Schaller 1977, Prater 1980, Gaston et al., 1981, Tak and Kumar 1987, Rodgers and Panwar 1988, Negi 1992, Cavallini 1992, Gaston and Garson 1992, Bhatnagar 1993, Chudawat 1994, Bhatnagar 1997, Manjrekar 1997, Alfred et.al.,2002, Chakraborty *et al.* 2005, Namgail T. 2006, Sharma and Saikia, 2009, Sharma and Saikia 2013). However, the present study area of Rakchham-Chhitkul wildlife sanctuary has received very little attention of the investigators due to severe cold climate, and inaccessible habitat. Only a few studies have been conducted on diversity and ecology of vertebrates of

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this sanctuary area (Wynter-Blyth, 1948; Narang, 1989; Negi and Banyal, 2015 A&B, Negi and Banyal, 2016 A&B and Negi and Banyal, 2017). The present study is the first of its kind and will act as baseline literature for further studies on the biodiversity of thus far neglected area.

II. Methodology

a) Stratification of the Study Area

The study area is present at the cusp of Great Himalayan and Trans Himalayan range thus presenting vast altitudinal, geological and ecological gradient. Apart from the altitude, there are major environmental differences present between the north-facing slopes and the south-facing slopes corresponding respectively with the left bank and the right bank of the Baspa River. The study area was divided in to three altitudinal zones viz., Zone-I: The area from Sangla to Kharogla (2700 to 3000 m) which support the forests of lower level fir like Tosh, Zone-II: The area from Rakchham to Mastarang (3050 to 3300 m) supporting the forests of Deodar and Blue pine and Zone-III: Area from Chhitkul to Dumti (3450 to 4200 m) supporting the tracts of blue pine, birch & rhododendron forests, and alpine meadows. Some areas which are traditionally famous for the presence musk deer like Brennalo in the forest of Chhitkul meaning Nullah or vale of Musk deers were especially earmarked.

b) Collection of Data

The data was collected by using a combination of direct and indirect methods. The direct methods utilized sighting of animals as the main data whereas indirect methods relied on quantification of indirect evidences such as pellet groups, scats, and hoof marks in a predetermined sampling unit. The direct evidences were made by using line transects method (Burnham *et al.*, 1980). The entire procedure of line transect sampling was performed by walking on local footpaths due to difficult terrain of the study area. The footpaths were monitored in morning and evening hours which generally coincide with maximum activity period of animals.

III. Results & Discussion

Present study revealed the presence of 3 species of wild ungulates, belonging to three genera and two Families Moschidae and Bovidae of Order Artiodactyla. It was further observed that no wild member of Order Perissodactyla was present in the study area.

Table 1: Systematic list of wild Ungulates observed in Rakchham-Chhitkul Wildlife Sanctuary, Baspa (Sangla) Valley, District Kinnaur, Himachal Pradesh (India).

Order: Artiodactyla Owen, 1848 Family: Moschidae Gray, 1821						
S. No.	Common Name	Scientific Name	IUCN REDLIST CATEGORY	IW(P)A SCHEDULE	CITES APPENDIX	Zone of Presence
1	Musk Deer	*Moschus chrysogaster* Hodgson, 1839	EN	I	I	II,III
Family: Bovidae Gray, 1821						
2	Himalayan Goral	*Naemorhedus goral* Hardwicke, 1825	NT	III		I
3	Bharal	*Pseudois nayaur* Hodgson, 1833	LC	I	I	II,III

Abbreviations

IUCN: International Union for Conservation of Nature and Natural Resources; **EN**: Endangered; **VU**: Vulnerable; **NT**: Near Threatened; **LC**: Least Concern; **IW (P)A**: Indian Wildlife (Protection) Act, 1972. **CITES**: Convention on International Trade in Endangered Species of Wild Fauna and Flora

The Musk Deer is an elusive animal having long, coarse and brittle hair. It is without any horn and facial glands, the structures present in all deers and instead possess a gall bladder which is absent in all other deers. In addition to this they also possess a caudal gland and a musk gland. The canines in male are 2-3 inches long, projecting out of the mouth. It is very active and progresses by series of leaps. During present study this species has been recorded in zone II as resident and rare species although it is present in zone III as well. The species was mainly recorded from higher reaches of the sanctuary mainly on the left bank of river Baspa though in Zone II i.e upto Mastarang it is present on right bank of the river as well. The present study supports the solitary nature of Himalayan Musk deer as shown by Green (1985). Similarly the traditionally famous area of Brennalo in the forests of Chhitkul was actually found to harbour the species. The reason for this could be attributed to the fact that this particular area is rich in *Rhododendron campanulatum* that provide perfect hide

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and food to this animal. The direct sighting of the species was recorded twice, but indirect evidences were recorded on every visit to this earmarked area. The species is declared as Endangered (EN) by the IUCN, listed in Appendix I in CITES and placed under Schedule I in Indian Wildlife (Protection) Act, 1972.

The Himalayan Goral is a stout and slender goat-like animal having small, irregularly curved, pointed horns in both sexes, body colour is grey suffused with black. The throat patch, chin, upper lips and jaw underside are white. A dark stripe extends down the spine and onto the forelegs. During present study this species has been recorded in zone I as resident with local migration and a common species. The Himalayan Goral was restricted to the lower altitudinal areas of the sanctuary. They were reported from the both banks of the Baspa River. It is placed in Schedule-III of the Indian Wildlife (Protection) Act, 1972 and declared Near Threatened by IUCN.

The blue sheep or Bharal is a unique mountain ungulate that displays the characteristics of both sheep and goat. The colour of coat is of slaty-blue which becomes red-brown in summer and more distinctly slaty grey in winter. The colour blends perfectly with the blue shale and rock of the open hill-sides. The body is sturdy, tail is short with black tip. Back of legs and underparts are white. The large rounded, smooth horns with fine striation, line of growth, are directed up and sideward in males while in females shorter, straighter. Many sheep like characters shown by this wild goat is the result of convergent evolution as the species has settled in a habitat which is usually occupied by sheep (Schaller 1977). Being intermediate between the sheep and goat they graze like sheep and climb to high and inaccessible cliffs like goats. These are the animals of high altitude which can ascend to 5000m during summers and rarely below 3600 m in the winters. They are found between tree line and snow line where plenty of grass and shrub is available for feeding. During present study this species has been recorded from zone II and III as resident with local migration and a common species. This species was mainly recorded from the alpine reaches in the areas of village Chhitkul right from the Mustarang area to Dumti area, during spring to autumn and they probably migrate to Uttrakhand side during the winters. As opposed to Musk deer which prefers thickly forested areas, the blue sheep prefers the more open, barren and rocky areas. It appears that these are the most populous among the species of large mammals found in this sanctuary area. They are the main prey species of the Snow Leopard and other predators. It is declared as Least Concern (LC) by the IUCN, listed in Appendix I in CITES and placed under Schedule I in Indian Wildlife (Protection) Act, 1972.

The study area has of late witnessed various anthropogenic development activities like tourism, road construction and hydroelectric projects. These will have a synergistic effect on many extinction drivers, such as habitat fragmentation and degradation, diseases and climate change. Further the local people traditionally hunted these wild animals for meat, skin and horns. The musk deer is hunted specifically for its musk because of high price of the musk in international market. Many local people in the area have access to guns and unfortunately the existing regulations to ban the hunting are seldom enforced. Further many outsiders acquire the permission from Government, to extract the medicinal herbs and plants from the sanctuary area, in the garb of which they actively albeit secretly engage their labourer into hunting of the wild animals of this area. All these anthropogenic activities are going to be detrimental to the wild life of this area and these activities are already beginning to show its baleful effect on the total biodiversity including the ungulates. Presence of these unique and endangered species of ungulates in the present study area accentuates the conservation importance of this sanctuary.

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Assessing Socio-Economic Impact of Rural- Urban Migration in Sodo Town, SNNPR Ethiopia

By Mefekir Woldegebriel

Abstract- This research deals with the socio economics impact of rural-urban migration in case of Sodo town. Rural-urban migration is part of worldwide process of migration which drawn from the rural agricultural sectors to provide need of man power for the urban industrial sector where productivity is increasing as a result of capital accumulation and technological advancement. The main objective of the research is to assess the socio-economic impacts of rural urban migration, assessing the origin of majority of migrants, assessing the origin of majority of migrants, identifying dominant migratory groups on the basis of age, sex, marital status the like socio-economic characteristics and to provide possible recommendation based on the findings. While preparing this paper, 56 respondents were used as sample size in the questionnaires and interview from governmental, nongovernmental organizations and migrants. The primary and secondary data were used. The methodologies that were used to analyze the data in his paper were mainly qualitative one. However, to some extent, the quantitative approach was also applied, simple statistical techniques, percentage values, tabular representation and descriptive statements were used to analyze and interpret the collected data.

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Assessing Socio-Economic Impact of Rural-Urban Migration in Sodo Town, SNNPR Ethiopia

Mefekir Woldegebriel

*Abstract-*This research deals with the socio economics impact of rural-urban migration in case of Sodo town. Rural-urban migration is part of worldwide process of migration which drawn from the rural agricultural sectors to provide need of man power for the urban industrial sector where productivity is increasing as a result of capital accumulation and technological advancement. The main objective of the research is to assess the socio-economic impacts of rural urban migration, assessing the origin of majority of migrants, assessing the origin of majority of migrants, identifying dominant migratory groups on the basis of age, sex, marital status the like socio-economic characteristics and to provide possible recommendation based on the findings. While preparing this paper, 56 respondents were used as sample size in the questionnaires and interview from governmental, nongovernmental organizations and migrants. The primary and secondary data were used. The methodologies that were used to analyze the data in his paper were mainly qualitative one. However, to some extent, the quantitative approach was also applied, simple statistical techniques, percentage values, tabular representation and descriptive statements were used to analyze and interpret the collected data. The findings shows that rural urban migration is have adverse effects on rural as well as urban socio-economic conditions, therefore, the government and the responsible bodies should have to focus at reducing the consequence of migration in Sodo town.

Chapter One

I. Introduction

a) Background of the study

Migration is a form of geographical mobility between one geographical units (origin) to a certain destination generally involving a change of residence from a place to the place of arrival (destination). It involves a permanent or temporary change of residence from one neighborhood settlement (Administrative Unit); this process is also out migration. Moving to a particular location is defined as immigration (Kebede, 1994).

In the past years rural to urban migration in developed countries grew during the time of industrialization, when more mechanized farming needed few agricultural workers in the rural area and when there was demand for labor in urban based industries. But this is not always the case in developing countries are more a function of rural problems than the urban attractions (Kenfe, 2001:46).

Like other developing countries of the world, our country Ethiopia, the process of migration is not a new phenomenon. The various population induced by trade, slave trade, national disaster, war- fare, famine and etc are mark the history of the country. The country has been undergoing rapid urbanization particularly during the past four-five year (Kebede, 1994:34) As different studies show migration related impacts are more serious in our country, more specifically,

Sodo town, a place where this issue is very common led to a number of socio economic impacts in the community. Therefore, this study focuses on assessing the issue of rural to urban migration in sodo town.

b) Statement of the problem

In Ethiopia like other less developed countries large numbers of people continuously migrate to urban centers. This is because of the pushing rural problem and pulling urban attractions respectively, the major rural problems are poor employment, natural disaster, harsh climate, law wages, political instability and housing shortage and etc, on the other hand urban pulling factors such as political stability, improved housing, high living standard, high wages, employment opportunity, favorable climate, fair services and etc that attracts people towards urban areas (Nigatu, 2004:125). The problem of migration in developing countries in now a boutduntly clear because the rate of rural to urban migration continue to exceed the rate of job creation and the absorption capacity of both industry and urban social service (Todaro, 1969:334).

Migration to cities and towns accelerates existing problems adding to urban un employment, increasing pressure on housing resources, traffic congestions social and psychological stresses amongst the urban population and poverty is wide spread and expanded in cities and towns of Ethiopia (Birru, 2004:125).

In Wolaita Zone there are four ten wored as and three city administration. Sodo town is administrative and trading center it is located at the center of roads to and seven entering gate. This geographical location of the town and other facilities has been encouraging a number or rural to urban migration searching for better

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employment, public service and better living conditions (Nigatu: 2004)

A number of migrants have been migrated to Sodo town from sodozuriaworeda, Damote Gale worda, Demote weydeworda, Areake town, Boditi town Humboworda, Damote sore worda, off aworda, kendo dedayeworda, Bolso sore worda, Bolosobonbeworda, Damotepulase kendo koyesheworda, Duguenefange and Dawero zone and Gamogofa zone etc. This numbers of Migrants have been observed creating a number of challenges such as over population un employment, hissing problems, congestion in social services, health problems, drug abuse, expansion of different criminal activities and etc (Nigatu, 2004).

Some studies have been conducted regarding socio economic impacts of rural –urban migration in the town. However, it could not bring remarkable solution to problems in the town and unable to give fair enough information to local areas people, administrative bodies and nongovernmental organizations, therefore a student researcher tried to fulfill the gaps that was observed in the previous studies and attempted to provide a solution to the problems for the concerned bodies.

c) Objectives of the study

i. *General objective*

The general objectives of this study are assessing the socio economic impacts of the rural-urban migration in Sodo town, in Wolaita Zone, SNNPR, Ethiopia.

ii. *Specific objectives*

The specific objectives of this study are to:-

- To identify the major socio economic impacts of rural to urban migration in the destination area.
- To identify the dominant migratory groups on the basis of age, sex, educational standards, marital status and other socio economic characters of the migrants
- To provide possible recommendations based on the findings

d) Research questions

This study tried to answer the following questions:-

1. What are the major socio economic impacts of rural to urban migration in the town?
2. Who are the dominant migratory groups on the basis of age sex, educational standards, marital status and other socio economic characteristic of the migrants?
3. What are the possible recommendations about the study?

e) Significance of the study

Conducting of the research on socio economic impacts of rural to urban migration has the following importance

- It addresses problems which are caused by rural to urban migration in the town.
- It provides reliable evidence and information for various concerned bodies
- It serves as a reference for researchers as steeping stone and become source for further studies.

f) Scope Delimitations of the study

This study is delimited in Wolaita zone, Sodo town. The paper focused on dealing the socio economic impacts of rural- urban migration in the study area.

g) Limitation of the study

While conducting this research the researcher encountered short coming such as:-

- Unwillingness of some respondents to give full information the researcher need to ask and lack of data he researcher needs to ask.
- Budge constant
- In adequate internet and computer service
- Lack of financial time and material insufficiency

h) Organization of the study

This paper is organization in to six chapters. The first chapter contained background of the study, statement of the problem, objective of the study, general objectives, specific objectives, basic research questions, significance of the study, scope of the study, limitation of the study and organization of the paper. The second chapter consists of review related literature. The third chapter is the research methodology. The fourth chapter contains description of the study area. The fifth chapter is contained results, discussion, analysis and interpretation of data. Finally the six chapter contained summary, concludes and recommendation the overall process of research.

Chapter Two

II. Review of Related Literature

a) Definition and concepts of migration

Migration is difficult to define, but it involves a permanent or quasi-permanent change in residence of twelve months or more. Different scholars and disciplines define migration differently. According to the United Nations multilingual demographic dictionary, migration is a form of geographical mobility between one spatial origin and another, generally involving a change of residence from place of origin to the place of destination (Abuzar, 2001).

According to Befkadu and Berhanu (2000), Migration is the movement of people in space often involving a change in the place of residence. For John R. (2003) Migration is defined as any permanent changes in residence. It involves the detachment from organization of activities at one place and the movement of the total round activities to others. Thus most aspect of migration is that it is spatial by definition. Most

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demographers argue that migration must involve an essential permanent territorial shift in residence to be distinguished from mobility, hence travelers and commuters are excluded from migration. To joy a movement migration, it should to have involve permanent change in place of residence, Demographers luck single operational definitions for migration because it occurs under different conditions. However, although heterogeneous factors make a universal definition in possible in general migration is in which an individual {group of people} shift their residence from one place to other. Migration can be personal who move to another area city or town with in a nation, job seeker who move to another country (region) for better economic opportunities (Kebede, 1994), A part from its spatial context migration also implies the disruption of work, schooling social life and another socio-economic condition

Migration can also be defined as a movement of people in or migration adds to (subtract from) areas on population depending on whether there is little or natural increase from the excess of birth over death (Nigatu, 2004: 124).

b) Types of Migration

In broadly speaking there are two types of migration based on the area od space affected by migratory movement. These are internal and international migration

i. *Internal migration*

Internal migration is the movement of people within the territorial jurisdiction of sovereign countries. It is also referred to as domestic or local migration. They have four types of internal migration can be identified rural- urban migration, rural migration, urban-urban migration and urban –rural migration.

The rural-urban migration is urban ward population movement from rural areas or country side caused by rural push factors and urban pull factors. This is the main features of LDCS. High rural population density aggravated by growing poverty is the main push factors the compels rural population to leave their place of origin such rural areas suffer from horrifying poverty, un employment, law and uncertain wages, land shortages and land lessens and poor facilities for educators health, recreation and other service are also equally important push factors. By compares, the pull of the urban area may include better employment opportunities: regular and higher wages, fixed working hours, better amenities of living, facilities for education and socio cultural activates, But the growing movement of people from rural to urban areas has resulted in rapid rate of urbanization and rural de- population.

ii. *International Migration*

International migration is a kind of human movement across the international boundary nations. It may take, the form of international or intra continental; it could happen voluntarily or compellation. It occurs in response to an equal distribution of human and physical resources. The most important of international migration in terms of volume and frequency of movement of people was the Trans- Atlantic European movements. This happened between 17 to mid 20th century.

The second wave of Trans – Atlantic European movement was directed to the temperate. Grass lands of America, South Africa. Australia and New Zealand. This last one was the biggest human movement in history that involved about one fifth of Europeans total population.

When migrant cross an international boundary the movement is called international migration. However, if the movement is within a national territory, it is referred to as internal migration. A movement in which migrant arrives at the last destination after a series of short term moves to other location is refers to step migration. When people move out with the intention of returning back to their place of origin after a few months or season or more, this Movements is called seasonal migration seasonal migration takes places commonly in rural Ethiopia.

During peak and slack seasons of agricultural labor migration can take the form of refuge migration, when people move for political reasons, war, ethic confects and discrimination or religious persecution or evacuees like earth quake, volcanic eruption, flooding drought etc and resettlement migration, when people are displaced by wars, natural climates etc are moved by governmental to new location generally, given assistance in order to establish themselves there in.

c) The causes of Migration

The researcher have shown that it is usually is not just one factors, but combination of factors have led people to move from their areas of origin to other destination, in the case of rural- urban migration, some of the key factors some migration literatures showed that because of poverty millions of people are driven from their home land to other destinations (De BLIJ, 1996).

In Ethiopia in particular, due to both economic and non economic reasons, many people are forced to migrate from are place to another, for example, from the economic factors, un pleasantly and intolerable living and working conditions and problems like population pressure, scarcity of farm land, environmental degradation and declining productivity and overall economic deterioration forced a number of people to migrate from rural to urban area in search of employment, better job opportunities and better living conditions (Assefa, 1999).

Concerning the economic factors 'Todaro's expected income' Model of migration worth mentioning here. In his most pronounced economic theory of migration, Todaro 91969, 1976) attempted to explain the

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behavior of rural to urban migration in terms of the income differentiation and the migrants expectation of obtaining an urban job in the urban formal sectors.
Todaro's Migration Model has four characteristics

1. The fact that migration is stimulated primarily by rational economic conditions of relative benefits and costs mostly financial but also psychological.
2. the decision to migrate depends on expected rather that actual urban rural wage differentials
3. The probability obtaining of an urban job is inversely related the urban un employment rate
4. Migration rate in excess of job opportunity growth rate are not only possible but also rational and even likely in the face of wide urban rural expected income differential high rate of un employment are, therefore, inevitable outcomes of the serous imbalances of economic opportunities between urban rural area of the most under developed countries (Todaro, 1969: 1976).

d) The impacts of Migrations

The impact of Migration is complex, depending on the types of migration involved. Generally, Migrants affect not only the economic and social environment of both origin and distention areas in any types of migrations but also their own living and working conditions as well (Barrett, 1992: 152).

e) The consequences of Migration

It has widely been recognized that migration that affects the area of out –migration, area of in – migration movements are the expression of reallocation of human resources and physical resources in both areas (Chandana, 1999)

An increase in migration to an area increases the density of population of that area. These increases the areas burden up on its resources or may force the society to exploit its resource more than the usual it used to. The rural 0migraants moving to the new industrial towns suffer from lack of open space and relatively new dietary habits.

Whenever migrants arrive in groups they also bring their cultures that would result intermediary of cultures. Sometimes, the physical contact of the people belonging to different racial group /families may exchange genetically traits.

Chapter Three

III. Materials and Methods

a) Research Design

The study researcher utilized mixed approach i.e. qualitative and quantitative approach. This is because to find out how people feel about socio economic impacts of rural to urban migration in the town qualitative approach was used where as to express the problems in terms of quantity and measurements quantitative approach is used.

b) Sampling techniques and sample size

Regarding the sampling techniques the study researcher used purposive sampling and simple random sampling techniques. Purposive sampling is used for those informants from governmental and non – governmental organizations because their opinion is relevant to the problem under study. Simple random sampling techniques were employed for migrant respondents. This was used because they are key informants and potential sources of information in general and the problem in particular.

According to 2007 E.C population census the total population of Sodo town was 102,922. Out of these 54,315 were males and 48,607 were females. To male the study easier the student researcher collected information from 56 respondents. From the whole respondents 30 males and 36 females were selected for interview and questionnaire.

c) Types and sources of data

The researcher used both primary and secondary sources to achieve the objectives of the study. The primary sources include governmental official, non-governmental organization workers and key informants Secondary sources were published and unpublished materials and internet.

d) Methods of data collection

To obtain sufficient information, the primary data sources were collected from government official and non-government organization workers through questionnaire and from migrant respondents by interview. The secondary data and un published materials.

i. *Questionnaire*

The study researcher prepared questionnaires for three governmental and three non-governmental employees prepared list of questions were distributed for the samples and they responded based on the instructions.

ii. *Interview*

An interview was held as a method of data collection to obtain valuable information from the selected fifty migrant respondents to get information about the problem under study.

e) Data collection procedure

Data was collected through the following stages first questionnaire and interview were prepared in English language and translated tow olay it a to (local language) because all respondents can speak and write the language.

f) Method of data analysis

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The data collected through questionnaire and interview was analyzed and interpreted by using both qualitative and quantitative method of data analysis.

g) Ethical consideration

There was some process before conducting the study in the area. Issues such As letter from the department to the concerned bodies, respondents feeling and characteristics and other main issues were considered to get full and genuine information from the respondents and different stakeholders. Besides the ethical consideration,

The student researcher would use clear words during the preparation of questionnaire and interview.

Chapter Four

IV. Description of the Study Area

a) Physical characteristics

The foundation of the town was back the period of Menlik II search palace for his military station .The name sodo town was founding during the time of emperor Menlik II in 1910 by the name of sodo nation (people) which live in SNNPR In sodo town. After the foundation the town, Sodo town municpale bureau was established. The fast growing of the town see after 2008 Ethiopia millennium such as Hospitals, stadium of sport, hotels, youth centres, water supply services are among the biggest. The study was conducted in sodo town, which is located in geographically in southern nations, nationalities and peoples region (SNNPR) part of wolaita zone which is about 383 km away from Addis Ababa the capital city of Ethiopia in south, 156 km from the capital city of SNNPR Hawassa in The town is located 37^0 20'-38^0 0 latitudes and 6^0 20' -$7^0$20' longitude east in terms of Astronomical /absolute location. (Sodo Town municipal office 2016)

b) Area of the study

The town wolaitasodo has 37 square kilometer wide and high road way passing through the town has seven gate way Five major transport routes connect Sodo with the neighboring zones and regions. These are Alaba- Shashemene (via- Boditi), Hossaina- Butajira-Addis Ababa (via-Areka), Waka-Taracha- Jima-MizanAman and Bonga (via- Bele), Arbaminch-Jinka (via- Tebela) and Goffa Sawula (via-Gesuba).

c) Socio-economic condition

In the last five years, the socio-economic development of the town was hopeful for the development of the town. The education sector boosted to 15 kindergartens, 17 primary Schools, 2 secondary schools, one agricultural college, one technical and vocational Education training college, one government university (Wolaita Sodo University) and 4Private established colleges. Health institutions in the town include one private referral Hospital, one government hospital, 3 public health centers and many more private clinics and pharmacies .The town also has 7 private, 3 governmental banks. Because of its Centrality, the town has many formal and informal trade activities. According to a survey Conducted by Sodo town trade and industry office, there are 3,000 registered business Activities and about 2,000 operators engaged in informal sector. There are 715 service Providing, 1016 retailer, 129 light industries of manufacturing, 153 whole sales, 150Transport sector and 30 urban agriculture businesses are operating in the town (STA, 2011)

d) Climatic Condition of the study area

The study area has characterized by different land forms like plain lands, plateau, gorges and rugged train system. The highest and the lowest altitude of the town from 166600-1900 meter above sea level average altitude of the town is1800 meter above sea level. The mean annual temperature and rain fall of is maximum 29^0 C, minimum 15^0 C and 1250 mm respectively. The temperature varies in summer; the town experiences sub humid type of climate gets rainfall twice in a year. It falls during "Belg" and "Kiremt" mostly the first falls from Megabit to Mid-may and the next comes from June to the end of September .Due to the town location in the up and down, and there is weather condition varying from day to night (Tamirate, 2008).

Sodo town is part of south western high lands. The town is established at the foot of mount *Damota*, 2,200 meters above sea level and from this mountain, its altitude descends to all directions. The topographic feature of Sodo town contains plain lands, plateaus, gorges, and rugged terrain system. The relief of the town is mainly characterized by gorges and plain lands especially towards southern direction. The western, eastern, and north eastern parts of the town have undulating topography affecting the flow directions of surface and ground water. The sloppy nature of the town also aggravates erosion of surface soil (Solomon 2009).

e) Demographic and socio economic characteristics

According to the result of housing and population census May, 2007 sodo town has population of 102,922, out of this 54,315 males and 48,617 females with the annual population growth rate about 5.3%

f) Administrative Structure of the Town

Wolaita Sodo is the capital town of Wolaita Zone as well as Sodo Zuria Woreda. In its administration jurisdiction, the town is divided into three-sub-towns (*Arada, Mehal and Merkato*) with 11 *kebeles* these three sub-towns are the lower and autonomous Administrative units and have full time workers. With regard to their location, *Arada*sub town is located in between two deep valleys of Basher and other small rivers. Generally, it is located at the western part of the town. *Merkato*sub-town is bordered by Addis Ababa-Arbaminch road at the

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west and extended towards east. As the name indicates *Mehal* subtownis located in between two sub-cities (*Arada and Merkato*). Most of the public services and administrative buildings are found in *Mehal*sub-city (Tamirat, 2008).

The town was serving as a center for Soddo Zuriaworeda under the administrative structure of previous Semen Omo zone until 2000. Since 2000, Sodo town became the capital of Wolaita administrative zone. This status of the town is believed to exert considerable impact on the concentration and growth of population. Because, several Offices and departments that have not been existed before the new administrative structure were established and resulted in high inflow of civil servants to the town (Habitamu, 2013).

g) The land use

The total amount of land use of the town is 37 square kilometers, the current existing urban boundary of the town is about 1,333.09 hectors out of which about 70% is found to be already built up and the remaining 29.25% non-built up area .Concerning the land use pattern most of the land used for residential purpose, the rest of the land used for commercial and industrial purpose. The central part of the town has good road accessibility and used for commercial and industrial purpose and the peripheral area is reserved for industrial purpose, where they are few plastic, floor factors and of gas oil reserved is found (Habtamu, 2013).

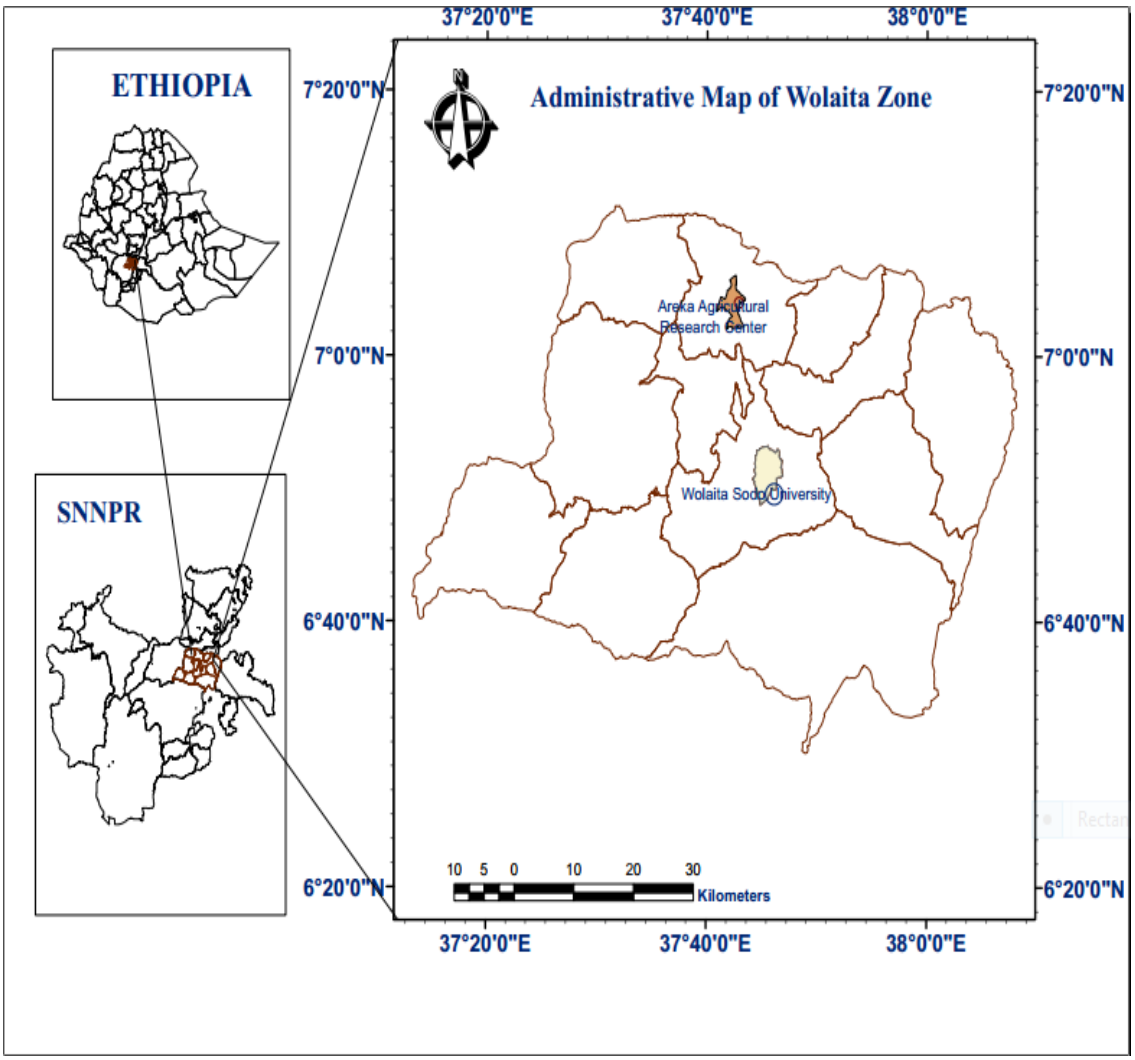


Figure 1: Study area map

Chapter Five

V. Result and Discussion

The researcher analyzed the already collected data and showed in the following three major parts, namely, the demographic characteristics of migrants the social status of migrants and the consequence of migration.

a) Demographic characteristics of migrants

In this part of the data analysis the demographic characteristics of the respondents such as sex, marital status and age are analyzed.

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i. *Sex distribution of respondents*

The study has tried to identify the sex groups whether females or males are more vulnerable to migration.

Table 1: Distribution of respondents by sex group

Sex	Frequency	Percentage %
Male	35	70
Female	15	30
Total	50	100

Source: field survey, 2016

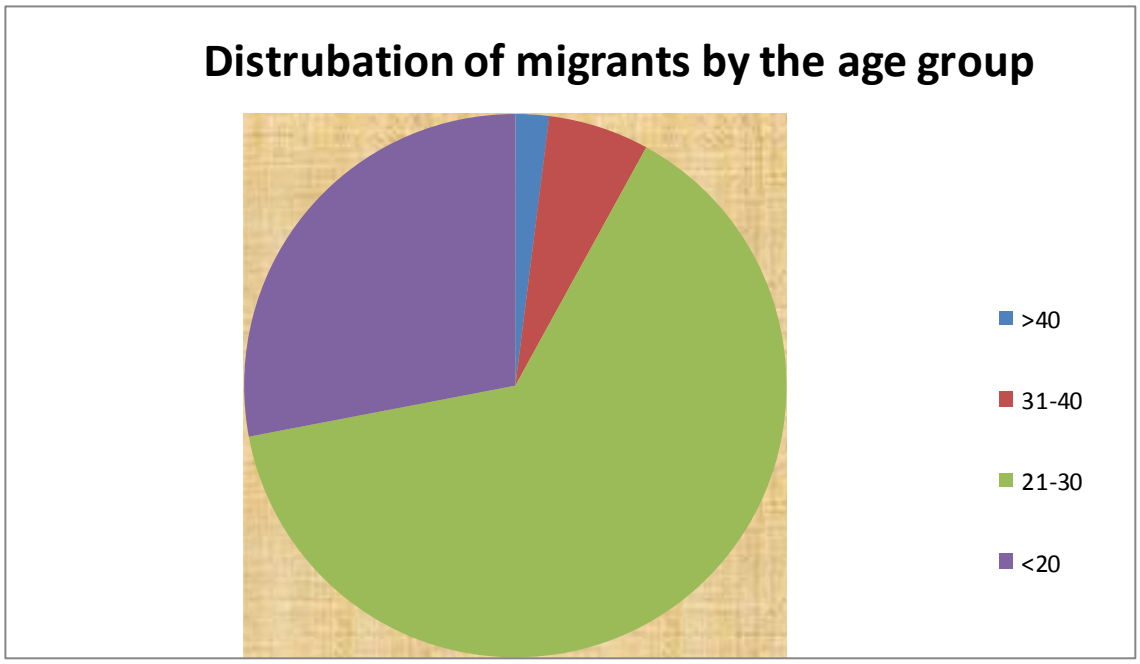
As indicated in the above table, the proportion of male migrants is greater than female migrants. From the total respondents male migrants account 70% and the female migrants account the remaining 30%. As Abdurrahman 1987) stated "rural urban migration particularly to large cities and towns is dominated by males than females since males are sensitive to migrate than females"

This show that males are highly migrant than the females because females in rural areas are mostly dominated by the society to be home worker.

ii. *Age distribution of migrants*

The researcher tried to identify that which group was highly migrate as shown in the bare graph below

Bare graph indicates that the high proportion of migrants is categorized under the age of 22-32 which accounts 64% of the total migrants. The second largest migrants are found under age group of 11-21 having 28% of the whole migrants and those migrants under the age of 33-43 are ranked in the third places with 6% of the total migrants. The remaining 2% of the found in the age group of the above 43.this indicates that people within the age integrity and as showed by many demographers people with in this age are highly sensitive to change.



Source: Field survey may, 2016

Figure 2: Distribution of migrants by the age group

iii. *Marital status of the migrants*

The study examined migrants based on marital status to know whether the majority of the migrants are single, divorced, married or widowed.

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Table 2: Distribution of respondents by marital status

Marital status	Frequency	Percentage (%)
Single	36	72
Married	5	10
Divorced	6	12
Widowed	3	6
Total	50	100

Source: Field survey may, 2016

As indicated on the table most rural-urban migrants are single having 72% of the total number of migrants. Those migrants who are divorced are ranked in the second place having 12% of the total migrants. The remaining 10% of the migrants are married and the migrants who are widowed account 6% of the total number of migrants. This indicates that the single or un married migrants are more vulnerable to migration than other portion of the society; As Lewis (1998) showed the singles have not that much family responsibility and they are highly vulnerable to motivation given by friends, who are early migrants.

iv. *Educational status of migrants*

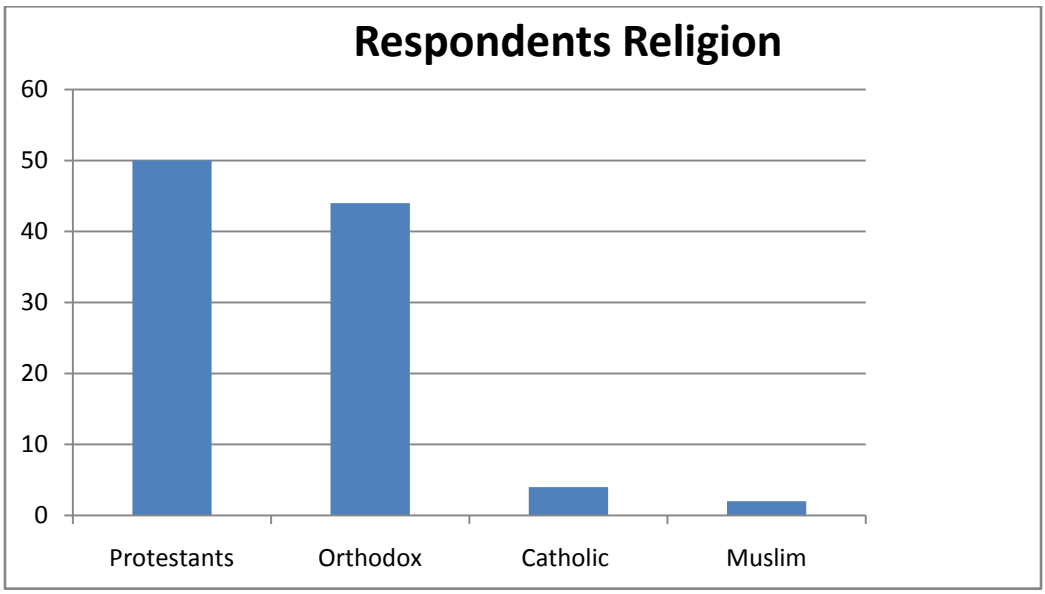
This is the part of analysis that deals with the educational status, religious, housing and health conditions of migrants.

Table 3: Distribution of respondents by educational status

Educations status	Frequency	Percentage (%)
Can't read and write	14	28
1-6	24	48
7-8	9	18
9-10	3	6
Total	50	100

Source: Field survey may, 2016

As shown on the table 1.4 48% of the total migrants are found under the educational status of grade 1-6 while the migrants who are illiterate can't read and write and those who are in grade 7-8 accounts 28% and 18% of the total migrants respectively. 6% of the migrants have educational level of grade 9-10. Therefore table shows that most of the migrants are under the educational status of grade 1-6 and as stated by Todaro (1969) most of the students in this level are single sensitive to new things and have less family obligation



Source: Field survey may, 2016

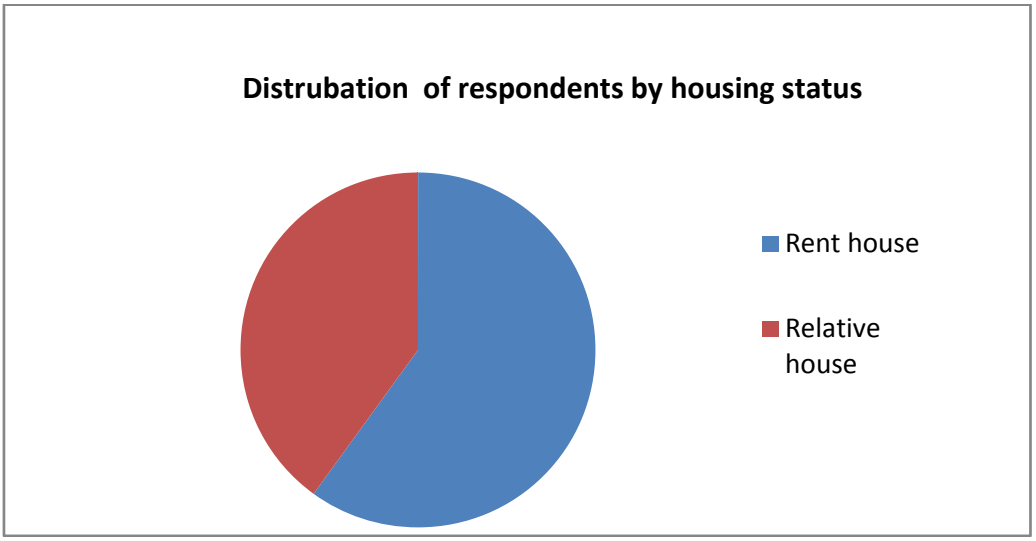
Figure 3: The religious profile of respondents

As indicated in the above graphs them a majority of the migrants having 52% of the total respondents are followers of protestant religion and 36% of the migrants are the followers of orthodox religion.

The remaining catholic and Muslim religion followers account 8% and 4% of the total number of migrants respectively.

b) Housing status of the migrants

From the below table we can understand that most of the migrants who account 60% of the total migrants do not have the access to housing in the destination area and the remaining 40% have the access to housing. The migrants who do not have the access to housing live on street (avenue).



Source: Field survey may, 2016

Figure 4: Distribution of respondents by housing status

i. *Sources of information for migration*

Table 4: migrants response for whether they have good information about Sodo town or not

Do you have good information About Sodo town?	Frequency	Percentage (%)
Yes	26	52
No	24	48
Total	50	100

Source: field survey may 20016

As the above 1.8 shows that most of the migrants who cover 52% of the total migrants did not have information about Sodo town before they come, where as 48% of the total migrants had information about Sodo town earlier.

Table 5: Distribution of migrants by source of information

Source of information	Frequency	Percentage (%)
Early migrants	25	50
From people who lead their by going and coming to Sodo	15	30
Self visiting of Sodo	6	12
Mass media	4	8
Total	50	70

Source: field survey may 20016

As the above table 7.9 indicates the majority of the migrants who cover 50% had got information about Sodo town from early migrants, while 30% of the migrants got information from people who lead their life going and coming to Sodo. The remaining 12% of the migrants got information because self visiting of the town, where as migrants who got information from mass media account 8% of the total migrants

i. *Problems of Sodo town*

Due to high rate of rural –urban migration in Sodo town the following problems have been identified: un employment, Vulnerability to streets, and position, environmental effects of migration (i.e. Huge waste, crime, violence's, shortage of housing, illegal trade (contraband) etc.

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c) Consequences of Migration

Concentration of people which can be due to migration or natural increase in urban areas where regarded as essential for the economy of scale. However, the available data shows that migration of the people have different socio-economic impacts.

ii. *Problems on the origins*

According to the information from the respondents and the key information's the effect of migration is not limited only to urban (destination) place but migration also has a negative impacts in rural areas /place of origin). The identified problems include:-

- ✓ De population of the rural population
- ✓ Loss of labor forces relevant to agricultural productivity
- ✓ Loss of assistant to old age parents
- ✓ Some cultivable lands are left underutilized because of migration of productive labor force
- ✓ It also results in further migration of rural people following the earlier migrants

iii. *Problems on the migrants*

Many of the migrants have been observed facing different problems in the destination area such as low income, health problem, un employment, housing problem etc.

Table 6: Migrants response face problem in destination areas or not

Do you have any problem?	Frequency	Percentage (%)
Yes	37	74
No	13	26
Total	50	100

Source: field survey may 20016

As the table 1.10 shows the majority of migrants who covers 74% of the total faced different problems in destination area where as 26% of them did not face any problem.

Table 7: Problems of migration on migrant

Problems	Frequency	Percentage (%)
Low income	20	40
Un employment	10	20
Housing problem	8	16
Discrimination	6	12
Health problem	4	8
Others	2	4
Total	50	100

Source: field survey may 20016

As the table 7 indicates 40% of the migrants are faced with the problems of the low income at destination place, while migrants faced with un employment and housing problem accounts for 20% and 16% of the total migrants respectively.

The remaining 12% and 8% of the migrants were faced with discrimination and health problem, where as 4% of the migrants to other problems such has shortage of the food.

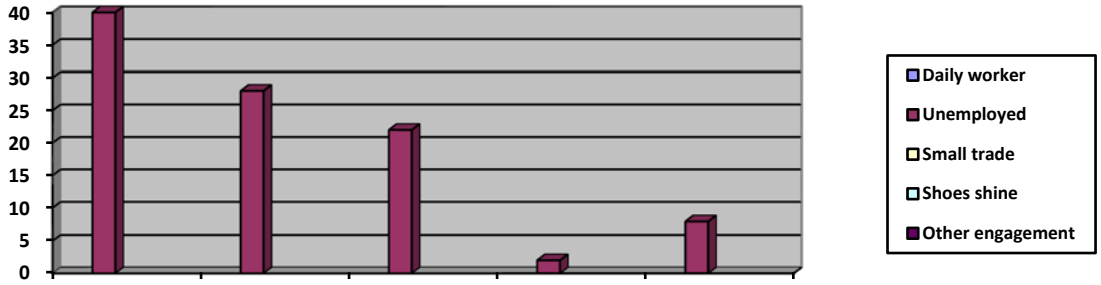
iv. *Problems on the town's residents*

According to the key informant because of large number of migrants the towns residents have been faced different problems. These problems include crimes such as theft, congestion in different infrastructural services such as rood and market instability, unemployment, pollution and cheating.

v. *Occupational change*

Even though most of the migrants were depending on parent in original area the other depends on agricultural activity, trade and other occupations. Therefore, after coming to Sodo town these migrants who were involved in agricultural activities changed their occupations and employed in other activities. The study has tried to see the current occupational status of the respondents after they migrate to the area. The migrants currently engaged in different occupations such as daily worker, shoeshine, trade and others.

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Source: field survey may 20016

Figure 5: The current occupational status of migrants

The figure 5 shows at daily workers occupational status covered 40% shows at daily works from the total migrants and 28% is covered by unemployed, while 22% and 8% of occupation status are covered by small trade and shoe shine respectively.

The remaining 2% of the total number of the migrants are engaged in other occupational such as messengers.

d) Population growth

According to the key informants, currently in Sodo town the number of population is increasing from time to time. They said that one of the majors for population growth is the rural –urban migration of many people. From different woredas and kebeles people are coming to the town with the intention of getting job opportunity, better wage and better standard of living. But whether the migrants achieve their objectives of coming to Sodo or not they became the source of population growth in the town. The researchers key informants further argued that if the trend of migration will not decrease in the coming years the current population number will also increase.

e) Current income of migrants

According to most of respondents the income of the migrants has not much changed they had no even better cloth from the time before migration and they live hand to mouth way of life. This is because in the town they don't get the expected job opportunities and high wage rather they are exposed to un employment and lower standard of living which could not enable them to have enough income. The government also prohibited some income providing activities by considering the activities illegal trade (contraband) i.e. selling, shoes and etc on the street.

f) Livelihood of the migrants before migration

The study has tried to identify the source of livelihood for the migrants in their place of origin before they came to Sodo.

Table 8: Sources of livelihood of the migrants before migration

Source of livelihood	Frequency	Percentage (%)
Parent income	24	48
Agriculture	11	22
Trade	9	18
Others	6	12
Total	50	100

Source: field survey may 20016

As table 8 shows for 22% of the migrants agriculture was used as the sources of livelihood. Out of the total number of the migrants 18% and 48% of the migrants were using trade and parent income as a source of livelihood respectively before they migrate.

The remaining migrants who were dependent on other livelihood such as living with others persons by selling their labor account 12% of the migrants. As indicated in the table most migrants were dependent on parent income as a source of livelihood before they migrate to Sodo.

Table 9: Responses of migrants to stay in Sodo or to return back to their original place.

Do you want to return back to your original place?	Frequency	Percentage (%)
Yes	35	70
No	15	30
Total	50	100

Source: field survey may 20016

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As indicated in the table 1.14 the major of the migrants who cover 70% out of the total migrants have the desire to return back to their original place because they didn't get the expected employment opportunity, better wage, high living standard although some of the migrants get some job, which they can't get enough income from it – following this low income and un employment problem they could not fulfill even their basic needs including clothing but 30% of the migrants do not want to go back to their original place because they have better income and employment. And they further said that the problems in the original area are worse than in destination area.

g) The Original area of the majority of Migrants

According to my informants and migrant respondents responses most of the migrants who cover around 80% came from the rural kebeles and 20% from rural woredas respectively.

This shows that the majority of the migrants came from Wolaita zone, woredas and kebeles this is because of the nearness of these rural woredas and kebeles to Sodo town besides unemployment problems that exist there.

Chapter Six

VI. Summary, Conclusion and Recommendations

a) Summary

Migration is a form of geographical Mobility between one geographical unit to a certain destination by permanently or temporary. In Ethiopia like other less developed countries large number of people is migrating from rural urban centers by continuously according to (Nigatu, 2004: 125). The same is true about at Wolaita zone in Sodo town administration.

There is the importance of socio-economic importance through conducting this research as a stepping stone and become source for further studies especially in Sodo town. Also they have some of limitations are budget constant, in adequate internet, computer services and information sources.

Generally migration there is two types based on the areas are space coverage such as, Internal /domestic and International migrations. This both types of migration affect the economy, scarcity of productivity, population number with in different aspects. Those migrants not only affect the economic and social environment of both origin and destination but working activities.

Basically this research data taken from 2007 E.C population census from Sodo town and both sampling techniques and sampling size collected by using primary and secondary sources by using the questionnaires and interview. The physical characteristics of study area location ally found in SNNPR and varied types of topography, climate, demography structure and social services. But the most of migrants are coming to Sodo town from different rural kebeles through the un employment problem that exist there.

b) Conclusion

The major objective of the study was to examine the socio-economic impacts of rural urban migration in the case of Sodo town. The data necessary for the study were collected from a total of 56 respondents through questionnaire, case study, key informants, interview and other secondary data sources. After analyzing the data the researcher has made the following conclusion.

The study shows that most of the migrants are male, adults. Less educated Protestants and many of them are unmarried by the time they migrate. This shows that people who are unmarried and who have no family obligation are more likely to migrate. These migrants who are in the age 16-51 and those who are single are the dominant migrants.

The study shows that the majority of the migrants are migrated to Sodo town without any information about its employment opportunities, better wage and etc so this leads them to different socio-economic problems in the town such as housing problem, health problems, discrimination, low income and unemployment. As the study shows most of the migrants are exposed to low income in Sodo town due to the Lawrence of better job opportunity, poor wage and excess labor. Among the migrants those who had good information about Sodo, the majority of them got the information from early migrants.

The un employment problems of barer with family, farming land scarcity, low infrastructure in rural area attractive information about Sodo town, the expected better wage, job opportunity, better education and health services in the urban area are the major pushing and pulling factors of migration.

Among the other things the most important pulling and pushing factors for migration as the study shows are the unemployment problem in rural area and the expectation of job in urban areas respectively. The migrants also created different socio-economic impacts on both the rural and urban areas as well. In urban areas the existence of these large numbers of migrants have created un employment problems pollution, expansion of theft, violence, market instability and expansion of illegal trade such as contraband.

Following this rural-urban migration in rural areas to many parents left without assistant and some agricultural land are left unutilized and unproductive. The study shows that the income of migrants is not that much changed, this is because of the absence of job opportunities and lower paid activities. As a result of this

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migrants are in a problem of even fulfilling their basic needs such as clothing, food, shelter and education, it in turn leads to the expansion of crime such as cheating and theft.

The study also indicates that the majority of the migrants come from Wolaita zone rural kebeles and woredas as the result of its proximity of Sodo town accompanied by the severe un employment problem in these rural wored as and kebeles. Because of the absence of the expected good job opportunities, better wage, better health and educational services, the migrants are exposed to different socio-economic problems even worse than the problems in the rural (original areas) therefore as the study show) the majority of the migrants have the desire to return back to their original area.

c) Recommendation

The study shows that the rural urban migration has created different problems on both the rural and urban areas such as unemployment, housing problem, Market instability, theft, low income, population and health problems and etc. the researcher has given the following recommendations as well as possible means of avoiding these problems and to reduce the rural _ urban migration.

In order to reduce the rate to the migrants in urban area it is very important develop informal sectors which will have a great importance in labor absorption and economic progress in urban areas.

The town administration should give emphasis to the city to faster its successful urban development in the way that encourage private owner to open new industry at the time more balanced treatments to the development of rural areas which helps to decrease the migration of people from rural to urban areas.

In order to reduce rural –urban migration the government should also develop infrastructural facilities to rural areas such as develop the education, health, rood telecommunication, pure water and sanitation etc.

Developing the agricultural sector in rural area through introducing new labor incentives, agricultural technologies developing irrigation facilities, increase access of fertilizer and other financial and technical supports including awareness creation is also very important because the agriculture can absorb a lot of labor force and can minimize the motivation to migrate.

Creating more urban modern sectors, job simultaneously improving rural incomes and employment opportunities which enable the migrants not to decide to leave their original place and if they migrate, the exercise of modern sector jobs in urban area can be absorb the migrants.

In urban areas the government should facilitate housing services for the migrants in order to protect the health of the migrants and other problems happen on the migrants such as theft and rape.

The government should create better job opportunity by organizing the migrants to work together by creating different micro and small enterprises which helps to increase the income of the migrants and reduce unemployment and other theft activities.

Improving creating educational access to the migrants is also important in order to make them creative and to involve in better income generating activities.

This also enables them to contribute to the development of the town because they will involve in other innovative activities

Awareness creation must be highly done among the migrants about the absence of the expected good employment opportunities and better wage in Sodo town; it will weaken and enable them to stay in their original area. The government should help financial and equipment found for rural to urban migrants to settling in their original area /earlier places.

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The Move from Safe Yield to Sustainability and Manage Yield

By Yohannes Yihdego & Muhammad Waqar
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Abstract- There is currently a need for a review of the definition and methodology of determining sustainable yield. The reasons are: (1) current definitions and concepts are ambiguous and non-physically based so cannot be used for quantitative application, (2) there is a need to eliminate varying interpretations and misinterpretations and provide a sound basis for application, (3) the notion that all groundwater systems either are or can be made to be sustainable is invalid, (4) often there are an excessive number of factors bound up in the definition that are not easily quantifiable, (5) there is often confusion between production facility optimal yield and basin sustainable yield, (6) in many semi-arid and arid environments groundwater systems cannot be sensibly developed using a sustained yield policy particularly where ecological constraints are applied. Derivation of sustainable yield using conservation of mass principles leads to expressions for basin sustainable, partial (nonsustainable) mining and total (non-sustainable) mining yields that can be readily determined using numerical modelling methods and selected on the basis of applied constraints. For some cases there has to be recognition that the groundwater resource is not renewable and its use cannot therefore be sustainable. In these cases, its destiny should be the best equitable use. We suggest using the term Managed Yield as an alternative to Sustainable Yield to clarify the ambiguity among stakeholders.

Keywords: groundwater, conjunctive use, sustainable yield, safe yield, sustainable development, mining yield, water budget, recharge, storage depletion, groundwater management.

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The Move from Safe Yield to Sustainability and Manage Yield

Yohannes Yihdego [α] & Muhammad Waqar [σ]

Abstract- There is currently a need for a review of the definition and methodology of determining sustainable yield. The reasons are: (1) current definitions and concepts are ambiguous and non-physically based so cannot be used for quantitative application, (2) there is a need to eliminate varying interpretations and misinterpretations and provide a sound basis for application, (3) the notion that all groundwater systems either are or can be made to be sustainable is invalid, (4) often there are an excessive number of factors bound up in the definition that are not easily quantifiable, (5) there is often confusion between production facility optimal yield and basin sustainable yield, (6) in many semi-arid and arid environments groundwater systems cannot be sensibly developed using a sustained yield policy particularly where ecological constraints are applied. Derivation of sustainable yield using conservation of mass principles leads to expressions for basin sustainable, partial (non-sustainable) mining and total (non-sustainable) mining yields that can be readily determined using numerical modelling methods and selected on the basis of applied constraints. For some cases there has to be recognition that the groundwater resource *is not* renewable and its use cannot therefore be sustainable. In these cases, its destiny should be the best equitable use. We suggest using the term Managed Yield as an alternative to Sustainable Yield to clarify the ambiguity among stakeholders.

Keywords: groundwater, conjunctive use, sustainable yield, safe yield, sustainable development, mining yield, water budget, recharge, storage depletion, groundwater management.

I. Introduction

Ground water systems conservation is a major challenge of this century, but their importance from a human perspective lies mainly in the functions and services they provide; Groundwater systems are important, which needs to maintain in sustainable future (Devlin and Sophocleous 2005; Yihdego et al. 2017; Yihdego and Becht 2013). The water function and services are not unique for groundwater systems and may be provided by other water system components as well. This is in particular the case for the water supply function: in most regions one may choose between groundwater and surface water, or even desalinized seawater and non-conventional sources such as treated waste-water, as alternative sources for satisfying the same water demand The resource exploration and its management has directional horizons e.g. increasing or decreasing. Groundwater development and management should be viewed in an integrated water resources management perspective, or even in a broader regional development context. Management aspect of ground water is difficult and have to develop on scientific grounds due to an increase in ratio of groundwater usage to groundwater availability. In this scenario over exploitation and long term capacity of aquifer is big question to solve because the capacity of aquifer is reducing continuously due to over exploitation (Custodio 2002). The key question then is not whether the development of a particular groundwater system is sustainable, but rather whether the complex of natural resources (to which that groundwater system belongs) allows and supports sustainable socio-economic development and preservation of desired environmental conditions in the region

The actual abstraction is significantly less than the theoretical proposed and calculated, there are cases where it has assessed that the abstraction exceeds the long-term capacity of the aquifer. In Australia for example, the total 538 Groundwater Management Units nationwide examined during a national water audit in 2000, 57 are regarded as being pumped at a rate that exceeds their long-term capacity (Kalf and Woolley 2005). Water resource managers have sought to redeem the situation by reducing the volume allocated, and in some cases the volume pumped, to a level that they have assessed is "sustainable" (Kendy 2003; Sophocleous 2005; 2007; Yihdego and Webb 2011; Yihdego and Drury 2016a, 2016b; Yihdego and Paffard 2016).

The debate has developed about the way in which the "capacity" of an aquifer to deliver water to sustainable end that should be defined and determined quantitatively and qualitatively. As ramification two prominent concepts were developed first Safe Yield and much later Sustainable Yield. These concepts together with a variety of applied constraints constitute what has been called "sustainable groundwater development"

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(Hiscock et al. 2002). If the concept of sustainable groundwater development is to be applied, then it is essential that both safe yield and sustainable yield be understood. Unfortunately, this is currently not the case and there is a variety of interpretations and often also confusion as to their exact meaning (Sophocleous 2005; Yihdego et al 2016a, 2016b).

This paper re-examines the concept of sustainable yield. It seeks to provide a scientific way of redefining these concepts, rather than a specific word definition, further explanation for practitioners and water resource managers who has concern with dynamic ground water system. Because the dynamic ground water system could be defined without the sound basis of ground water quantification concept. Another objective is to rephrase the concept on a sound scientific ground sin the light of fundamental groundwater principles. Most of the concepts outlined in this paper are not new because they have been retrieved from the available literature, based on intention to develop a new perspective as a way of reminding water resource managers and others that fundamental principles should not be overlooked as they seek to show that use of natural resources is sustainable. The reason is that ground water resources have different worth as compare to other natural resources.

This paper begins by first referring the long historical development of yield definitions to place their meaning into context, provide some examples of concepts used in a number of countries, and to outline some of the ambiguities of sustainable yield definitions. This is followed by a derivation of basin sustainable yield based on conservation of mass principles and applied constraints, and a discussion of the implications of some practical issues.

Some examples of sustainable and non-sustainable yield assessment are followed by a listing of some considerations relevant to groundwater management and concepts presented, and conclusions.

II. Discussions

a) *Development of Safe Yield concept*

The safe yield concept has originated with prime attention to environment and unwanted declining of water table. At first this concept was based on capacity of aquifer and its size reduction without defining its spatial aspects. Lee (1915) was first who define the safe yield as maximum quantity of water that could be withdraw from ground water system without producing the unwanted results to aquifer. Soon after him Meinzer (1923) has defined safe yield as rate of maximum output of aquifer to human being. It seems that the Meizer has discussed only the economic aspects of ground water system. After that Conkling (1946) and Banks (1953) has discussed the water quality and water rights concept. Further addition was made by Todd (1959) in safe yield concept as "it is amount of water that can be withdrawn annually without producing undesired results".

With the passage of time safe yield concept further manipulated but Thomas (1951) Kazmann (1956) have inhibited this definition because of misconstruction, vagueness, static and dynamics difference of ground water system. Although this definition of safe yield still in use ignoring other relevancy to ground water system but still yield quantification required to improve it further. Another ambiguity linked with maximum and minimum limits of safe yield is still unstipulated (Calo wet al. 2010 and Mukherji 2008).

Many suggestions for improving the safe-yield concept have focused on considering the yield concept in a socioeconomic sense within the overall framework of optimization theory. The optimum yield is determined by selecting the optimal management scheme from a set of possible alternative schemes. Of course, within such a framework, consideration of present and future costs and benefits may lead to optimal yields that involve mining ground water, perhaps to exhaustion.

A common misperception tailored that the development of ground water system is safe if the average annual rate of ground water withdrawal does not exceed the average annual rate of natural recharge. Brede hoeft (1982) and Bredehoeft (2002) give examples of how safe development of aquifer depends instead on how much of extraction can be captured from increased recharge and decreased discharge. Sophocleous (1997) and Bredehoeft (1997) have further elaborate that for safe yield the quantification of recharge should be greater than discharge on contrary discharge increase will not hold safe yield concept.

b) *Development Sustainable yield*

The sustainable concept is developed in early 1980s with centered idea of limited availability of resources and how to regenerate for coming generations. Proper definition of was given by Brundtl and commission (1987) which was also known as world commission on environment and development that is "to meet the needs without compromising the future generations. Then United Nation (1992) has put forward the concept of sustainability. This idea is based on integration of environmental and development apprehensions. Further it is highlighted in recent World summit that sustainability is concept which deals with resources quantification.

The water resources sustainability is different as compare to other natural resources. It is also crucial to define water sustainability, because it is vitally linked with existence of human being and according to some estimation more than 0.783 billion people will not have safe drinking water by 2050 (Gleick 2001). Like the

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concept of safe yield, sustainable yield is also expressed in broader extent which make somewhat ambiguous due to applied constraints. Holistic view of sustainable yield may be valuable to some environmental economic aspects but in water resources it is defined within the confined framework which is not elaborating water resources in detail due to broader spectrum (Sophocleous 1998; Alley et al. 1999; Sophocleous 2000). Although it is tried to explain sustainable yield in similar lines of safe yield concept but it is still ambiguous due to dynamic ground water system and its development.

The major challenge of this era is to define sustainability due to its versatile scope (UNESCO 1999; Loucks 2000). Some ambiguities attached with sustainability concept due to its philosophical framework (Norton and Toman 1995). For example, the use of resources will be differed from ecologist to economist due to their perspectives of ecosystem existence and profit generation or else. And also economist will think about non declining end of his capital stock and will seek the relation between strong and weak sustainability of his resources.

c) The managed yield concept and its justifications

The safe yield and sustainable yield concept could not be fully implemented to ground water system due to its complex structure and applied constraints attached with it. Sustainability concept related to ground water resources is more concern with safe yield. Because of dynamic nature and anthropogenic intrusion along with land use change (Alley et al. 2002). Safe yield has functional relation with water withdrawal and its temporal pattern while the sustainable yield caters long term availability of water resource through replenishment in dry season and withdraw in wet season.

Sustainability is a very complex concept. Its practical interpretation depends on the systems considered, the angle of view, the overall local context and subjective comparisons between alternative futures. Applied to groundwater abstraction, it makes a difference whether one has sustainable pumping in mind or the sustainability of the local society and ecosystems. In the latter perspective, even unsustainable pumping from a non-renewable groundwater resource might contribute to sustainable development, provided that other water resources are available to meet water demands on the long run, after the non-renewable groundwater resource will be exhausted. Furthermore, the extent of storage depletion due to pumping may vary from case to case, and the same is true for the impacts of storage depletion. Such impacts tend to be more severe in arid than in humid climates, because buffering by other components of the water cycle there is less likely to occur.

Sustainable yield has not enough to justify ground water in dry and wet periods, per capita water demands, withdraw management, impacts of renewable fluxes (base flow intrusion), runoff recharging variables, ground water stress estimation, subsurface anomalies, spatial and temporal pattern of ground water availability, social issues, environmental problems, legal aspects, chemical parameters, physical and biological variables, water demand and supply, anthropogenic variables and climate change scenarios. Sustainable yield put forward by considering water as capital which could be maximized and optimized for future that seems less practical.

We are agreeing that water is natural resources and it may have been considered as renewable resources in past but growing population has changed this approach. According to UNDESA 2015 world population will grow up to 9.7 billion by 2050 which will put pressure to ground water system to withdraw more water to meet the increasing demand of masses. It would become difficult to define per capita water availability due to limited resources of water. This upsurge of population will also become a reason for growing urbanization which will further reduce the natural replenishment of ground water system.

We may consider of ground water as partial renewable resource due to reduction of recharge and increase in discharge from ground water system due to negative impacts of physical, social, environment and legal variables. So to secure ground water for our future we don't need to sustain on philosophical agreements but we need to develop out ground water resources in a managed manner. We can manage it by making the controlled with drawal of water from system and maximizing input to system for replacement. Stress analysis should be done to optimize the availability of water in managed way. Quantification and qualification may also be achieved through strict management and policy making efforts. Furthermore, subsurface anomalies will be treated in technical way with its spatial, temporal and trans boundary aspects. Anthropogenic and climate variable may be adopted in a managed fashion to avoid future uncertainties.

In view of above discussions, we may conclude that "managed yield" is more sophisticated term instead of using the safe yield or sustainable yield. Because we only manage the ground water availability in the long run ignoring the undesired effects on water table. It is very difficult to apply the sustainability concept to ground water system due to its complexity, dynamic nature, quantification aspects and spatio-temporal variability.

III. Conclusions

The safe yield concept was developed the idea of water withdrawal from ground water system while the sustainable yield concept was developed on optimization of resources by considering water as capital resource. But practical simplicities attached to

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these concepts are ambiguous and misinterpreted t of ground water system e.g.the recharging and discharging in growing population and technical variables.The sustainable yield conceptis more economical, social, and legal in nature while safe yield considered only technical aspects of ground water system. In view of both concepts either safe yield or sustainable yield cannot define the ground water system alone, therefore a sophisticated approached is required to explain system regardless all ambiguities

In addition to sustainability concept interpretation, whether one is able to cope with certain physical impacts of ground water mining varies according to the local conditions. Wealthy developed societies with good access to financial resources and technology are in this respect in a more favorable position than poor developing countries. Whatever perspective is chosen, it is clear that groundwater development always comes at a cost (environmental, financial or otherwise). It is up to society to decide whether this cost is balanced or outweighed by the benefits of the abstracted groundwater and does not threaten sustainable development. In order to underpin such a decision adequately, it is important to have a good picture of the groundwater system considered, to understand its response to pumping (avoiding the water budget myth and other erroneous concepts) and to oversee its socio-economic and environmental setting.

Water resources cannot be developed without altering the natural environment; thus, one should not define basin yields, either as safe or sustainable, without carefully explaining the assumptions that have been made about the acceptable effects of ground water development on the environment. Even with assumptions about acceptable changes, the concept of a static safe, or sustainable, yield may not be realistic in light of potential changes in hydrology from landuse activities and climate change. For example, urbanization and agricultural development in a basin affect infiltration, runoff, evapotranspiration, and recharge, resulting in the changing of hydrologic cycle through time.

a) Summary Remarks

Although many people have expressed concerns about the ambiguity of the term sustainability, the fact remains that prudent development of a ground water basin in today's world is a complicated undertaking. A key challenge for sustained use of ground water resources is to frame the hydrologic implications of various alternative development strategies in such a way that their long-term implications can be properly evaluated. Each hydrologic system and development situation is unique and requires an analysis adjusted to the nature of the water issues being faced, including the social, economic, and legal constraints that must be taken into account. The role of hydrologists in addressing issues of sustainability is evolving as technologies, understanding of the long-term effects of ground water consumption, and societal priorities. For example, meeting the challenges of water resources sustainability increasingly involves understanding and predicting long-term ecological and water quality impacts and applying innovative approaches to conjunctive use of ground water and surface water, artificial recharge, and water reuse. Scientists and engineers should continue to play a key role in shaping this transition.

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Studies on Nature and Properties of Salinity across Globe With a View to its Management - A Review

By Yohannes Yihdego & Subhabrata Panda
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Abstract- Salinity is a complication towards evolving a sustainable food production system and habitat management throughout globe. Such problem has its origin from marine, geological and anthropogenic activities. Nature and properties of salinity has been reviewed on global extent with a view to its management in this regard.

Keywords: salinity, sustainable, crop production, water harvesting, coastal area.

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I. Introduction

Salinity across globe can be broadly grouped as ocean and terrestrial salinity. Terrestrial salinity has its manifestation on land surface and in groundwater [33, 34, 35, 36]. Salinity of ocean is most vividly revealed and which hardly needs a classification, though sea temperature is the crucial factor for which salinity changes from place to place on oceans. Salinity is the outcome of various geological factors in association with atmospheric influence. Atmospheric components along with geological circumstances are the determinants of salinity on land territories including groundwater and in oceans.

The present review work is targeted to find out nature and properties of salinity on global scale with a view to its management, especially managing salinity for sustainable food production through better agriculture and aquaculture, building construction and fresh water harvesting.

II. Materials and Methods

Literature survey is done on studies on geographical expanse of salinity in water and in soil under the various geological and atmospheric influences. Native geological features, territorial water bodies and streams and even oceans and seas are influencers of soil salinity. Thus, literature survey will target to find out those native factors including atmospheric components to study the nature and properties of salinity, especially soil and groundwater salinity, for its management with a view to effective utilization of landmass and water bodies and oceans for a better scope for creation of dwelling places and security of food, fodder and fibres in future for human beings on a global scale. Here, groundwater, mouths of rivers and coastal areas are interfaces between land territory and ocean.

Salinity is the indication of property of both water and soil. It is the saltiness characterized by amount of dissolved salts present and expressed as grams of salt present in one kilogram of water or soil with a unit of parts per thousand or ppt or $^{0}/_{00}$. Dissolution of salts results in higher density of salty water than freshwater. This property is used to measure salinity of water by hydrometer. Similarly salty water refracts more than freshwater and this property is the reason for measuring salinity of water by refract meter. As the property of variation of microwave emissivity with temperature and salinity of sea surface, salinity sensor is mounted on NASA's Aquarius Instrument satellite (June 10, 2011) to measure changes in global sea water salinity. Readings with that instrument can identify roughness created by the shallow pools of freshwater due to intense rainfall on ocean. Carrying capacity of electrical charges by ions in water is employed to measure salinity of water by electrical conductivity meter. This meter is also used to measure salinity of 1:2 soil-water saturation extract. Apparent electrical conductivity of bulk soil in field is done through electrode probes or electromagnetic induction or time domain reflection. Aquarius Instrument satellite also measures global soil moisture status. With the another instrument, Argentine built Microwave Radiometer aboard, in future, that Aquarius will gauge intense rain over ocean simultaneously to salinity readings. After thorough refining microwave emissivity measurements that salinity sensor may succeed in measuring accurate soil salinity over the globe. There is another scope for refining measurement soil moisture content with the help of physical procedures or of certain bacteria like *Escherichia coli* and joint venture of this microbiological method with the microwave emissivity salinity sensor may lead to precise estimation of soil salinity. [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

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III. Discussion

Nature of Salinity – Salinity is the accumulation of salts above certain level in water or soil matrix and geological formations. Sources of salinity can be broadly classified into salinity of water and salinity of soil. Each has its effect on the other. Thus, the two cannot be segregated in nature. Besides climate has great binding on salinity and, thus, there is soil-water –atmosphere continuum in nature of salinity, studies of which will be effective in its management, especially managing soil salinity. For the purpose of clarity the whole discussion is divided into:

i) Ocean salinity
ii) Terrestrial salinity

a) Ocean salinity

i. *Physical states of water*

There are three physical states of water like liquid, ice and vapour. Water, in its liquid state, dissolves rocks and sediments and reacts with emissions from volcanoes and hydrothermal vents. This results in complex solution in ocean basins. Apart from that salts with minerals are released in oceans as a result of weathering of rocks. Other two states are salt incompatible and, thus, formation of ice through condensation and vapour formation through evaporation are responsible for increase in salt concentration in water.[3, 10, 11, 12]

ii. *Water Cycle*

The globe is broadly composed off one third parts of land and two third parts of water. Global 78% precipitation and 86% evaporation occur over ocean. This difference in fresh water input-output affects the ocean dynamics, where ocean surface salinity is the key factor. Tracking of that salinity helps to directly monitor land runoff, sea ice freezing and melting; evaporation and precipitation over ocean.

Formation of ice and evaporation are responsible for increase in salt concentration in ocean. Processes like input of fresh water from precipitation (rain, snow), surface (river) and sub surface runoff (fresh groundwater flow) and melting of ice are responsible for continually decreasing salinity against different salinity factors. Still it is of great concern that small variations in salinity in ocean surface can eventually affect the circulation in ocean and global water cycle.[5, 7, 10, 11, 12]

iii. *Ocean Circulation and Climate*

Upper ocean circulation is driven by winds. Deep below the surface the changes in sea water density is the casual factor of ocean circulation, while sea water density is dependent on salinity and temperature.

On high latitude regions, such as on the North Atlantic east of Greenland, cold surface ocean waters becomes saltier due to evaporation and/or sea ice formation. In those regions surface water turns dense enough to sink to the ocean depths. That pumping of surface water forces the deep ocean water to move horizontally until it can find areas where it can move up to the surface of ocean. That ocean current is called as 'thermohaline circulation', as that is caused by changes in temperature (thermo) and salinity (haline). It is a very large and slow current estimated to be on the order of 1000 years to complete a full circuit, also called the 'Global Conveyer Belt' as this works as an interconnected system. Such studies can help to emergency preparedness towards disaster management with regard to cyclones, sustainable fishing from seas and estuaries, etc.

Studies on salinity in coastal areas are helpful for planning rain water harvesting for more crop production.[1, 3, 4, 5, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22]

iv. *Salinity Regions*- knowledge base for land salinity management

a. *High Salinity*

a) In centre of the ocean basins, away from the mouths of rivers which input fresh waters.
b) In sub-tropical regions, due to high rates of evaporation as a result clear skies,
c) little rain and prevailing winds. In landlocked seas in arid regions.

b. Low Salinity

a) In high latitudes due to lower evaporation rates and melting of ice which dilutes sea water.
b) In tropical areas dominated by rain.

Such differences in salinity regions have a significant impact on ocean circulation and the global climate. [3, 4]

v. *Sea–land proximity and Geomorphology – knowledge base for land salinity management*

The Bay of Bengal is less saline than the Arabian Sea. Because Bay of Bengal is showered by intense monsoon rains and gets fresh water discharges from the Ganges and other large rivers, whereas the Arabian Sea is laid up against dry Middle East.

Drift of sea water by winds is a major factor for salinization of coastal soils. More sandy soils are less affected by salinity. Large rivers, generally, form delta near its mouth and carry sediments constituting clay fractions in majority, which are susceptible to adhesion of ions of salts, *i.e.* the cause of salinity. For these reasons the coastal soils by the Arabian Sea have less saline area than the coastal soils of Bay of Bengal.

Such examples can be cited for other places which would be of much helpful for managing country wise land salinity.

b) Terrestrial Salinity

Terrestrial salinity may be due to one of the following causes:

i. Marine origin,
ii. Natural terrestrial origin,

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iii. Anthropogenic terrestrial origin.
iv. Mixed origin.

a) Manifestations of Terrestrial Salinity

i. Soil salinity
   a. Frozen Soil Salinity
   b. Agricultural Soil Salinity
ii. Surface Water Salinity
iii. Groundwater Salinity

i. *Frozen Soil Salinity*

Continental salinity is concerned mainly for soil and water salinity affecting agriculture. Salinity is the problem for building construction everywhere and especially in arctic coasts for anomalous load bearing property of frozen saline soils. Frozen saline soils are also distributed in Central Siberia, where continental salinization is caused by predominance of evaporation over precipitation and that is characterized by prevalence of sulphate and carbonate ions and such soils are characterised by special engineering property of low bearing capacity. Those soils possess property between frozen and unfrozen soils because of their freezing at lower temperature and contain more unfrozen water than the same soil without salt. On such soil test of bearing capacity should allow constant load for construction of building.[19]

ii. *Agricultural Soil Salinity*

Agricultural Soil Salinity is the manifestation of both the soil and water (surface and ground) salinity, as water is a useful input in irrigated agriculture. In case of non-irrigated agriculture question of water salinity is not concerned.

During the process of weathering of rocks and parent material salts are released which makes the soil saline *in situ* and through transportation by surface and sub-surface runoff salinized azonal soils are formed. For such origin of salinity rainfall, sheet, rill, gullies, streams, rivers and groundwater flows are causing factors. Due to work of wind, moving glaciers, lakes, river, ocean various azonal soils (e.g. alluvial, colluvial) are formed. Contamination of those forceful geomorphic agents is also the cause of origin of saline soils on various parts of the globe. For example, coastal saline soils originated due to closeness of the coasts with the sea. Such geographical situation also affects the salinity of groundwater. Incidental flooding by sea water and high tides in the sea and drifts from seawater by wind are causes of salinity of coastal rivers and groundwater. Impeded drainage condition due to impervious or negligibly permeable soil layer at depth cause collection of salts in soil layers and on drying of surface causes salts to rise up and makes the soil saline which is usually characterised by salt efflorescence which is named in different parts of the globe differently like *reh* in India. Dissolution of calcium from clay complex turned the saline soil sodic (alkali) soil.[23, 24, 25, 26, 27]

Anthropogenic activities are causes of salinity in every parts of the globe right from the snow covered territory to shoreline of the hot continent. Those can be classified as anthropogenic pollutants like road salt (applied in winter in cold countries), fertilizers, domestic, industrial and agricultural effluents spilled oil and gas filled brines and brines from desalination plants and ice making plants, etc. Apart from those over pumping of groundwater in coastal areas may cause saline water ingress in groundwater. Ponding of saline river water or sea water for inland prawn culture, application of saline water for irrigation cause soil salinity. Construction of railways, roads and dams for canal irrigation are some of cause of impeded drainage condition leading to soil salinity. Construction of such canals was identified as main cause of increase in areas of saline as well as sodic (alkali) soils in India.[26, 27, 28, 29]

b) Management of Terrestrial Salinity

Management of land salinity requires area specific characterisation of salinity both in water and soil as well. Because either the salinity of soil or water cannot be separated like dilemma of differentiating flesh and blood. Groundwater is also an important component which needs attention in managing continent salinity, and, thereby using the vast saline tract for useful purpose for growing food mainly through agriculture and aquaculture.

From the generic point of view, as sodic soils are non-separable from saline areas, management of salinity in soils should take care of alkalinity of soil while planning for drainage of saline land. [26, 27, 28, 29]

c) Precautions for Drainage of Saline Soil for Conservation of Agricultural Lands

Through judicious practice of art and science of land drainage, drainage of saline soils can accomplish considerable achievements in conserving agricultural lands, in improving marginal agricultural lands, and in mitigating effects of other lands and water development projects.[30] This can be explained with the following six examples.

Example 1: Drainage of pilot area of Chacupe, in the arid coastal area of Peru.

For the reclamation of that strongly salinized sodic soil following were done:

i. Preparation of water and salt balance,
ii. Preparation of Leaching Curve,
iii. Estimation of required Leaching Time,
iv. Estimation of Lime Requirement of soil for application of necessary Ca amendments.

Example 2: Drainage for sugarcane cultivation in coastal low lands of Guyana.

Establishing a critical value of the seasonal Number of days with a High Water Level in open

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collector drains (NHW, above 90cm below soil surface), by relating it to production of sugarcane.

The critical NHW value was found to be 7 days, below which production was not affected and above which production showed a declining trend.

That example showed a good use of water level (instead of discharge flow) as a criterion for land drainage.

Establishment of that criterion helped to determine corresponding discharge by standard hydrological procedures.

Such criterion helped to classify estates with excessive, good and deficient drainage systems and to recommend required remedial measures.

Example 3: Subsurface drainage for water logging and salinity in the Nile Delta, Egypt.

Thatstudies in Mashtul Pilot area showed that

i. Examining the modestly deep water table (about 0.8m as a seasonal average) sufficient to control soil salinity at a safe level as well good crop production,
ii. Imposing deeper water level for intensive drainage would have the negative side effects towards higher drainage losses as well as lower irrigation efficiency,
iii. Merit of such drainage criterion was found to be also effective in areas under crops other than rice.

Example 4: Subsurface drainage for water logging and salinity control in northwest India.

To reclaim seriously salinized soil in Sampla Pilot area, Karnal, Haryana with upward seepage of salty groundwater a subsurface drainage was commissioned manually.

i. Collection of drained water in a sump from the system, which is ultimately pumped out into the open drain.
ii. Drainage of salty water is done only during the rainy season (monsoon period, June-September), when rivers and canals carry a large amount of fresh water, so that mixing of that water will do no harm. During that season almost all the river water (Yamuna river, a tributary of the Ganges) reaches the sea (Bay of Bengal).
iii. Draining huge amount of salty drainage water in dry season, was cautioned to be more harmful for surrounding soil. On the other hand irrigation water, being scarce in that season, salty drained water is used for irrigation, having no danger of undue salinization of soil, as once in two or three years the monsoon gives sufficient rainfall to leach the soils and to evacuate the accumulated salinity.
iv. This is the example of a restrained operation of drainage system, where water table is permitted to be as shallow as possible and it is environment friendly with savings for irrigation water and operational costs as well.

Example 5: Subsurface drainage of acid sulphate and muck soils in southwest India.

That drainage system was installed in farmers' fields to improve acid sulphate and muck (peat) soils in La poder area, 1 to 2m below mean sea level, in Kerala.

i. Traditionally only surface drainage is practised for that purpose,
ii. Due to high rainfall (about 3000mm/year) with plenty of fresh water in ring canals the area maintained almost permanently under water to yield two rice crops a year, with duck rearing in between.
iii. Temporary lowering of water table in the December (dry month) helps

a) to increase crop yield from 1.5 t/ha to about 2.5t/ha,
b) to wash down acids and toxic elements to deeper depth with the next flooding of the field,
c) to contribute to better aeration of the soil, with a subsequent improvement of the quality of the organic matter.

Similar phenomenon, by tradition, is possibly occurring in restrictively drained areas of Pulau Petak, south Kalimantan, Indonesia.

Example 6: Subsurface drainage in winter for wheat production in England.

In a pilot area near Drayton, England following were observed:

i. Winter wheat is sown in previous autumn.
ii. Summer production of winter wheat was correlated with depth of water table in Winter.
iii. In summer there is no problem of water logging due to higher evaporation.
iv. Production only decreased when the average depth of the water table in winter was less than about 0.5m.
v. With the deeper water table production was not affected.

Such area specific studies on identifying minimum average depth of water table is helpful for designing suitable drainage system for better crop production.

VI. Conclusions

i. Studies on marine and estuarine and coastal salinities have good bearing on sustaining food production.[31, 32]
ii. Management of salinity needs location specific establishment of criteria for reclamation and/or drainage to obtain higher efficiencies both for drainage and irrigation with regard to crop cultivation.
iii. Aquaculture should also take of judicious application of science of soil and water salinity management as per need.
iv. Construction of building on frozen saline soil must undertake tests of bearing with fixed load in contrast to increasing load.
v. Environment friendly approach should aim at lowering operational cost for managing salinity for increasing production of food through agriculture and

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aquaculture, which would ultimately take care of minimizing salinity pollution from anthropogenic activities.

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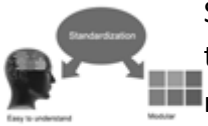


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21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments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



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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.

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Mistakes to evade

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- Submitting a manuscript with pages out of sequence

In every sections of your document

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

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· 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

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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.

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- 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:

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- 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

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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.
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- 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.

Methods:

- 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.
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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.



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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
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- 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**
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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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