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Highlights

- Compact City Concept
- Difference of Misinterpretation
- Natural Uranium Content
- Assessment of Excess Cancer Risk

Discovering Thoughts, Inventing Future

VOLUME 16 ISSUE 4 VERSION 1.0

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Punjab in the Grip of an Ecological Disaster: Is there a Solution?

By Hardev Singh Virk
SGGS World University

Introduction- Punjab, the land of five rivers, is facing one of the worst crisis in its history. Its youth is trapped in drugs, marginal farmers are trapped in bank loans and are forced to commit suicides, the financial situation is so dismal that the State is in a debt trap, and the moral fabric of vibrant Punjabi society is under attack by internal and external contradictions.

However, I am not going to focus on the obvious but will like to investigate the long term effects of Ecological Disaster hovering over Punjab. During 1990s, when our research group in Guru Nanak Dev University was sanctioned a research project by Bhabha Atomic Research Centre (BARC) of Department of Atomic Energy (DAE) to undertake a survey for Environmental Radiation Health Hazards to population of Punjab, we could never imagine the consequences would be so alarming? Our aim was to assess the environmental radiation dose to inhabitants due to Radon gas emanating from the soil; the source of this gas being radioactive Uranium in soil and groundwater. We reported that in Malwa belt, the radiation dose is 20% higher compared with other districts of Punjab. However, there was no imminent danger to public health due to presence of indoor Radon in homes.

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I. Introduction

Punjab, the land of five rivers, is facing one of the worst crisis in its history. Its youth is trapped in drugs, marginal farmers are trapped in bank loans and are forced to commit suicides, the financial situation is so dismal that the State is in a debt trap, and the moral fabric of vibrant Punjabi society is under attack by internal and external contradictions.

However, I am not going to focus on the obvious but will like to investigate the long term effects of Ecological Disaster hovering over Punjab. During 1990s, when our research group in Guru Nanak Dev University was sanctioned a research project by Bhabha Atomic Research Centre (BARC) of Department of Atomic Energy (DAE) to undertake a survey for Environmental Radiation Health Hazards to population of Punjab, we could never imagine the consequences would be so alarming? Our aim was to assess the environmental radiation dose to inhabitants due to Radon gas emanating from the soil; the source of this gas being radioactive Uranium in soil and groundwater. We reported that in Malwa belt, the radiation dose is 20% higher compared with other districts of Punjab. However, there was no imminent danger to public health due to presence of indoor Radon in homes.

We did not bother to evaluate the risk due to presence of Uranium (U) in soil and groundwater of Punjab. Uranium poisoning in Punjab first made news in March 2009, when a South African Clinical Metal Toxicologist, Carin Smit, visiting Faridkot city in Punjab found surprisingly high levels of uranium in 88% of the blood samples collected from amongst mentally retarded children in the Malwa region of Punjab. The results revealed that 87% of children below 12 years and 82% beyond that age having uranium levels high enough to cause diseases, and in the case of one child, the levels were more than 60 times the maximum safe limit.

This report opened the Pandora's Box and the echo of this report reverberated in the Parliament House. BARC teams under the direction of DAE were alerted to visit Punjab and an MOU was signed with GND University for undertaking a comprehensive survey of all districts for assessment of health risk due to Uranium concentration in ground waters. A large number of reports have been published in research journals. Most of the team members involved in this Project have been my old students and collaborators. My recent survey of four districts (SAS Nagar, Fatehgarh Sahib, Sangrur and Bathinda) have shown that Uranium content in water is within safe limits in SAS Nagar and Fatehgarh Sahib but it is higher than the safe limit fixed by Atomic Energy Regulatory Board (AERB) of India for Malwa belt (Sangrur, Bathinda, Mansa and Ferozpur). Punjab State department of Sanitation and Water Supply based in Mohali has reported the highest value of Uranium content of 2200 microgram per litre (ppb) in ground water collected from a deep borewell (700 feet) in Badla village of Dasuya Block of Hoshiarpur district. Some scientists propose that Uranium can be mined from underground waters of Punjab. What is the source of high U content in water? The Scientists of PU Chandigarh group report that high U content in water can be attributed to high salinity of water and Phosphatic fertilizers being used in Malwa region of Punjab. Calcium bicarbonate acts as a leaching agent for U in soil and it gets concentrated in groundwater by geochemical processes. It seems to be a plausible explanation but not the ultimate solution of the problem.

High U content in soil and groundwater is harmful for human beings as well as flora and fauna of Punjab due to its radiological and chemical toxicity. The survey conducted by BARC and GNDU teams have confirmed that 50% samples are unfit for human consumption due to excess amount of U and heavy metals like Arsenic, Cadmium, Nickel, Manganese and Barium. It is recommended that canal water may be used as potable water in water supply schemes of Punjab, as its U content is much lower than U content of the ground water. The second alternative is installation of RO (reverse osmosis) system to remove toxic elements (U and heavy metals) from water supply lines using underground water. Punjab has opted for both these alternatives in Malwa belt.

During 1950s, prior to Green Revolution in Punjab, the landscape was looking like a desert dotted with sand dunes right up to the foot hills of Siwalik range. But the water table of this sandy desert was quite shallow with depth of aquifer varying from 5 to 10 meters in most of the districts. During Monsoon months, it rose up to 1 meter within the top surface layer. Green

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revolution brought prosperity to Punjab but at what cost? As reported in The Tribune of 1st June, the ground water table has been depleted to 50-60 meters in most of the districts, except some blocks of Muktsar, Faridkot and Ferozepur districts where water-logging has created another havoc. Punjab has the highest density of Tube-wells in India reaching a figure of12.7 lakh, with nearly 50% of submersible variety capable of depleting water table up to 100meters depth and beyond. Manohar Singh Gill (Ex-MP Rajya Sabha) has highlighted this problem and its impact on marginal farmers in his article published in Indian Express (also reported in The Sikh Review, May 2016). It is in the air that Punjab Govt. has already approved the sanction of 1.25 lakh new Tubewell connections keeping in view the vote-bank politics of Punjab.

The Ministry of Drinking Water and Sanitation under National Rural Drinking Water Programme has provided online data for whole of Punjab (www.-indiawater.gov.in/imiswebReports) where water quality of each village is reported. There is another online facility provided by Central Ground Water Board, Ministry of Water Resources, and Govt. of India, which provides the nature of geomorphology and geohydrology data of Punjab at Block level (*cgwb.gov.in/gw_profiles/-st_Punjab.htm).* A clear WARNING has been issued to Punjab Govt. for restricting the number of Tubewells and shifting to Canal irrigation, to avoid further depletion of Water Table in Punjab.

A simple solution to the problem is also suggested: (i) promote Organic farming in Punjab, (ii) stop free supply of power to Tubewells, and (iii) adopta cropping pattern which breaks the wheat-paddy cycle. By our actions, we shall bring back desert conditions in Punjab in next 50 years; with hardly any hope of survival for future generations in Punjab. Clock is ticking fast for Punjab to act, otherwise the backbone of Punjab, its peasantry, will be destroyed!

I am reminded of a couplet of Oliver Goldsmith in his celebrated poem “The Deserted Village”:

Ill fares the land, to hastening ills a prey,
Where wealth accumulates, and men decay:
Princes and lords may flourish, or may fade—
A breath can make them, as a breath has made:
But a bold peasantry, their country’s pride,
When once destroyed, can never be supplied.

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Examine Sustainable Urban Space based on Compact City Concept

By Hsueh-Sheng Chang & Tzu-Ling Chen
National Cheng Kung University

Abstract- The concept of compact city has been evolved through the time, the urban development phase, and the advanced technology. Traditional compact city measurement categorized cities according to the compactness based on single-core urban development. However, the outward extension of city become multi-core and such urban pattern might need to be re-examined for sustainable development. Housing price to income ratio is a popular indicator to assess the livability in such compact city. Therefore, this study applies temporal section analysis to explore urban compactness in 1995 and 2006 in Taipei metropolitan area, Taiwan. The principle component analysis will be utilized to classify compact city types according to the urban development features. Moreover, geographical weighted regression will then be used to explore the effect of urban compact features on house price-income ratio. The PCA results show that the improved urban functions in high-medium compact city while the medium-low compact cities remain the same. The GWR results show that the higher mixed land use might attract more diverse industries which can increase household income and mitigate housing pressure.

Keywords: compact city, principle component analysis (PCA), geographically weighted regression (GWR, house price income ratio (PIR).

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EXAMINESUSTAINABLEURBANSPACEBASEDONCOMPACTCITYCONCEPT

Strictly as per the compliance and regulations of:

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Keywords: compact city, principle component analysis (PCA), geographically weighted regression (GWR, house price income ratio (PIR).

I. Introduction

The United Nations Conference on Environment and Development (UNCED) in 1992 recommended compact urban patterns with high density and mixed land use as ways to control urban sprawl and save energy (Mindali et al., 2004). The concept of compact city has been practiced to single-core urban area to encourage the aggregation tendency from periphery to downtown area (Breheny, 1995). The concept of compact city has evolved from the beginning the protection of environment and agricultural land to contemporary livability and diversity. With the challenges of global climate change and energy crisis, compact city become paradigm to integrate economic development, urban reconstruction and growth adaptation. Previous studies emphasized comprehensive analysis comparing city compactness (Burton, 2002; Thinh et al., 2002; Kasanko et al., 2006; Schneider and Woodcock, 2008). However, the results might able to cluster the cities but unable to sketch out the interaction within cities accurately.

Many measurements have been proposed to analyze the physical environment and urban function of compact city. Li and Yeh (2004) used landscape fragmental index to analyze the physical pattern of compact city. Burton (2002) constructed three dimensional indicators including density, mixed, and intensity to analyze urban function. The application of compact city measurement can help to categorize cities according to the compact degree but ignore other urban development features. In fact, urban development might be varied for different location, terrain, scale or industry (Catalan et al., 2008). The combination of natural resource, industrial type, technical progress might construct various compact city types. Therefore, the single measurement of city compactness should be the first step to detect the compact city, and there is necessary to apply other measurement to explore the relationship between compact city and urban feature.

With the completeness of compact city concept, there are four aspects altitude, density, efficiency, and flexibility (Dantzig and Saaty, 1973 ; Burton, 2002).High density urban space, clustered economic effect, the decrease of travel distance and high efficiency urban development might help to practice sustainable development. However, high population density and intensified activities have already impacted livability seriously such as congestion (Breheny, 1995; Balcombe and York, 1993) and the increment of crime ratio and housing price (Lin and Yang, 2006). According to the statistic of Ministry of Interior, the housing price has increased 20% in the past 10 years while the household income has only increased 5%, such housing price to income ratio (PIR) has indicated the decrease of livability in urban space.

Compact city pattern has way beyond single-core aggregation to disperse multi-core connection. Therefore, this study attempts to categorize urban space according to the urban features. Furthermore, the limited urban space with increasing population emigration might impact urban livability while such impact might be varied due to the compact city pattern. Firstly, this study applies principle component analysis (PCA) to analyze compact city pattern and the change tendency in two different time periods. Next, the impact of housing price to income ratio (PIR) is then discussed by using geographical weighted regression (GWR). Section 2 presents the evolution process of compact city. Sections 3 and 5 discuss the methodology and results. The paper concludes in the last section.

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II. The History of Compact City Concept

The concept of compact city has evolved. The original concept of compact city is the protection of natural environment and agricultural land from urban expansion. Recently, compact city has become a measurement to fight against global climate change and energy crisis. The followings are the evolution of compact city (OECD, 2012).

a) The emergent compact city

The ancient compact city emerged in the Middle Ages. Residents got well protected inside the wall which become an ancient compact city pattern. However, the eighteen-century Industrial Revolution and large amount of people moved into cities had radical impacts on the wall.

b) Improve living condition in urban space

In eighteen- and nineteen- century, large-scale urbanization has cut down open spaces. In addition, insufficient public facilities were unable to process sewage water and garbage and resulted in serious public health issue. During that time, garden city proposed by Ebenezer Howard and radiant city proposed by Le Corbusier had become the transforming compact city. Such buffer zone of urban environment and natural environment has contentedly become the core of urban planning in England, Japan, Hong Kong, and other countries (UK Department of the Environment, 1995; Kuhn, 2003; Tang et al., 2007; Kim, 2010).

c) The emphasis of diversity and livability

After 1960, livability became an important issue in urban planning field. The green buffer zone is not only a segregation of urban space and natural environment but open space and leisure. In addition, the vitality of urban activities and mixed land use might improve livability in urban space (Jacobs, 1962). Until Dantzig and Saaty (1973), compact city has finally addressed with high density development and avoiding excessive urban sprawl.

d) Urban sustainability and green growth

Green Paper on the Urban Environment (Commission of the European Communities, 1990) indicated that compact city is one of the planning measures to achieve sustainable development. In fact, the compact city not only achieve sustainability but satisfy multiple purposes such as the clustered economic effect, the decrease in travel distance and urban efficiency (Thomas and Cousins, 1996; Churchman, 1999).

III. Methodology

a) Study area

This study subjects to Taipei metropolitan area as the study area where has been regarded as the 46th metropolitan area in the world, 40% entire population clustered in 3,700 km2 (see Fig.1). Large amount population and industries aggregation extends the development area and become multi-core metropolitan area.

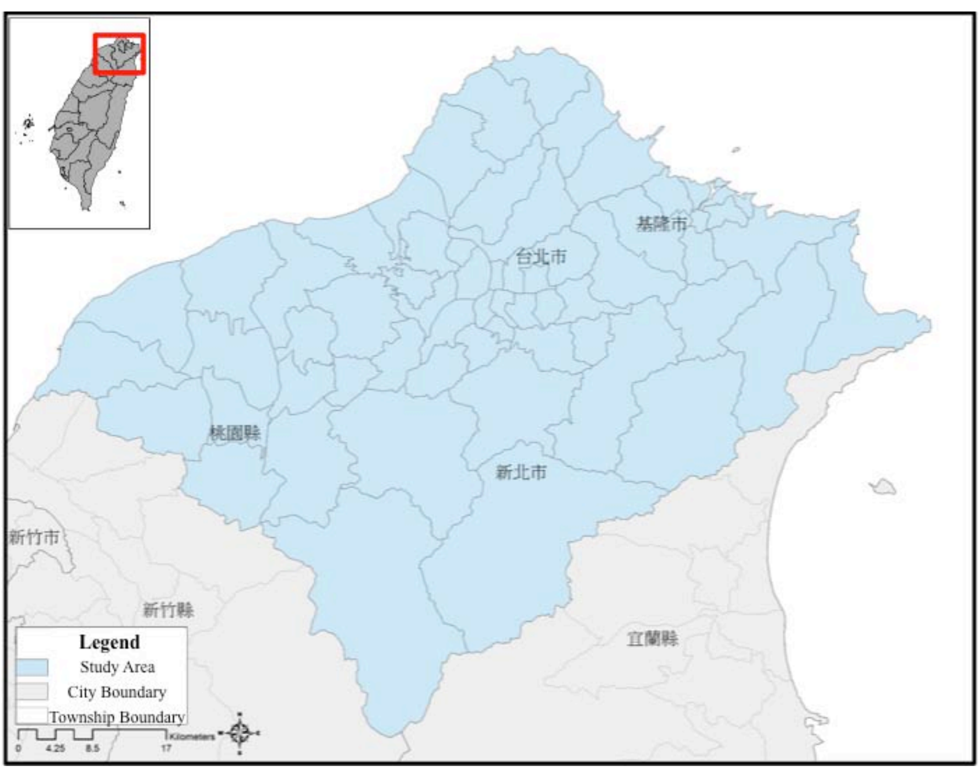

Fig. 1 : Study area

b) *Variables*

i. *Compact measurement*

Previously, the measurement of compact city emphasized various dimensions such as Thinh et al. (2002) discussed compact city based on the spatial distribution of built enviroment, Li and Yeh (2004) focused on the urban physical pattern, and Burton (2002) considered diverse urban development aspects including density, mixed use, and intensity. Due to the compact city indicators proposed by Burton having a comprehensive consideration of urban development, this study follows Burton measurement to do the rest measurement. In addition, this study follows the principles representativeness, relation, and in consistency to Taiwan feature to select the variables. (See Table 1)

Table 1 : Variables in compact measurement

Variables		Description	Resource
Density	Population density	Population/Area	Urban and Regional Development Statistics
	Sub-core population density	The highest population density of village/ Village area	Household Registration Division
	Building density	Householdamount/ Developmental land area	National Land Surveying and Mapping Center, the Census Administration
	Residential density	Residential area/ Total area	
Mixed use	Facilities	Residential area/ Non-residential area	
	Mixed land use	(Residential area+ Commercial area+ Industrial area)/ Total area	
	Employment	1-[(Local employment in tertiary industrial sectors/ Local population)-(Taiwan employment in tertiary industrial sectors/ Taiwan population)]	Commerce and Service Census
Intensity	The increment of population density in sub-core	[(2006 population density – 2005 population density)/ 2005 density]×100%	Household Registration Division
	Population increment	(2006 population – 2005 population)/ Total population	

ii. *Urban feature*

Three categories have been defined to discuss urban feature urban development, economic development, and population distribution. The variables in urban development include residential area, commercial area, industrial area, and public infrastructure area. The variables in economic development include employment in manufacturing sector, construction sector, transportation sector, and tertiary sector. The variables in population distribution include population density, household amounts per hectare, and the ratio of population increment. (See Table 2)

Table 2 : Variables in urban development feature

Category	Variables	Source
Urban development	Residential area	National Land Surveying and Mapping Center (1995 and 2006)
	Commercial area	
	Industrial area	
	Public infrastructure area	
Economic development	Employment in manufacturing sector	Commerce and Service Census (1996 and 2006)
	Employment in construction sector	
	Employment in transportation sector	
	Employment in tertiaryindustrialsector	
Population distribution	Population density	Household Registration Division (1995 and 2006)
	Household amounts per hectare	
	The ratio of population increment	

iii. *Housing price to income ratio (PIR)*

Housing price to income ratio is often used in assessing the affordability of housing, and such measurement has been regularly used in The Economist and the OECD Economic Outlook (Chen et al., 2007; Zhang and Zhang, 2011; André et al., 2014). The measurement is the total house price divided by household income, and the higher value indicates the housing prices outpacing household income growth, and vice versa. The annual real estate market price and average household income of township from the Department of Land Administration, Ministry of Interior have been adopted in this study.

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c) Methods

i. *Principle component analysis (PCA)*

A linear transformation is processed in principle component analysis (PCA) from a series of correlated variables to uncorrelated principle components based on multivariate analysis (Sun et al., 2009; Abdi and Williams, 2010; Shi, 2013). Through the process, the first principle component (PC) is designed to have the largest variance, and the ranking of PCs is according to eigenvalues. The following is the PCA formula:

$$\begin{cases} U_1 = l_{11}x_1 + l_{12}x_2 + \cdots + l_{1p}x_p \\ U_2 = l_{21}x_1 + l_{22}x_2 + \cdots + l_{2p}x_p \\ \cdots \\ U_m = l_{m1}x_1 + l_{m2}x_2 + \cdots + l_{mp}x_p \end{cases} \quad (1)$$

where *n* denotes to spatial units, *p* denotes the number of variables, x_p denotes the original variables, and U_m denotes principle components. U_1, U_2, …,U_m (m≤p) are linear combinations of x_p.

ii. *Geographically weighted regression (GWR)*

Ordinary Least Squares (OLS) is one of the conventional global regression models to analyze the pattern of the data by fitting a model to the observed data (Hutcheson and Moutinho, 2008; Hutcheson, 2011). However, conventional global regression models ignore spatial heterogeneity and summarize across the entire area. In fact, many processes are spatial heterogeneity and might produce various responses (Fotheringham et al., 2002). However, geographically weighted regression is an increasingly popular method of analyzing spatial heterogeneity in urban geographic analyses (Lafary et al., 2008).

In order to identify the spatial relationships between urban compactness and housing price to income ratio (PIR), this study applies GWR model. The following is the GWR model:

$$y_i = \beta_0(u_i, v_i) + \sum_k \beta_k(u_i, v_i)x_{ik} + \varepsilon_i \quad (2)$$

where (u_i, v_i) refers to the coordinate location of each observation *i* in a space, β_0 and β_k are estimated parameters, and ε_i is the random error at *i*.

Bandwidth selection is important in GWR model, and there are two measures: a fixed-distance kernel and an adaptive kernel. A fixed-distance kernel indicates a constant radius while an adaptive kernel indicates a constant number of neighbors. Due to the wide range of spatial units, the application of adaptive bandwidth might be more appropriate. In addition, there are two ways to measure the number of neighbors: cross-validation (CV) and the Akaike information criterion (AIC). Both measures will be applied and compared to determine the appropriate bandwidth.

The following is the adaptive Gaussian kernel:

$$\begin{cases} w_{ij} = \exp\left[-\frac{1}{2\left(\frac{d_{ij}}{b}\right)^w}\right], when\ d_{ij} \le b \\ w_{ij} = 0, when\ d_{ij} > b \end{cases} \quad (3)$$

where d_{ij} refers to the spatial distance between observations, and b refers to the bandwidth of variables.

IV. Results

a) Cross analysis of urban compactness in 1995 and 2006

According to the compact measurement, both the high density and intensity are extended outward and they are increasing in both periphery townships, and the mixed-use degree remains high and increasing. The cross analysis of compact degree in 1995 and 2006 shows that there are four types of compact city pattern in Taipei metropolitan area including high compact, medium compact, low compact, and special urban development. (See Fig. 2)

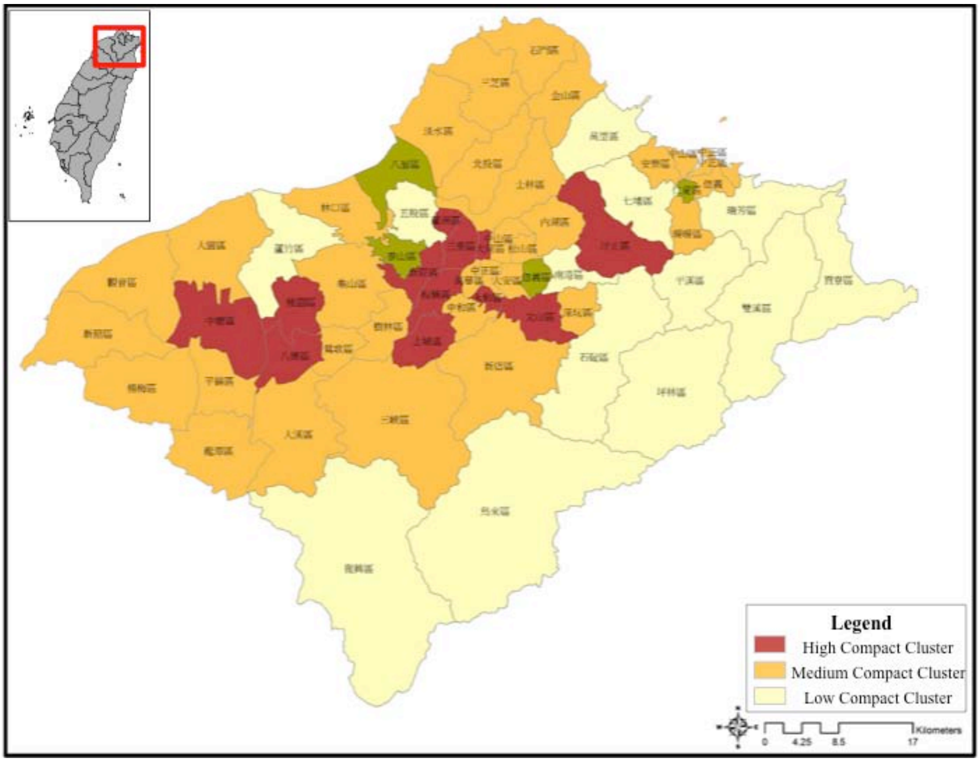

Fig. 2 : The cross analysis of urban compactness in 1995 and 2006

b) Category of urban feature

This study further applies principle component analysis (PCA) to various compact clusters. In high compact cluster, the results show that industrial activities are the main development feature in 1995. Nevertheless, it has become much diverse in 2006. In addition, the significance of public infrastructure and transportation in 2006 indicates that the improved accessibility and convenience in high compact cluster.

Table 3 : Component matrix of high compact cluster

Urban Development Feature	1995		2006	
	PC1	PC2	PC1	PC2
Residential area	-0.336	0.900	0.851	0.490
Commercial area	-0.095	0.422	0.789	0.230
Industrial area	-0.705	0.679	0.931	-0.262
Public infrastructure area	0.009	0.367	0.111	0.920
Employment in manufacturing sector	-0.759	0.147	0.667	-0.438
Employment in construction sector	0.649	-0.050	-0.085	0.370
Employment in transportation sector	0.535	-0.205	-0.424	0.716
Employment in tertiary industrial sector	0.724	-0.147	-0.670	0.335
Population density	0.322	0.312	-0.158	-0.141
Household amounts per hectare	0.637	0.167	-0.024	-0.399
The ratio of population increment	-0.666	-0.723	-0.241	0.034
Eigenvalue	3.379	2.320	3.391	2.342
Proportion (%)	30.715	21.086	30.825	21.289
Cumulative (%)	30.715	51.801	30.825	52.114

In medium compact cluster, population aggregation seems to be the reason of the compact development for “employment in tertiary industrial sector”, “population density”, “household amounts per hectare”, “residential area”, and “industrial area.” In 2006, industrial development is still the main driving force of such compact pattern but attracts commercial activities and public infrastructure.

Table 4 : Component matrix of medium compact cluster

Urban Development Feature	1995		2006	
	PC1	PC2	PC1	PC2
Residential area	0.138	0.847	0.785	0.196
Commercial area	0.582	0.088	0.769	0.225
Industrial area	-0.651	0.686	0.412	0.906
Public infrastructure area	-0.088	0.561	0.917	-0.086
Employment in manufacturing sector	-0.686	0.343	0.273	0.744
Employment in construction sector	0.457	-0.312	-0.466	-0.125
Employment in transportation sector	0.066	-0.413	-0.266	-0.161
Employment in tertiary industrial sector	0.698	-0.185	-0.076	-0.758
Population density	0.701	0.027	-0.022	-0.395
Household amounts per hectare	0.643	-0.155	-0.122	-0.442
The ratio of population increment	-0.696	-0.425	0.158	0.129
Eigenvalue	3.349	2.135	2.627	2.455
Proportion (%)	30.442	19.409	23.885	22.320
Cumulative (%)	30.442	49.849	23.885	46.206

In low compact cluster, both urban development features in 1995 and 2006 are similar. The comprehensive development for "residential area", "commercial area", "industrial area", "public infrastructure area", "employment in manufacturing sector", "household amounts per hectare" and "the ratio of population increment" are positively significant in both years.

Table 5 : Component matrix of low compact cluster

Urban Development Feature	1995		2006	
	PC1	PC2	PC1	PC2
Residential area	0.756	-0.265	0.877	0.376
Commercial area	0.841	0.083	0.810	0.002
Industrial area	0.921	-0.270	0.999	0.039
Public infrastructure area	0.671	-0.242	0.763	0.637
Employment in manufacturing sector	0.610	-0.285	0.833	0.047
Employment in construction sector	-0.412	-0.181	-0.413	-0.013
Employment in transportation sector	0.321	-0.527	0.291	-0.359
Employment in tertiary industrial sector	-0.493	0.606	-0.761	0.060
Population density	0.437	0.036	0.436	0.717
Household amounts per hectare	0.036	0.994	-0.014	0.673
The ratio of population increment	0.125	0.815	0.832	0.150
Eigenvalue	3.674	2.621	5.417	1.673
Proportion (%)	33.398	23.827	49.245	15.205
Cumulative (%)	33.398	57.225	49.245	64.450

V. Spatial Heterogeneity of Compact City and PIR

This study compares traditional ordinary least square (OLS) and geographically weighted regression (GWR) to see if there is any spatial heterogeneity. The result shows that R square is higher and AICc value is lower in GWR suggested that GWR has better explanation for considering spatial heterogeneity. (See Table 6)

Table 6 : ANOVA of OLS and GWR

Item	OLS	GWR
AICc	254.084	133.11
Adjusted R^2	0.479	0.918

The significant spatial scale dependence occurs in the relationships between urban compactness and PIR. At a spatial scale of 25 neighbors, the AICc value has the lowest value. Therefore, 25 neighbors has become the acceptable bandwidth to model the relationship between compact city and PIR.

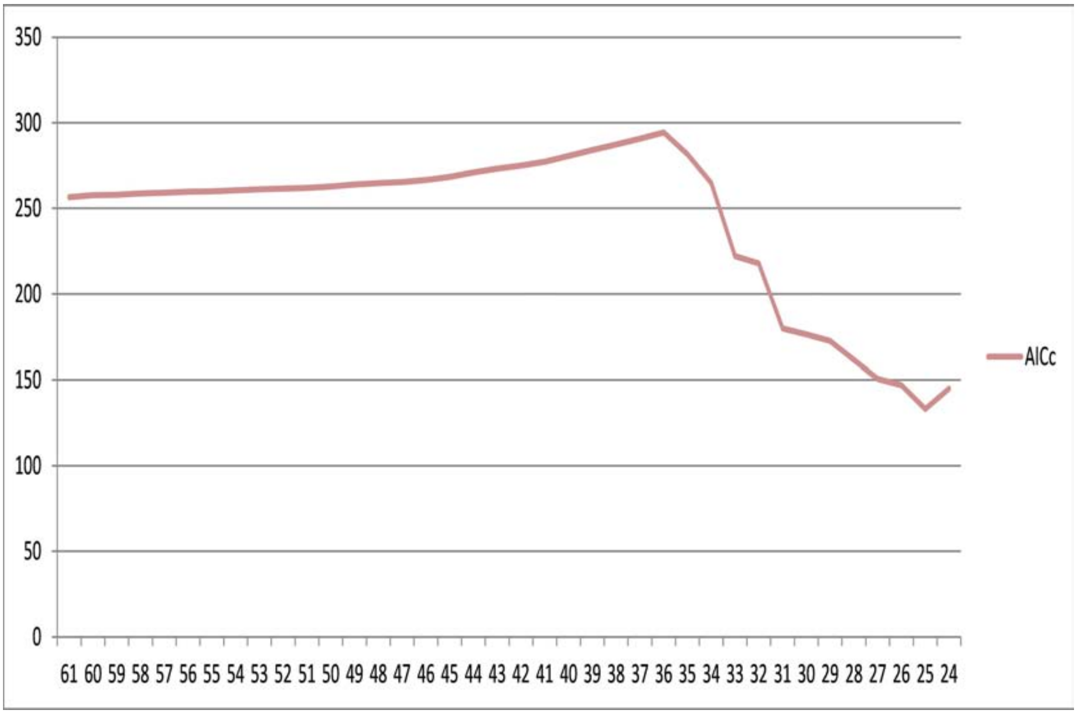

Fig. 3 : The bandwidth and AICc value

The study investigates the varying relationship between urban compactness and PIR based on the slope parameters (β coefficients) and local R^2. The coefficient represents the intensity on such relationship. The local R^2 ranges from 0 to 1 measuring the fitness of the model. The average local R^2 is 0.784, and the western study area has relatively higher local R^2 suggested a better-fit model. The Monte Carlo test shows that all variables except "facilities", "the increment of population density in sub-core", and "population increment" are significant. (See Table 7 and Fig. 4)

Table 7 : The AICc value, adjusted R^2, and Monte Carlo test in GWR

	AICc	Adjusted R^2	Monte Carlo Test	
			Slope	Intercept
Population density	270.073	0.231	-3.031	***
Sub-core population density	262.735	0.319	1.462	***
Building density	273.111	0.212	0.699	***
Residential density	271.802	0.231	5.055	***
Facilities	279.203	0.071	-1.144	-
Mixed land use	264.326	0.459	-0.743	***
Employment	273.979	0.205	-1.94	**
The increment of population density in sub-core	280.231	0.079	0.408	-
Population increment	279.596	0.052	0.293	-

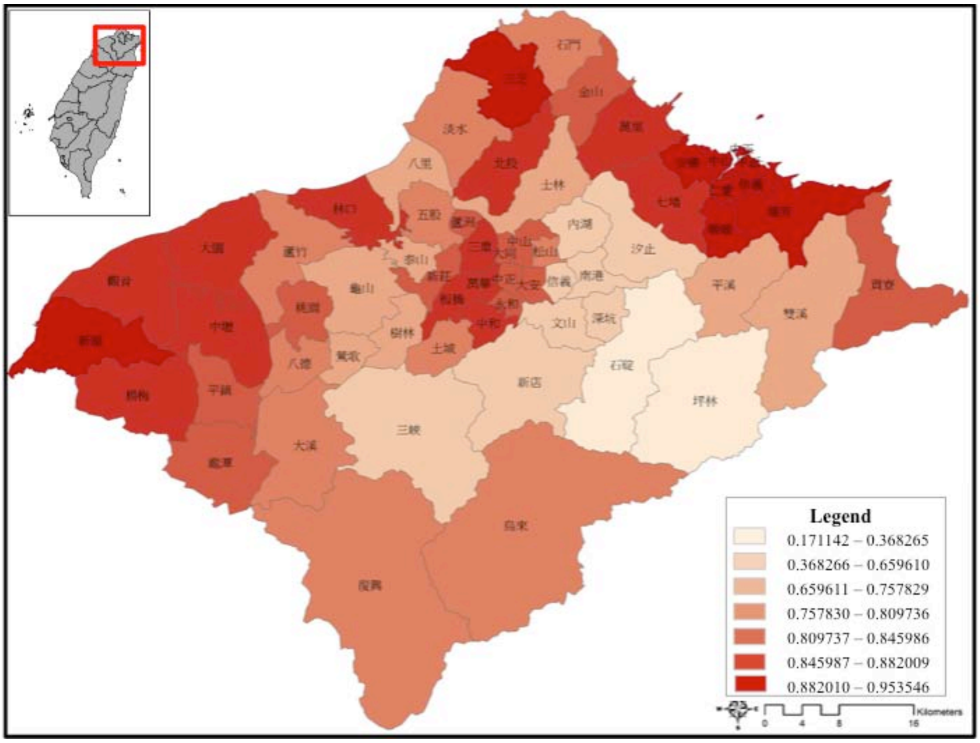

Fig. 4 : The spatial distribution of local R^2

a) The impact of population density to PIR

The average coefficient value in population density is -3.066 indicating a negative relationship between population density and PIR. However, in the city center and the eastern area have relatively positive effect suggesting a relative high housing price.

b) The impact of sub-core population density to PIR

The average coefficient value in sub-core population density is -0.02 indicating a negative relationship between sub-core population density and PIR. Only western districts and some southern districts have positive effect while those districts are sub-core area in practice. Therefore, the increment of population might have relatively impact on the housing price and further increase the pressure on house affordability.

c) The impact of building density to PIR

The average coefficient value in building density is 2.187 indicating a positive relationship between building density and PIR. Only partial districts show negative effect for relatively lower built environment in the southern districts and rapid developing in city center. In rapid development districts, the increment of building density is able to mitigate the housing affordability.

d) The impact of residential density to PIR

The average coefficient value in residential density is 2.184. The study area except the eastern districts show positive effect indicating the higher residential density equals to the higher housing demand and might result in an increasing pressure in housing affordability.

e) The impact of mixed land use to PIR

The average coefficient value in mixed land use is -0.776and all the study area show negative relationship between mixed land use and PIR. The increment of mixed land use is not only improving livability but increasing local employment. The satellite town is able to stabilize housing affordability.

f) The impact of employment to PIR

The average coefficient value in employment is 0.106. The study area except the eastern districts show negative relationship between employment and PIR. The increment of employment indicates a more mixed land use pattern and such economic development might mitigate housing affordability by providing more housing units and increasing household income.

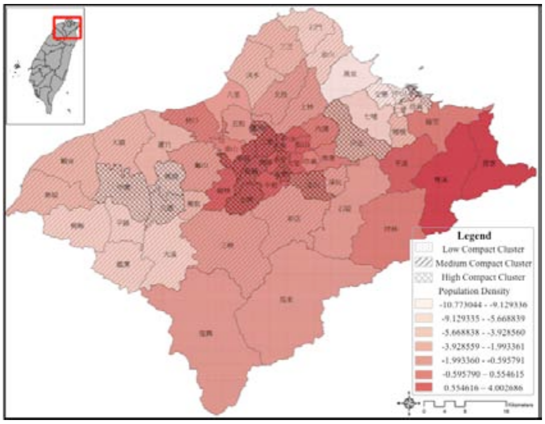

Fig. 5 : Population density

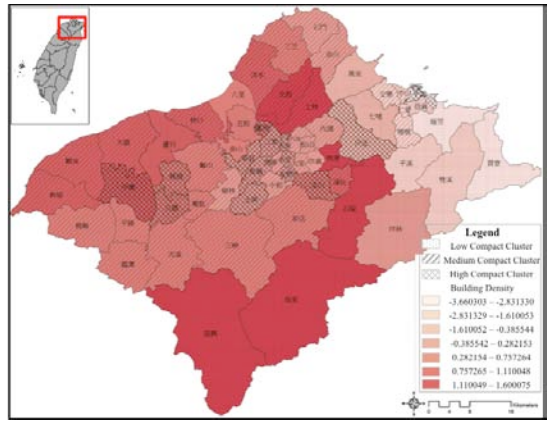

Fig. 6 : Sub-core population density

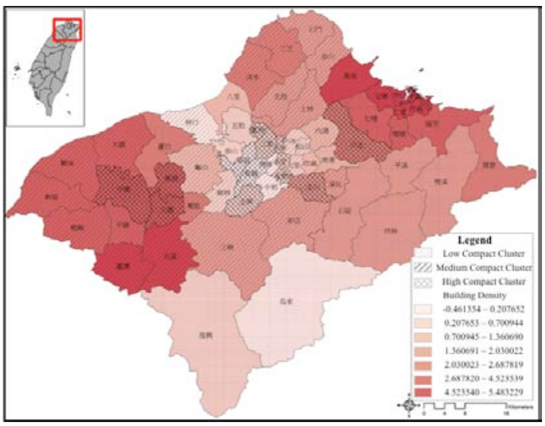

Fig. 7 : Building density

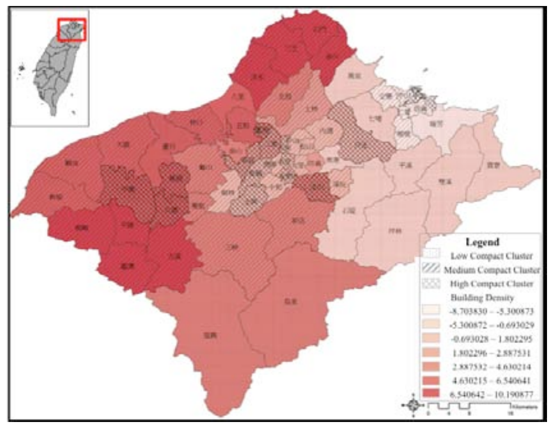

Fig. 8 : Residential density

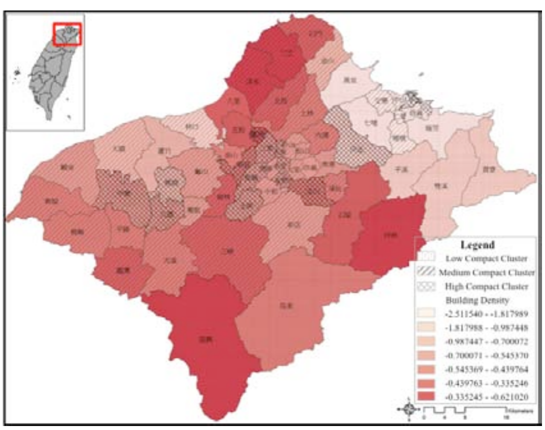

Fig. 9 : Built environment

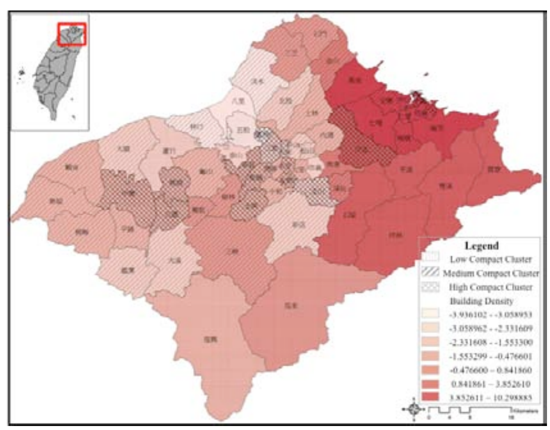

Fig. 10 : Employment

VI. Conclusions

This study discusses beyond categorization of urban compactness but comparing urban compactness across different time periods. The results show that high compact cities show an improvement on public infrastructure and become more livable. Medium and low compact city stay similar urban features such as manufacturing and residential. In addition, the results of GWR show various relationships between urban compactness and PIR. Among them, population density, building density, residential density have positive effect indicating the more people aggregate might increase the housing pressure. On the contrary, mixed land use and employment have negative effect indicating a more mixed-use environment might attract diverse industries to increase household income.

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Natural Uranium Content in Ground Waters of Mohaliand Fatehgarh Districts of North Punjab (India) for the Assessment of Excess Cancer Risk

By Hardev Singh Virk, Rajan Jakhu & Pargin Bangotra
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GJHSS-B Classification : FOR Code: 960406

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Strictly as per the compliance and regulations of:

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Hardev Singh Virk [α], Rajan Jakhu [σ] & Pargin Bangotra [ρ]

Abstract- LED Fluorimeter has been used to measure the uranium content of the ground water samples of Mohali and Fatehgarh districts of North Punjab (India).33 locations have been selected for the present investigation. The aim of this study is to investigate the uranium content of the ground water in Northern districts of Punjab for sake of comparison with its occurrence in Southern districts of Punjab; and to assess the radiological and chemical risk due to the uranium present through ingestion. The uranium concentration of the water samples of the studied villages varies from 0.63 to 57.82 μgl^{-1} with an average value of 16.93 μgl^{-1}.Theuranium content of all the samples in groundwater lies within the safe limit of 60 μgl^{-1}(ppb) of uranium proposed by AERB, India.

I. Introduction

The presence of natural Uranium in rocks, soils, plants and even in sea water makes its transportation easy in the environment. The rocks of the particular area are the prime source of the uranium to the environment. The solubility of the uranium in water in hexavalent (U^{6+}) form and to precipitate as a discrete mineral in tetravalent (U^{4+}) form, the uranium got deposited in the earth's surface provided to the favorable geological or environmental conditions. Surface water and especially ground water plays a vital role in the migration and redistribution of the nuclides in the earth's crust. Uranium present in water is transferred to plants and hence it enters the food chain and it becomes a source of health hazard to the humans. The World Health Organization recommended a reference level of the permissible limit of Uranium in drinking water 30 $\mu g\ l^{-1}$ (WHO) [1]. The accumulation of the uranium inside the human body results in its chemical and radioactive effects for two important target organs being the kidneys and lungs [2 - 4]. Uranium and radium have the bone seeking properties hence the kidneys, liver and the bones become the principle sites of deposition. The toxicity of uranium depends upon many factors like the route of exposure, particle solubility, contact time, and route of elimination [5]. Drinking water is the major source of the uranium to the human body. Drinking water contributes about 85% and food contributes about 15% of ingested uranium [6]. An exposure of about 0.1 mg/kg of body weight of soluble natural uranium results in transient chemical damage to the kidneys [7]. Uranium is a radioactive heavy metal, it decays into many other radioactive metals or gases which can further become a health hazard [8]. Though Uranium is a weak radioactive metal, if uranium content of the drinking water is high it may be hazardous. Due to high concentration of uranium in water and its extent of getting ingested into human body, the assessment of risk of health hazards are important. Uranium estimation of water systems of the Punjab State and the neighboring areas has been reported by some workers [9 - 15]. The objective of present investigations is health risk assessment due to natural uranium in drinking water in Mohai and Fatehgarh districts of North Punjab.

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II. The Study Area

a) Location

S.A.S Nagar (Mohali) district is located in the eastern part of the Punjab state and lies between North latitudes of 30°21´00" and 30°56´00" and East longitudes of 76°30´00" and 76°55´00" covering a geographic ambience of 1189 sq.km. The district is bounded by Patiala and Fatehgrah Sahib districts in the south-west, Ropar district in the northwest, Chandigarh and Panchkula in the east and Ambala district of Haryana state in the south. Fatehgarh Sahib district is located in southeastern part of Punjab state and lies between 300 25' 00" to 300 45' 45" north latitude & 760 04' 30" to 760 35' 00" east longitude covering an area 1147 sq. km.

b) Geomorphology and Soil types

The area can be broadly grouped into two depending upon its geomorphic features as alluvial fan and alluvial plains. Alluvial fans are deposited by hill torrents with a wavy plain rather than a steep slope. Adjacent to the alluvial fan are the alluvial plains which forms a part of large Indo-Gangetic Quaternary basin

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comprises of thick sand and silty sand layers inter-bedded with silt and clay beds. The alluvial plains are of vital economic value as it supports the dense population of the district. The soils are mainly developed on alluvium under the dominant influence of climate followed by topography and time. The major soil type of the district is weakly solonized tropical arid brown soils. In Fatehgarh Sahib district,the soils are loamy sand at the surface and calcareous sandy loam in subsurface layers. Sand constitutes 80% in the soil profile, silt constitutes 11%, and clay 9% in the soils.

III. METHODOLOGY

a) Sampling

Sample collection was done in both the districts in a contiguous area starting from Mohali tehsil, then entering Fatehgarh tehsil and winding up in Mohali in a circular loop. Before collecting the sample, we run the hand-pump or motor for few minutes and then collected the samples in the pre-processed bottles after rinsing twice with the water to be collected. Samples were filtered with 0.45 micron filter paper. The samples were analyzed within a week.

b) LED Fluorimeter

Quantalase has developed Fluorimeters which use banks of pulsed LEDs to excite fluorescence in sample under study. The wavelength, pulse duration and peak power of the LED output can be set to match the excitation requirements of the sample. The fluorescence is detected by a pulsed photomultiplier. Suitable filters after the LEDs and before the photomultiplier tube prevent LED light from reaching the photomultiplier tube directly. The filters can be broadband coloured glass filters or multilayer narrow band filters. The instrument is controlled by a microcontroller which pulses the LEDs and photo-multiplier tube. The microcontroller also controls the ADC which convert the fluorescence signal from photomultiplier to digital form for further processing. A single board computer averages the photomultiplier output over 2000 pulses and carries out any calculations necessary. A touch screen display permits the operator to set necessary parameters and also display the fluorescence measurement.

c) Calibration of Fluorimeter

Standard solution of Uranium is used to calibrate LED Fluorimeter. The instrument was calibrated in the range of 1-100 ppb using a stock solution of standard which was prepared by dissolving 1.78g uranyl acetate dehydrate ($(CH_3\ COO)_2\ UO_2.2H_2O$) in 1L of Millipore elix-3 water containing 1ml of HNO_3. The blank sample containing the same amount of fluorescing reagent was also measured for the uranium concentration. 5% phosphoric acid in ultra-pure water was used as fluorescence reagent. All reagents used for experimental work were of analytical grade.

d) Preparation of FLUREN (Buffer Solution)

Weigh 5gms of Sodium Pyrophosphate powder and add it to a flask/plastic bottle. Add 100ml. of double distilled water and shake well to dissolve the Sodium Pyrophosphate powder. Add Ortho-phosphoric acid drop by drop while monitoring the pH of solution until a pH of 7 is reached. This is the desired buffer solution, also called FLUREN.

Adding buffer solution to a uranium sample increases the fluorescence yield by orders of magnitude. It is recommended that 1 part of buffer solution be added to 10 parts of uranium sample solution and this mixture be used for measurements.

e) Analytical Procedure

A water sample of quantity 6ml is used to find its uranium content. The water sample is taken in the clean and dry quartz cuvette made up of ultrapure fused silica. The instrument was calibrated with the standard uranium solution of known activity. The water sample of quantity 6 ml is mixed with 10% of the buffer solution. Buffer solution is made from sodium pyrophosphate and orthophosphoric acid of pH 7. Buffer solution is used to have the same fluorescence yield of all the uranium complexes present in the water.

The concentration of the uranium in the water sample is calculated as follows:

$$\text{Calibration factor CF} = \frac{\text{Concentration of Uranium in standard solution}}{\text{Fluorescence of standard} - \text{Fluorescence of water}}$$

$$\text{Concentration of uranium in water sample} = \text{CF x (Fluorescence from sample} - \text{Fluorescence from water)}$$

All these calculations are done by the instrument itself. The instrument averages the fluorescence for 256 pulses and displays the average value of U concentration in the sample.

f) Theoretical Formulation

Ingestion of the uranium through drinking water results in both radiological risk (carcinogenic) and chemical risk (non-carcinogenic). The methodology used for the assessment of the radiological and chemical risk due to uranium concentrations in the water samples is described below:

g) Radiological risk assessment

Calculation of Excess Cancer Risk:Excess cancer risk from the ingestion of natural Uranium from the drinking water has been calculated according to the standard method given by the USEPA [17].

$$ECR = Ac \times R$$

Where 'ECR' is Excess Cancer Risk, 'Ac' is Activity concentration of Uranium (Bql-1) and 'R' is Risk Factor.

The risk factor R (per Bq l^{-1}), linkedwith ingestion of Uranium from the drinking water may be estimated by the product of the risk coefficient (r) of Uranium (1.19×10^{-9}) for mortality and per capita activity intake I.'I' for Uranium is calculated as product of life expectancy as 63.7 years, i.e. 23250 days and daily consumption of water as 4.05 $lday^{-1}$ [18].

$$I = 4.05\ \text{lday-1} \times 23250\ \text{days}$$

$$\text{Risk Factor (R)} = r\times I$$

h) Chemical Risk Assessment

The chemical toxicity risk for Uranium is defined in terms of Lifetime Average Daily Dose (LADD) of the uranium through drinking water intake. LADD is defined as the quantity of the substance ingested per kg of body weight per day and is given by the following equation [19, 20].

$$\text{LADD} = \frac{C \times IR \times ED \times EF}{AT \times BW\ X\ 365}$$

Where 'C' is the concentration of the uranium(μgl^{-1}), IR is the water consumption rate (4.05 $lday^{-1}$), ED is the lifetime exposure duration (63.7 years), EF is the exposure frequency (365 days y^{-1}), BW is average body weight of the receptor (70kg), and AT is the Averaging time i.e. life expectancy (63.7 years).

i) Calculation of Hazard Quotient

Hazard quotient (HQ) is the measure of the extent of harm produced due to the ingestion of uranium from the drinking water.

$$HQ = \frac{LADD}{RfD}$$

Where, LADD is Lifetime Average Daily Dose; RfD is the reference dose = 4.53 μg $kg^{-1}day^{-1}$.

IV. Results and Discussion

Groundwater samples were collected from villages falling under Mohali and Fatehgarh Tehsils of both these districts of Punjab (India) and analysed for Uranium content using calibrated LED Flourimeter (Quantalase Make). Uranium content varies from 0.63 ppb (RO filtered water) to 24.20 ppb (Motor Driven Pump) in Mohali district. In Fatehgarh district, the U content varies from 2.14 ppb (RO System in Reona) to 57.82 ppb for a deep bore Tubewell in Banda Bahadur Engg. College Campus. In Badali Mai Ki village, U content in water of hand pump is 17.22 ppb while it is below detection limit (BDL) in RO filtered water being supplied to the village. It clearly proves that RO System is highly efficacious for getting rid of Uranium from groundwater in Punjab. The safe limit of uranium in groundwater is fixed to be 60 ppb by AERB [21] in India, while other agencies fix it in much lower limits of 30 ppb (EPA, USA)[17]; 15 ppb (WHO)[1]; 9 ppb (UNSCEAR)[22] and 1.9 ppb (ICRP) [23]. If the observed data of uranium content of water (Table 1) is compared with the guideline of AERB, none of the samples record higher than 60 ppb, hence qualify the safe limit certification of AERB, Government of India.

a) Radiological risk

In the present investigation, uranium content of the ground water samples of the Mohali and Fatehgarh districts of North Punjab has been measured and further analysis has been carried out for the excess cancer risk assessment.

The radiological risk has been calculated due to ingestion of natural uranium in the drinking water, assuming the consumption rate of 4.05 L /day and lifetime expectancy of 63.7 years for both males and females. The excess cancer risk has been observed to be in the range of $0.02\times10^{-4} – 1.64\times10^{-4}$. The value of the excess cancer risk in the surveyed districts is lower than the maximum acceptable level of 1.67×10^{-4} according to AERB, DAE guidelines. If we assume lifetime water consumption rate of 4.05 L/day with the present uranium content of water, the mean value of excess cancer risk in the surveyed districts comes out to be 0.48×10^{-4}, which works out to be approximately 1 per 20,000 people.

b) Chemical toxicity risk

Uranium is a radioactive heavy metal, so it has health impacts due to its both radioactive and chemical nature. If we take into account chemical toxicity of the uranium, the kidneys are the most important target organ. The chemical toxicity of the uranium dominates over its radiological toxicity on the kidney in general at lower exposure levels [24]. The chemical toxicity has been estimated from the value of lifetime average daily dose (LADD) and Hazard quotient. Hazard quotient has been estimated by comparing the value of the calculated LADD with the reference dose level of 4.53 μg $kg^{-1}day^{-1}$. The reference level has been calculated for the maximum contamination level of the uranium in water of 60 μg/L. The variations in the values of the LADD and Hazard quotient are observed from 0.04 μg/kg/day – 3.35 μg/kg/day and from 0.01 – 0.74, respectively.

V. Conclusions

- The concentration of the uranium in ground water samples collected from the hand pumps or other ground water sources of several villages of Mohali and Fatehgarh districts is found to be within the safe limit of 60 ppb recommended by AERB, India.
- The cancer risk due to presence of U in groundwater is almost negligible.

- Our investigations establish that uranium content in North Punjab districts is much lower than South Punjab [13, 15].
- If agricultural practices are similar in North and South Punjab, e.g., use of fertilizers and crop pattern etc., then what is the source of Uranium enhancement in Southern districts of Punjab?
- It will be of interest to study nature of aquifers in North and South Punjab based on geological, morphological and hydrogeological investigations.

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Table 1 : Uranium content in the water samples of Mohali and Fatehgarh Sahib Districts and corresponding risk factors

S.No	Location	Water Source	Uranium Concentration (ppb)	Uranium Concentration (Bq l^{-1})	Excess Cancer risk * 10^{-4}	LADD (µg kg^{-1} day^{-1})	Hazard Quotient
	District Mohali						
1	CGC Jhanjheri	Tubewell (T.W.)	10.29	0.26	0.29	0.60	0.13
2	Jhanjheri	Hand Pump (H.P.)	14.39	0.36	0.41	0.83	0.18
3	Landran Gurudwara	T.W./M.P.	24.20	0.61	0.69	1.40	0.31
4	Kargil Park, Sector 71, Mohali	T.W.	12.40	0.31	0.35	0.72	0.16
5	Majat	H.P.	14.82	0.37	0.42	0.86	0.19
6	Bharatpur	T.W.	4.92	0.12	0.14	0.28	0.06
7	Chudiala	H.P.	3.74	0.09	0.11	0.22	0.05
8	Chudiala Sudan	H.P.	7.06	0.18	0.20	0.41	0.09
9	Pattran	M.P.	10.36	0.26	0.29	0.60	0.13
10	Maujpur	H.P.	3.63	0.09	0.10	0.21	0.05
11	Mohali Water Supply	Canal Water	3.26	0.08	0.09	0.19	0.04
12	HS Virk House	RO	0.63	0.02	0.02	0.04	0.01
	District Fatehgarh						
1	SGGS WU Fategarh	T.W.	55.12	1.39	1.56	3.19	0.70
2	BBEC Fatehgarh	Borewell (B.W.)	57.82	1.46	1.64	3.35	0.74
3	Atewali Gurudwara	H.P.	30.57	0.77	0.87	1.77	0.39
4	Kotla Bijwara	T.W.	24.00	0.61	0.68	1.39	0.31
5	Raipur Gujran	T.W.	25.39	0.64	0.72	1.47	0.32
6	Badali Ala Singh	Motor Driven Pump (M.P.)	24.62	0.62	0.70	1.42	0.31
7	Akal Akademi Chuni	T.W.	17.04	0.43	0.48	0.99	0.22
8	Biromajri	H.P.	2.81	0.07	0.08	0.16	0.04
9	Bhagrana	H.P.	6.98	0.18	0.20	0.40	0.09
10	Badali Mai Ki	H.P.	17.22	0.44	0.49	1.00	0.22
11	Badali Mai Ki	RO	BDL	BDL	BDL	BDL	BDL
12	Slaimpur	HP on Canal	20.29	0.51	0.57	1.17	0.26
13	Pola 1	H.P.	18.99	0.48	0.54	1.10	0.24
14	Pola 2	H.P.	15.3	0.39	0.43	0.89	0.20
15	Rajindergarh	H.P.	26.24	0.66	0.74	1.52	0.34
16	Sadugarh	H.P.	6.18	0.16	0.18	0.36	0.08
17	Hansali	H.P.	22.18	0.56	0.63	1.28	0.28
18	Dageri	H.P.	24.26	0.61	0.69	1.40	0.31
19	Hindupur	H.P.	16.76	0.42	0.47	0.97	0.21
20	Panjola	H.P.	18.14	0.46	0.51	1.05	0.23
21	Reona Neevan	RO	2.14	0.05	0.06	0.12	0.03

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Renewable Energy Deployment as Climate Change Mitigation in Nigeria

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Abstract- The scientific evidence of climate change as a result of greenhouse gas emissions which causes ozone layer depletion is becoming increasingly obvious and clear. Findings revealed that energy from the fossil fuel is the major source of greenhouse emission which destroys the environment and makes it unhealthy for living beings. In Nigeria, conventional energy (oil and gas) with gas flaring has the highest percentage of 52% and liquid fuel of 32% of carbon dioxide (CO_2) respectively. This sector contributes revenue of over 70% to Nigeria's economy and generates an average total 21.8% of greenhouse gas emission. In Nigeria, there is a much more potential for share renewables with 15.4% of total energy production and 8.6 % of energy consumption. In reality with global environmental concern, Nigeria's carbon dioxide emissions have increased with energy production and consumption. The Integrated Renewable Energy Master Plan of 2008 projects a 26.7% renewable energy contribution to the Nigeria's energy use and this is expected to reduce CO_2 and greenhouse gas emissions at 38% by 2025.

Keywords: greenhouse gas emission, mitigation, nigeria, climate change, renewable energy, resources, conventional energy, environment.

GJHSS-B Classification : *FOR Code: 090608*

RENEWABLEENERGYDEPLOYMENTASCLIMATECHANGEMITIGATIONINNIGERIA

Strictly as per the compliance and regulations of:

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Olotu Yahaya [α] & Oyati Edith Nwabuogo [σ]

Abstract- The scientific evidence of climate change as a result of greenhouse gas emissions which causes ozone layer depletion is becoming increasingly obvious and clear. Findings revealed that energy from the fossil fuel is the major source of greenhouse emission which destroys the environment and makes it unhealthy for living beings. In Nigeria, conventional energy (oil and gas) with gas flaring has the highest percentage of 52% and liquid fuel of 32% of carbon dioxide (CO_2) respectively. This sector contributes revenue of over 70% to Nigeria's economy and generates an average total 21.8% of greenhouse gas emission. In Nigeria, there is a much more potential for share renewables with 15.4% of total energy production and 8.6 % of energy consumption. In reality with global environmental concern, Nigeria's carbon dioxide emissions have increased with energy production and consumption. The Integrated Renewable Energy Master Plan of 2008 projects a 26.7% renewable energy contribution to the Nigeria's energy use and this is expected to reduce CO_2 and greenhouse gas emissions at 38% by2025. Nigeria has not been playing significant role by reducing emissions of greenhouse gases. This paper highlights Nigeria's climate change situation and penetration requirements for various renewable energy deployments as mitigating instrument for climate change towards healthy and productive environment.

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I. Introduction

Climate change is a serious global concern and widely acknowledged as a strong challenge being faced by the twenty first century. The impacts of greenhouse gases (GHGs) emissions and the resulting climate change have serious impact on global economy; therefore the need to control atmospheric emission of greenhouse and other associated gases will increasingly be based on efficiency of energy production, transmission, distribution and consumption in any nation [1]. It has been alarming that the global warming is increasing due to the burning of fossil fuel [2]. In Nigeria, convectional energy (oil and gas) contributes more than 75% s of country's economy and generates an average total of 21.8% of greenhouse gas emission [2].

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Nigeria's population is increasing geometrically and this further puts pressure on energy demand for socio-economic growth and development. If the growing population continues to depend on convectional energy; this will lead to overdependence on the non-renewable and depleting energy source which will not meet the demand and consequently increase the CO_2 emission and makes the environment highly unhealthy [2]. The linkage of the concepts of climate change mitigation and matching energy demand-supply is very important in addressing the well-being, economic growth and sustainability of any nation. Meeting growing energy demand and provide sustainable future energy needs; moving towards the deployment of renewable energy resource is a strong alternative mean to convection energy. If the abundant renewable energy resources in Nigeria are well harnessed; this will serve a strong instrument to creating friendly environment by lowering Co_2 emission and other associated greenhouse gases [3].

Theoretical and technical potentials of renewable energy resources (solar radiation, biogas, wind, and hydropower energy) indicated that Nigeria has strong potential of meeting energy demand for agricultural, domestic and industrial without relying on fossil fuel [4]. An average daily solar radiation (Rs) and wind energy of 12.MJ/m^2 to 28.5 MJ/m^2, 3.3 m/s to 7.0 m/s in the coastal to the northern part of the country could generate 427,000MW, hydropower, biogas and wind energy were estimated to have energy potentials of 11,000MW and 6.6 million (m^3) of biogas daily[4].

Climate change mitigation generally involves reductions in human (anthropogenic) emissions of greenhouse gases (GHGs)[5]. One of the major contributors to climate change mitigation is the adaptation of energy technologies. These include renewable energy sources such as solar power, tidal, ocean energy, geothermal power, and wind power; nuclear power, the use of carbon sinks, and carbon capture and storage [5]. Renewable energy is the key to solving country's energy-related inadequacy and also mitigating climate change effects. In Nigeria, it is important to control carbon dioxide (CO_2) emission and other associated greenhouse gases by moving towards to renewable energy development and application of energy efficiency mechanism. This paper provides a holistic overview of the renewable energy development and application for climate change mitigation, energy supply and sustainability for the growing population in Nigeria.

II. Global Energy Consumption

Global energy consumption has doubled in the last three decades of the past century [6]. In 2004, about 77.8% of the primary energy consumption is from fossil fuels (32.8% oil, 21.1% natural gas, 24.1% coal), 5.4% from nuclear fuels, 16.5% from renewable resources, of which the main one is hydroelectric, 5.5%, whereas the remaining 11% consists of non-commercial biomasses, such as wood, hay, and other types of fodder, that in rural-economies still constitute the main resource [7]. These 'rural' biomasses (mainly fodder) are usually ignored by statistical reviews of energy consumption proposed by oil companies, but for a correct global perspective they ought to be considered, because at least two thirds of human kind still lives in rural and artisanship economies not too different from the European Middle Age [7]. The fraction of energy demand covered by fossil fuels in 2004 appears to be 87.7%, a percentage often cited by various sources. Direct solar energy usage is about 11 Mtoe (millions, not billions of toe), less than 0.1% of the global consumption [7]. Fig.1.1 and 1.2 show the global energy consumption for two time slices.

a) *Nigeria and energy consumption*

Nigeria is endowed with convectional and renewable energy potentials. Despite the huge energy resources, the country is very far from meeting the energy demand of her populace. The sudden increase in population of Nigeria put high pressure on energy demand for socio-economic development. Population is a major driver of energy demand while its most important determinant is the level of economic activity and its structure measured by total Gross Domestic (GDP) alongside with its shares by various sectors and sub-sectors of the economy [8]. This increase in the energy demand is due to the high level of economic activities expected in Nigeria as measured by the total GDP [9]. At present, the nominal electricity generating capacity in Nigeria is less than 6000MW. The actual capacity is about half of the installed capacity [10]. Fig.1.4 and 1.5 shows the energy consumption and production in Nigeria in 2011. All renewables combined accounted for only 19% share of electricity production in the world, with hydroelectric power providing almost 90% of it as shown in fig.1.9 [10]. Therefore, substituting fossil fuels with renewables for electricity generation must be important part of any strategy of reducing CO_2 emissions into the atmosphere and combating global climate change [10]. One family using a typical solar home system can save yearly 290 litres of kerosene by using solar lighting technology and can prevent the emission of 0.76 ton CO_2 per year [11]. Fig.1.3a and 1.3b show the greenhouse gas emissions.

III. Renewable Energy and Climate Change

Demand for energy and associated services, to meet social and economic development and improve human welfare and health, is increasing [12]. The quality of energy is important to the development process [12; 14; 15]. Attaining sustainable development, delivery of energy services with low environmental effects is very important. However, energy services must be provided with low environmental implication considering the greenhouse gas emission.

The IPCC Fourth Assessment Report (AR4) reported that fossil fuels provided 85% of the total primary energy in 2004 [16]. Recent data confirm that consumption of fossil fuels accounts for the majority of global anthropogenic GHG emissions [16]. Emissions continue to grow and CO_2 concentrations had increased to over 390 ppm, or 39% above preindustrial levels, by the end of 2010. To maintain *both* a sustainable economy that is capable of providing essential goods and services to the citizens of both developed and developing countries, and to maintain a supportive global climate system, requires a major shift in how energy is produced and utilized [17]. However, renewable energy technologies, which release much lower amounts of CO_2 than fossil fuels are growing.

Renewable energy sources have contributed to Nigeria's energy mix for centuries now, albeit in a largely primitive way [21]. Fuel wood - or what is commonly referred to as woody biomass - is the longest standing primary energy source for rural Nigeria, and indeed, for much of the African continent [22]. Large hydropower has also featured substantially as an energy source, providing about 32 percent of Nigeria's national electric grid supply [23]. Nigeria's adoption of 'new' renewable energy sources solar photovoltaics, solar thermal, wind, small hydropower and efficient biomass is relatively recent [24]. The country is endowed with significant, even abundant quantities of each of these resources. Despite this huge potential, the existing renewable energy projects in Nigeria are very few and far between [22]. Fig. 1.9 shows the share of total world renewable energy.

A 10 MW pilot wind plant has been built in Katsina and is waiting commissioning, Zungeru hydropower plant of 700 MW installed plant capacity is under construction in Niger State [25]. A number of smaller hydropower plants are also being planned such as Gurara (30 MW) or Kashimbilla (40 MW)[26]. The 3,050 MW Mambilla hydropower plant project is currently being reviewed. In addition, the Nigerian Electricity Regulatory Commission (NERC) has issued licenses for 8 solar projects totaling a capacity of 868 MW and a 100 MW wind park [26]. Furthermore, investors are increasingly enthusiastic about developing large solar plants in the country. Table 1.1 shows the potential of the country's renewable energy which has been designed for clean energy generation purposes, while Table 1.2 reveals the energy balance in Nigeria in 2012.

The percentage of renewable energy consumption is majorly from hydropower as shown in fig 1.4. Energy resources from wind, geothermal, tidal, bio-power have not deployed in Nigeria [26]. In addition, the development of solar energy through the photovoltaic panel for converting the solar radiation to electricity is very nascent in the country [26]. Fig 1.3 shows electricity generated (Terawatt/hour) from non-hydro-renewable energy in United State of America [27]. The values of energy generated from renewable energy in US without considering hydropower shows that the country can sufficiently meet energy demand from every sector (agricultural, manufacturing, transportation e.t.c) without compromising the future demand. Without the deployment of renewable energy since 2005, green-house gas emissions in 2012 could have been 7% higher than actual emissions [27]. Renewable techno-logies also increase energy security [27]. Without the additional use of renewable energy since 2005, the EU's consumption of fossil fuels would have been about 7% higher in 2012. The most substituted fuel was coal, where consumption would have been 13% higher, while natural gas use would have been 7% higher, at a time when European gas reserves are dwindling [27]. Renewable energy has not been the only factor reducing Europe's greenhouse gas emissions. Policies and measures designed to reduce emissions, improve energy efficiency and stimulate the deployment of renewable energy have all played a role [27]. There were also other drivers for this reduction, including changing economic factors and shifts to less-polluting types of fuels [27].

IV. Renewable Energy in Nigeria

Renewable energy is energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves, and geothermal heat [28]. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, air and water heating/cooling, motor fuels, and rural (off-grid) energy services [28]. It is one of the means of tackling the global challenges of climate change [28]. Renewable energy supply in Nigeria is dominated by hydro-power and solar energy with 1% energy consumption from hydropower [28]. The total existing capacity for hydro power (small and large dams) in Nigeria is 1,930 MW [29]. The installed capacities of hydropower are estimated at with 14,750 MW [29]. The share of solar energy in the renewable energy share is expected to increase because of its strong potential across Nigeria and friendly technologies compared to other renewable energy sources such as tidal, wave, geothermal [30]. This level of solar radiation across the country can support huge deployment of solar power infrastructure designed to primarily feed in to the regional power distribution entities [30]. Fig 1.7 shows the estimates of renewable energy in Nigeria. Worldwide investments in renewable technologies amounted to more than US$214 billion in 2013, with countries like China and the United States heavily investing in wind, hydro, solar and biofuels."[30]. Deployment of renewable energy [RE] has been increasing rapidly in recent years. Under most conditions, increasing the share of RE in the energy mix will require policies to stimulate changes in the energy system [31]. Government policy, the declining cost of many RE technologies, changes in the prices of fossil fuels and other factors have supported the continuing increase in the use of RE[31]. In 2009, despite global financial challenges, RE capacity continued to grow rapidly, including wind power (32%, 38 GW added), hydropower (3%, 31 GW added), grid-connected photovoltaics (53%, 7.5 GW added), geothermal power (4%, 0.4 GW added), and solar hot water/heating (21%, 31 GWth added)[31]. Biofuels accounted for 2% of global road transport fuel demand in 2008 and nearly 3% in 2009[32]. The annual production of ethanol increased to 1.6 EJ (76 billion litres) by the end of 2009 and biodiesel production increased to 0.6 EJ (17 billion litres)[33]. In Nigeria there is need for the Federal government to look at existing policies on renewable energy and take full advantage of it to boost her power generating capacity"[30]. Investigations showed that the development of alternative energy sources is relatively young in the Nigeria [33]. In fact, a regulation to stimulate investments in 2,000 MW of electricity from renewable energy sources by 2020 was approved by the Nigerian Electricity Regulatory Commission [34].

V. Climate Change Mitigation

Nigeria as a country is highly vulnerable to the impact of climate change because its economy is mainly dependent on income generated from the production, processing, export and/or consumption of fossil fuels and associated energy-intensive products [35]. This sector contributes revenue of over 70% to Nigeria's economy and generates an average total 21.8% of greenhouse gas emission [35]. Nonetheless, carbon emissions from any country contribute equally to the pressure on the global climate [29]. The use of renewable energy sources is becoming increasingly necessary, if we are to achieve the changes required to address the impacts of global warming [35]. Apart from its benefits in GHG reduction, the use of solar energy can reduce the release of pollutants such as particulates and noxious gases from the older fossil fuel plants that it replaces [36]. Solar thermal and PV technologies do not generate any type of solid, liquid or gaseous by-products when producing electricity [36]. The future share of RE applications will heavily depend on climate change mitigation goals, the level of requested energy services and resulting energy needs as well as their relative merit within the portfolio of zero- or low-carbon technologies [37]. A comprehensive evaluation of any portfolio of mitigation options would involve an evaluation of their respective mitigation potential as well as all associated risks, costs and their contribution to sustainable development [37]. Setting a climate protection goal in terms of the admissible change in global mean temperature broadly defines a corresponding GHG concentration limit with an associated CO_2 budget and subsequent time-dependent emission trajectory, which then defines the admissible amount of freely emitting fossil fuels. The complementary contribution of zero- or low-carbon energies to the primary energy supply is influenced by the 'scale' of the requested energy services. [37].

a) *Energy efficiency and GHG emission mitigation*

Industry and manufacturing sector use almost 40% of worldwide energy [38]. It contributes almost 37% of global GHG emissions [38]. In most countries, CO_2 accounts for more than 90% of CO2-eq GHG emissions from the industrial sector [39; 40]. These CO_2 emissions arise from three sources: (1) the use of fossil fuels for energy, either directly by industry for heat and power generation or indirectly in the generation of purchased electricity and steam, (2) non-energy uses of fossil fuels in chemical processing and metal smelting, and (3) non-fossil fuel sources, for example cement and lime manufacture[40].The energy intensity of most industrial processes is at least 50% higher than the theoretical minimum [40].This provides a significant opportunity for reducing energy use and its associated CO_2 emissions [41]. A wide range of technologies have the potential for reducing industrial GHG emissions, of which energy efficiency is one of the most important, especially in the short- to mid-term [40]. Other opportunities include fuel switching, material efficiency, renewables, and reduction of non-CO_2 GHG emissions [41].

VI. Conclusions

Climate change is one of the most difficult challenges facing Nigeria and world. The cause can be natural or anthropogenic in nature. Climate change from anthropogenic causes due to the human activities on earth can be mitigated using technologies and formulation of environmental policies and laws. Convectional energy (oil and gas) which is the main economic stream of Nigeria generates high value of Co_2 emissions and other associated greenhouse gases into the atmosphere, leads to ozone layer depletion, global warming and consequently climate change. Therefore, moving towards renewable energy resources will play an important role in mitigation Co_2 emissions and GHGs. The large potential of renewable energy resources in the country is an advantageous factor for deploying RES for greenhouse mitigation measures, create clean and environment- friendly technologies and energy use mechanism. Actual energy-cost production is higher than the theoretical cost by 22% in Nigeria and such lead to high production cost in the country, demand for more energy, increase in Co_2 emissions and GHGs and increased cost of living. In turn, existence of enabling Energy policies (ECN) of Nigeria should be designed to support renewable energy sources and installed power plant efficiently.

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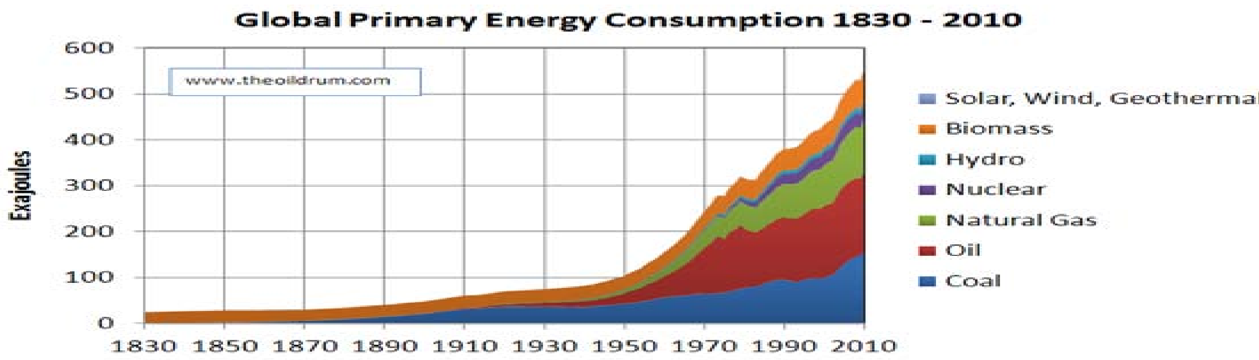

Fig. 1.1 : Global primary energy consumption (1830-2010)

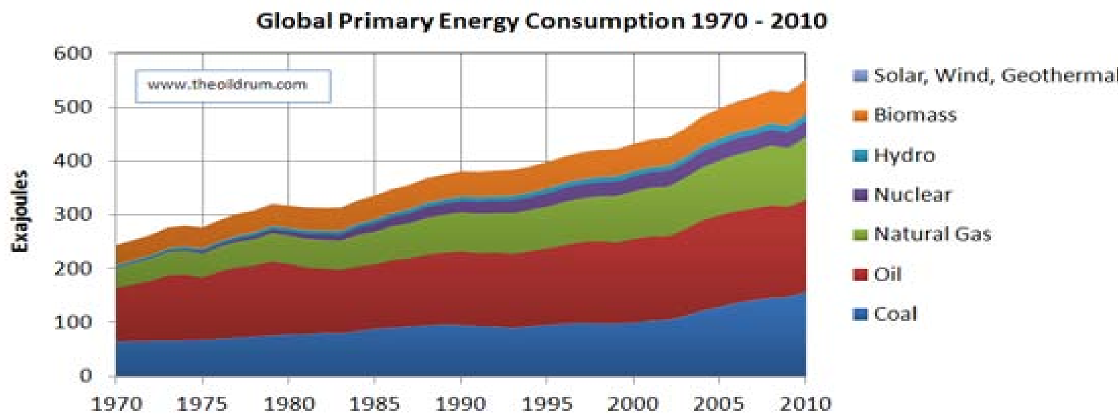

Fig. 1.2 : Global primary energy consumption (1970-2010)

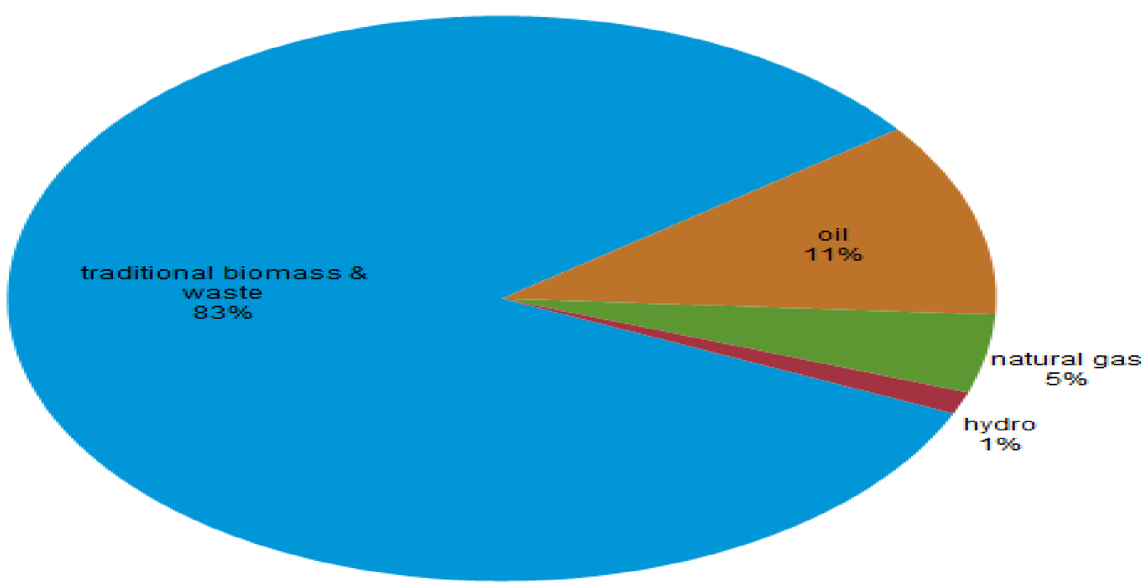

Fig. 1.5 : Total primary energy consumption in Nigeria, 2011 [23]

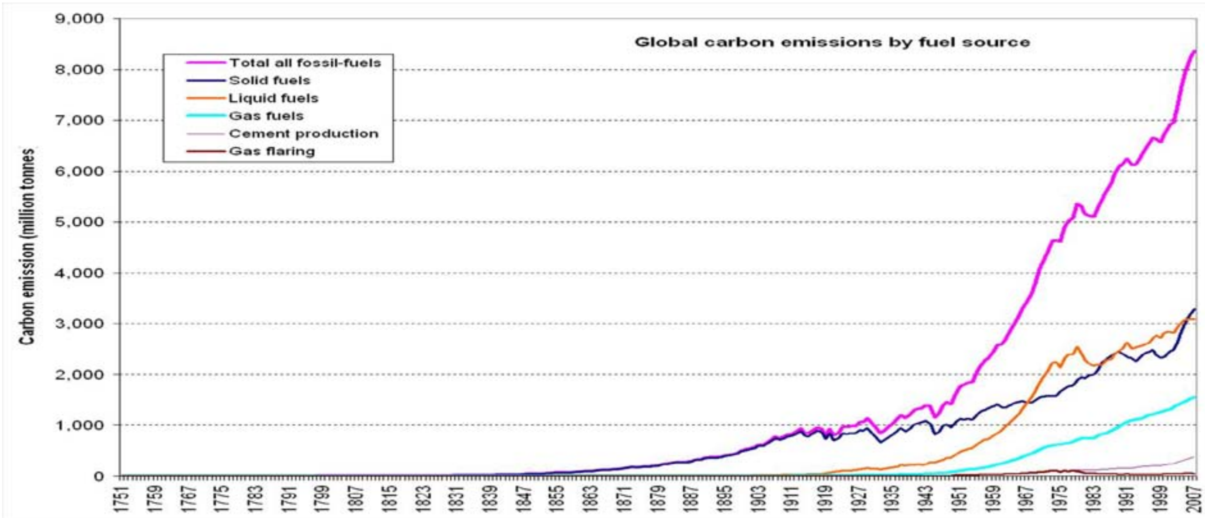

Fig. 1.3a : Global carbon emission from fossil-fuel [20]

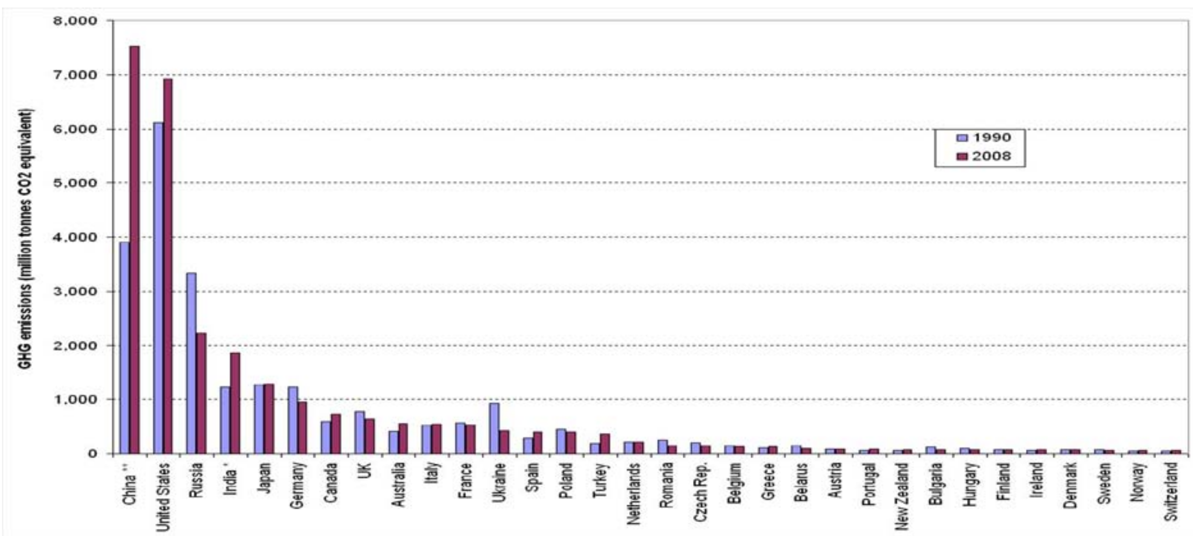

Fig. 1.3b : Global carbon emission from fossil-fuel on country level [20]

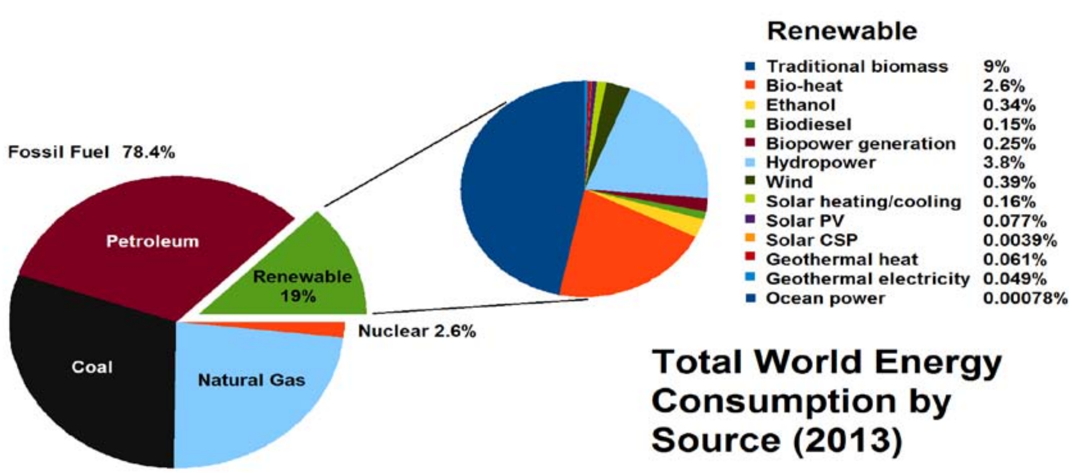

Fig. 1.9 : Share of total world renewable energy [30]

Table 1.1 : Renewable energy potential in Nigeria [23]

Energy Resources	Estimated Reserve
Large Hydropower	11,250 MW
Small Hydropower (<30 MW)	3500 MW
Fuel Wood	11 million hectares of forest and woodland
Municipal Waste	30 million tonnes/year
Animal Wastes	245 million assorted animals in 2001
Energy Crops and Agricultural Residue	72 million hectares of agricultural land
Solar Radiation	3.5-7.0 kW h/m^2/day
Wind	2-4 m/s at 10 m height Wind speeds in Nigeria range from a low 1.4 to 3.0m/s in the Southern areas, except for coastal line and 4.0 to 5.1m/s in the North. The Plateau area particularly interesting.

Table 1.2 : Energy balances for Nigeria in 2012 kilotonne of oil equivalent (ktoe)[6]

	Coal and peat	Crude oil	Oil prod-ucts	Natural Gas	Hydro	Biofuels and waste	Total
Production	30	129,409	0	33,645	487	108,142	271,712
Imports	0	0	8,440	0	0	0	8440
Exports	0	-126,413	-755	-21,032	0	0	-148,201
International marine bunkers	0	0	-397	0	0	0	-397
International aviation bunkers	0	0	-186	0	0	0	-186
Stock changes	0	1830	538	0	0	0	2368
TPES* Total Primary Energy Supply	**30**	**4,825**	**7,640**	**12,613**	**487**	**108,142**	**133,736**
TPES (%)	**0.02%**	**3.61%**	**5.71%**	**9.43%**	**0.36%**	**80.86%**	**100.00%**

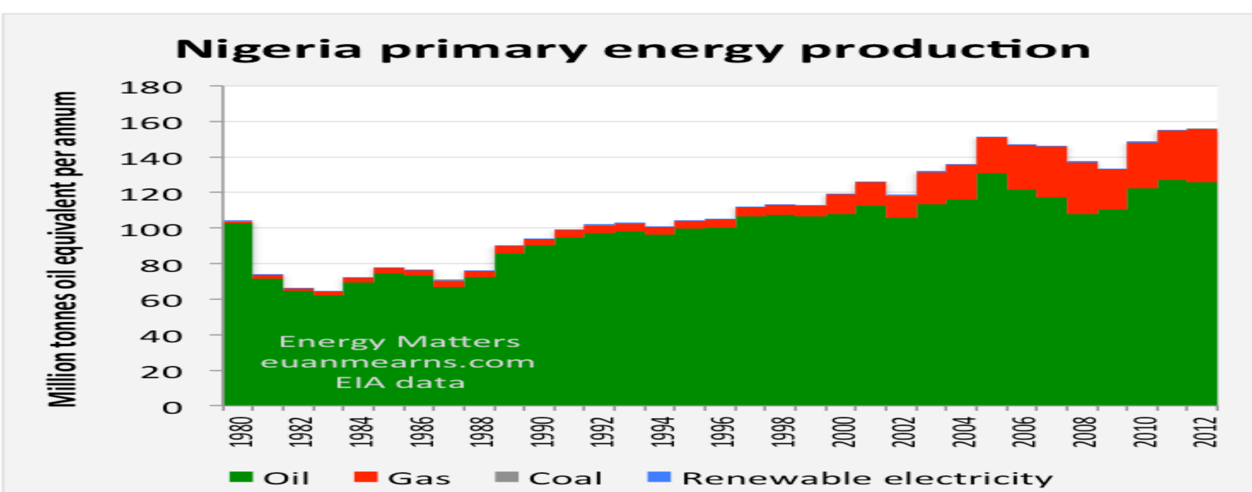

Fig. 1.5 : Nigeria primary energy production [16]

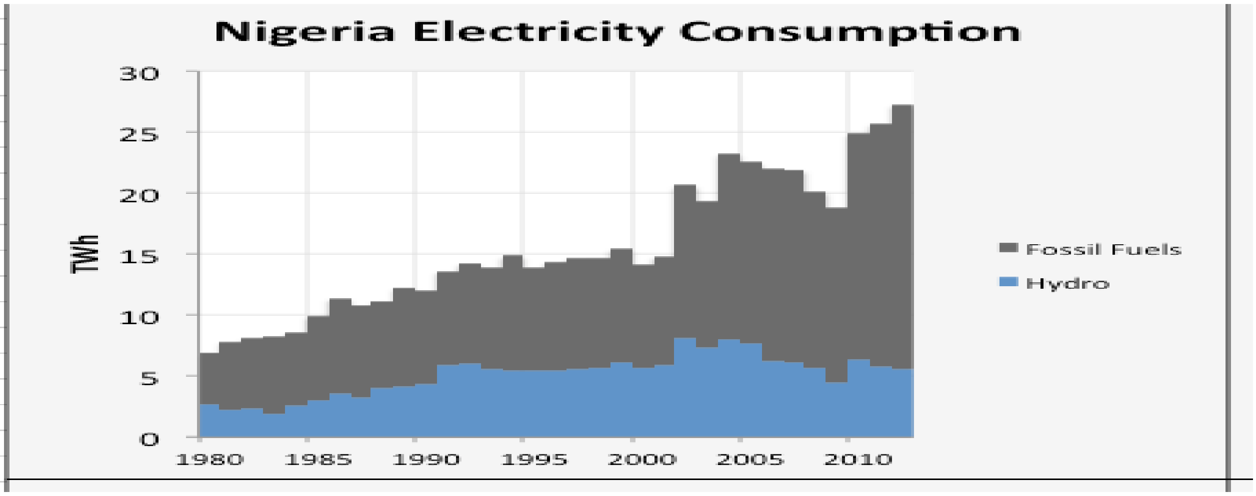

Fig. 1.4 : Nigeria electricity consumption [16]

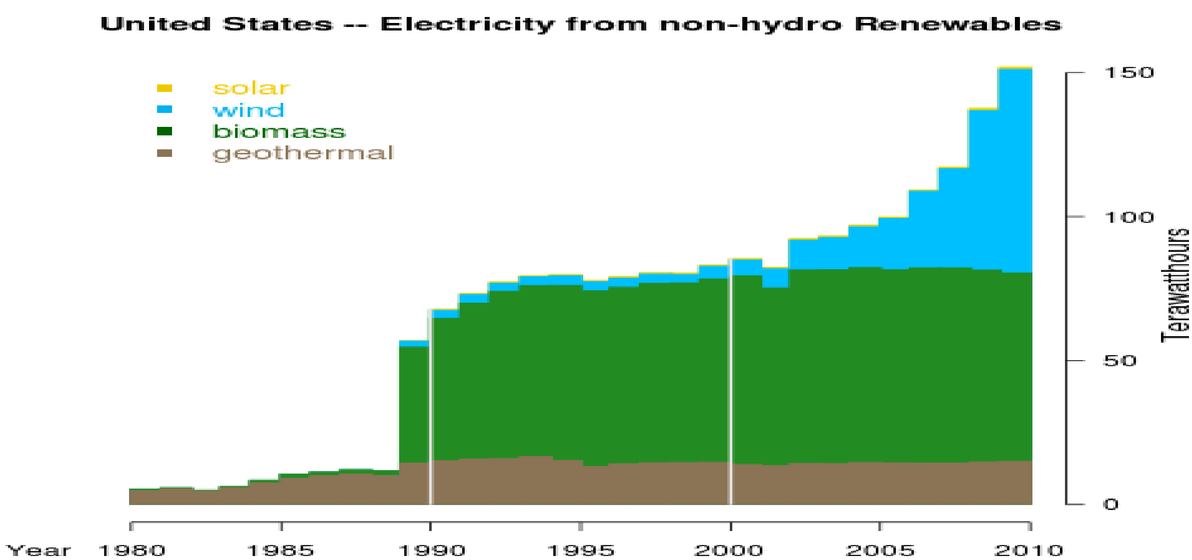

Fig. 1.6 : United States- Electricity from non-hydro-renewables

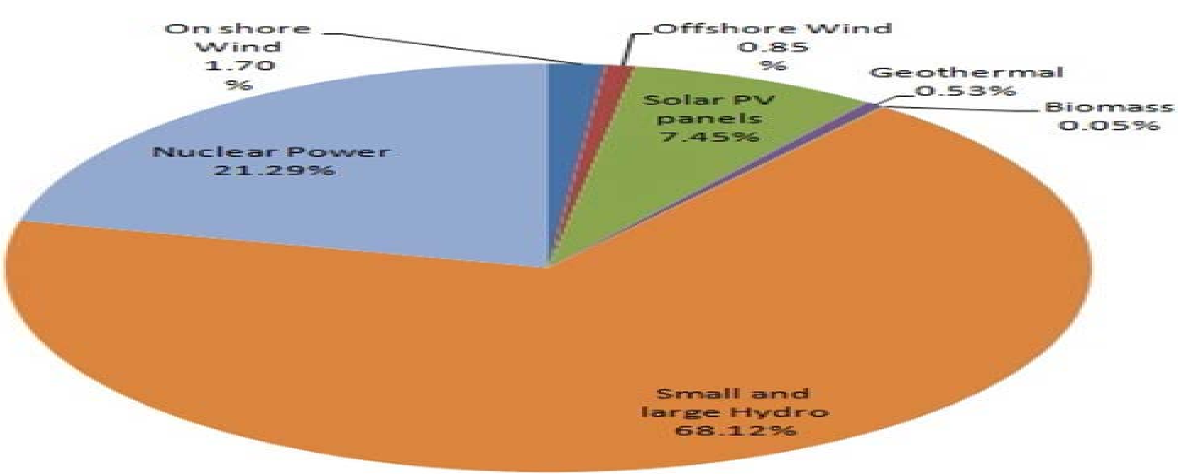

Fig. 1.7 : Estimates of renewable energy potential in Nigeria [23]

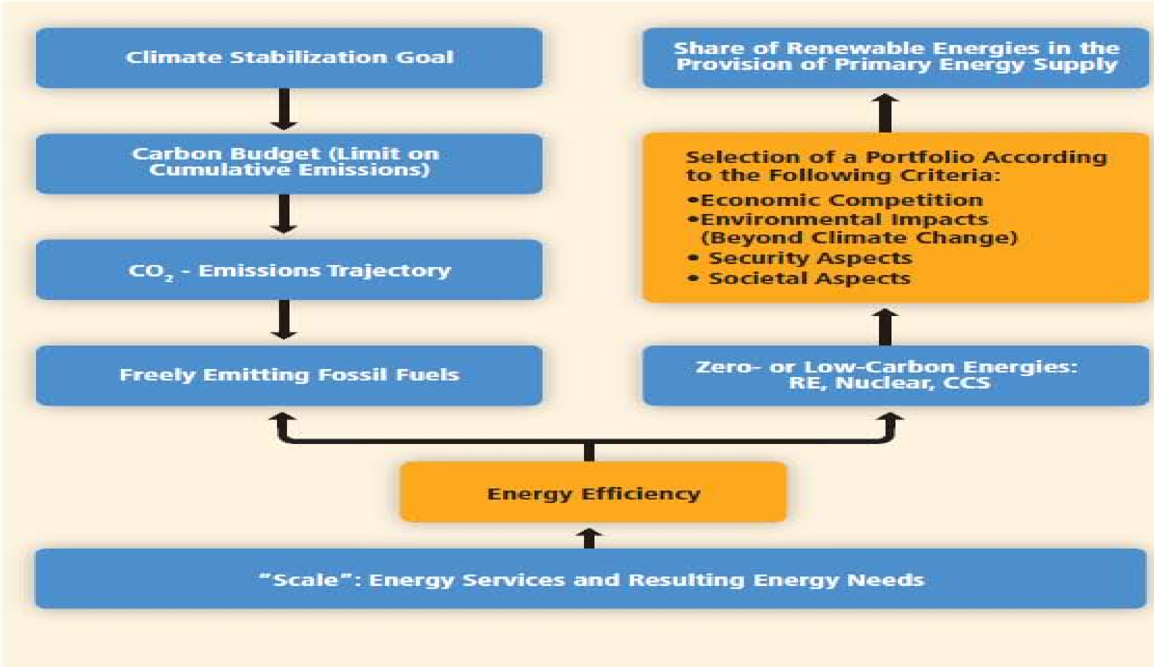

Fig. 1.8 : The role of renewable energies within the portfolio of zero- or low-carbon mitigation options (qualitative description). [33]

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Cross Validation can Cause a Difference of Misinterpretation to Valid Interpretation

By Vipin Upadhyay & B. S. Adhikari
Wildlife Institute of India

Abstract- Easy availability of remote sensing dataset increases its importance and use by multiple folds, especially in areas of rough and difficult terrain like snow bound mountains. But at the same chances of misinterpretations will also be increased in the same proportion, when dealing with high altitude mountains in remote sensing. Seasonal variation within single year time framework and temporal changes in long time are more important to understand separately. Verification of the imagery selection, operations and findings is the key of analysis. This paper focused upon misinterpretation often occurs in the geospatial domain by shifting the focus, when observations transforming to information. A negligible error in selection of imagery, operation or perception make it possible to misinterpret the findings. In this study we are try to withdrawing kind attention of users toward small-small negligence, that cost a lot. In this study we take area under Nanda Devi national Park as an example to highlight such errors.

Keywords: accuracy assessment, cross validation, land use land cover, change detection, remote sensing and misinterpretation.

GJHSS-B Classification : FOR Code: 969999

CROSSVALIDATIONCANCAUSEADIFFERENCEOFMISINTERPRETATIONTOVALIDINTERPRETATION

Cross Validation can Cause a Difference of Misinterpretation to Valid Interpretation

Vipin Upadhyay [α] & B. S. Adhikari [σ]

Abstract- Easy availability of remote sensing dataset increases its importance and use by multiple folds, especially in areas of rough and difficult terrain like snow bound mountains. But at the same chances of misinterpretations will also be increased in the same proportion, when dealing with high altitude mountains in remote sensing. Seasonal variation within single year time framework and temporal changes in long time are more important to understand separately. Verification of the imagery selection, operations and findings is the key of analysis. This paper focused upon misinterpretation often occurs in the geospatial domain by shifting the focus, when observations transforming to information. A negligible error in selection of imagery, operation or perception make it possible to misinterpret the findings. In this study we are try to withdrawing kind attention of users toward small-small negligence, that cost a lot. In this study we take area under Nanda Devi national Park as an example to highlight such errors. As we observed a clearly change in vegetation cover as well as in snow cover on direct compression of satellite images from two different time frame in first operation. While in reality the change in snow cover is just because of seasonal snow fall is only become known after second operation. Such kind of misinterpretations are often in studies using geo-spatial technologies and remote sensing. Therefore, it must be required to validates and examine observations every time whenever reporting, our findings. And also requires to understanding about concepts properly prier interpret results and observation of any findings. Article like this useful to manager's researcher and other remote sensing users in assessment, clarification and validations of their findings.

Keywords: accuracy assessment, cross validation, land use land cover, change detection, remote sensing and misinterpretation.

I. Introduction

Remote sensing' refers as detection of electromagnetic energy from aircraft or satellites, which was reflected back from earth surface and entities on earth. Remote sensing Data are often distributed in a matrix of square picture elements called pixels (Turner *et al,* 2003). Remote sensing is the technique of deriving information about objects on the surface of the earth without physically coming into contact with them. This process involves making observations using sensors (cameras, scanners, radiometer, radar etc.) mounted on platforms like aircraft and satellites (Lillesand & Kiefer, 1987). Measurement of reflected energy under visible, near- and middle-infrared, and thermal-infrared range of electromagnetic radiation is commonly used for land-use land cover monitoring via passive remote sensing technique (Turner *et al*, 2003). Satellite remote sensing found to be useful in estimating the diversity, richness and extent of land cover throughout the different landscapes, meeting a fundamental need that is common to many ecological applications (Kerr & Ostrovsky, 2003). Satellite imageries obtained from various satellites are increasingly being used for various purposes including land use mapping, change detection and other geographic information system (lee, 1991). Geospatial information about land-use land cover and its patterns having important applicability for development and conservation planning/management. Data for Land-cover and land-use are necessary for various different purposes like environmental monitoring, change detection, as well as development schemes (Mumby & Harborne, 1999 and Mumby & Edwards, 2002).

Snow bound mountains are sensitive to climate and also act as best indicators for change. Therefore, monitoring of these mountains thus subject to monitoring of environmental and climate changes (Oerlemans, 1994). Information about changes or change detection on the earth's surface is becoming more and more important in monitoring of resources and environment at the local, regional as well as global scale. Remote sensing techniques are best suited and easily applicable way to analyze and to monitor these remote snow bound mountains (Bolch & Kamp, 2008). The easily availability of remote sensing imagery of present as well as past makes it possible to analyze spatio-temporal pattern of environmental elements, changes throughout the time interval and impact of human activities in past decades (Jianyaa *et al,* 2008). Change detection plays a very important role for development, conservation, economic construction and national defense as well. Change detection and its accuracy is a main issue for resource and environmental monitoring, disaster monitoring, city expansion, geographic information update and military defense (Li, 2010).

Accurate and timely information about land use and land coverof a landscape or landforms and its changes over the time plays a crucial role for land management, decision-making, ecosystem monitoring, conservation, urban planningand development (Zhou *et. al*, 2008). There are two types of information-processing system: the type that is capable of converting the

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information it receives into knowledge and the type that is not (Dretske, 1981). There are surprising number of things that we cannot know (or questions we cannot answer) that are not the result of imperfect information. Forms of not knowing are pervasive in domains as diverse as mathematics, logic, physics, and linguistics, and are apparently irreducible (Couclelis, 2003). In applications of GIS and other geo-spatial technologies, being right (accurate, correct, precise) is considered of paramount importance and may be sometimes mean the difference between life and death (Couclelis, 1992).

Error associated with data acquisition, processing, analysis and interpretation can have significant impact on management planning and conservation efforts (lunette *et al* 1991). Although the use of advance techniques is increasing rapidly our understanding about data processing, integration and especially result interpretation, leg far behind. Performing geospatial operations using satellite imageries especially in high mountain regions with low accuracy and narrow range of operations without actual verification will produce product of low confidence (Veregin, 1989). Therefore, it must be needed to clearly identify the types of errors that may occur, proper understand of concepts and how these errors propagate and how to remove them or avoid them (Marin,1989). Main objective of this article is to highlighting one of the basic conceptual errors occurring during use of remotely sensed imaginary for high mountain regions studies and its resolution.

a) Background

Snow bound mountains and their surrounding regions like Nanda Devi National Park in India is best areas to study the climate change impact on glaciers and its outcomes on life forms (Bolch, 2006, Gong, 2008 and Oerlemans, 1994). Without using advance geospatial techniques like remote sensing and GIS Studying such rough terrain is not an easy task (Kerr, 2003). Easily availability of remotely sensed imagery for high range of temporal resolution make it easier to analyze change over the time period (Rees, 2002). But due to seasonal variation within year time framework, it is more important to understand and carefully selection of imagery and operations should be clearly analyzed and verified. A negligible error in selection without verifications make it possible to misinterpret the findings. This paper focused upon misinterpretation often occurs in the geospatial domain by shifting the focus from observations to information, as well as on the schemes applicable for validation of results.

II. Material and Methods

Satellite remote sensing had been used for meeting a fundamental need that is common to many geospatial applications (Lu *et al.,* 2004, Manonmani 2010 and Stacy, 2002). Satellite images for year 2003, 2004, 2014 and 2015 were acquired from earth USGS explorer (http://earthexplorer.usgs.gov/). Lands at 8 satellite image of the study area (Row: 39, Path: 145) for April 2014 &2015 and October 2014 & 2015 and Landsat 4-5 TM (Row: 39, Path: 145) image for October 2002 and April 2003 were used. Sun Elevationangle54.33, 63.25, 59.22, 46.13, 47.17, and 43.57 for images April 2003, 2014, 2015, and October 2002, 2014 and 2015 respectively. And Sun Azimuth angle of 131.46, 126.55, 131.84, 150.52, 152.62 and 153.42 for images April 2003, 2014, 2015, and October 2002, 2014 and 2015 respectively.

Lands at remote sensing datasets were acquired with initial geo-rectification completed. After acquiring the satellite images of the study areas Atmospheric and radiometric corrections (Leonardo *et al.* 2006) was performed where ever needed. And then False Color Composite (FCC) map was developed using layer stack function in EARDAS Imagine software by taking four band Red (wave length of 0.636-0.673), Blue (wave length of 0.412-0.512), Green (wave length of 0.533-0.590) and Infrared (wave length of 0.851-0.876) each with spatial resolution of 30m and radiometric resolution of 8 bit and 16 bit for Lands at 4/5 and Landsat 8 respectively. The software packages used for assessment were ERDAS IMAGINE 13 and ArcGIS 10.2.Change detection analysis on the seasonal basis (April to April and October to October) was carried out by visual interpretation of FCC created using four different band i.e. Red, Blue, Green and infrared band and further verified by NDVI calculations (Ichii, 2002, John, 1998, Paruelo, 1998 and Ricotta, 2000).

In this study three different operations were performed. In the first operation, direct comparison (Singh, 1989 and Deer, 1999) of FCC created from images of two different time frame 2002/3 and 2014 for pre as well as post monsoon season separately. In the second operation, compression of FCC produced from images of two successive years 2014 and 2015 with 2003 image similarly for both seasons. And in third operation compression of NDVI of pre and post monsoon season (vegetation cover) for two successive years 2014 and 2015 with 2002-2003 images.

III. Results

In the first operation visual interpretation of FCC produced from pre-monsoon images acquired on April 2003(figure 1a) and 2014 (figure 1b) and post monsoon images acquired on October 2002 (Figure 1c) and 2014 (Figure 1d) were compared. In this operation there was an increment in vegetation cover and snow cover (only in post monsoon image) and decrement in thickness of snow in latter images (2014-15).

While in the second operation (which was performed to check the validity of the first one) visual interpretation of FCC produced from pre-monsoon images acquired on April 2003, 2014, 2015 and pre-monsoon images acquired on October 2002, 2014 and 2015(figure 2) all together were compared. Results of this operation were contradictory to the first operation results, i.e. no change in snow cover. This clearly indicates that the increment in snow cover in first operation was observed only because of early snow fall for that year at the time of image acquisition. This change is not land cover change but it is an artifact of technology.

But at the same time increment in vegetation cover was observed in both (first and second) the operations indicates an actual increment (more in pre monsoon images i.e. April). This increment in vegetation cover was also supported by NDVI calculations (figure 3) of imagery collected for both operations in entire time frame from 2002 to 2015.

As the interpretation about decrement of snow thickness produced by first operation was also not clearly validated here, therefore it requires a more focused study on it with some more clear and precise methodology.

IV. Conclusion

As reported in the results of first operation there was an increment in snow cover is an example of over dependency on technology without knowing about facts. Take it as an example, in such cases technology without knowing about facts sometimes gives false information. Therefore, it must be required to validates and examine (using like in second operation of successive years' imagery compression) findings every time whenever reporting, our findings. And also requires to understanding about concepts properly prier interpret results and observation of any findings.

Similarly, in case of interpretation about increment in vegetation cover was cross checked and validated by second (i.e. Compression of imagery of successive years) and third (i.e. NDVI assessment of Vegetation) operations. This increment in vegetation cover was found in both successive years from 2003 to 2014 and 2015 and also using NDVI results validate each other. In this case one can says that if results of two different operations was found to be same then there are high chances of valid and error-less interpretations. The changes in vegetation cover (increased) can be result of conservation efforts during the time frame also validated by this study.

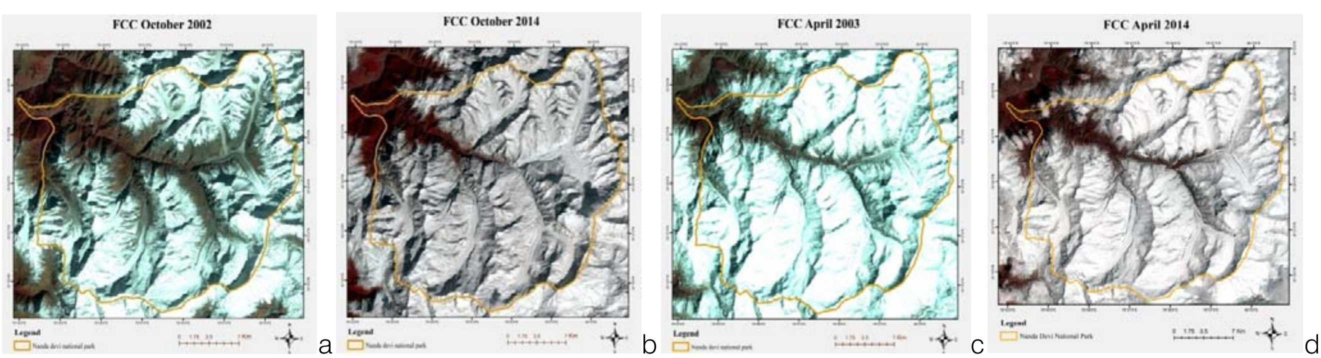

Figure 1 (a and b); Preliminary assessment of land cover change using FCC (False color composite) clearly indicates an increment in vegetation cover, increment in area under snow cover and decrease in thickness of snow was visualized since last 12 years in post monsoon images. *(c and d);* Preliminary assessment of land cover change using FCC clearly indicates an increment in vegetation cover, no or very less change in area under snow cover and decreases in thickness of snow since last 12 years in pre-monsoon images.

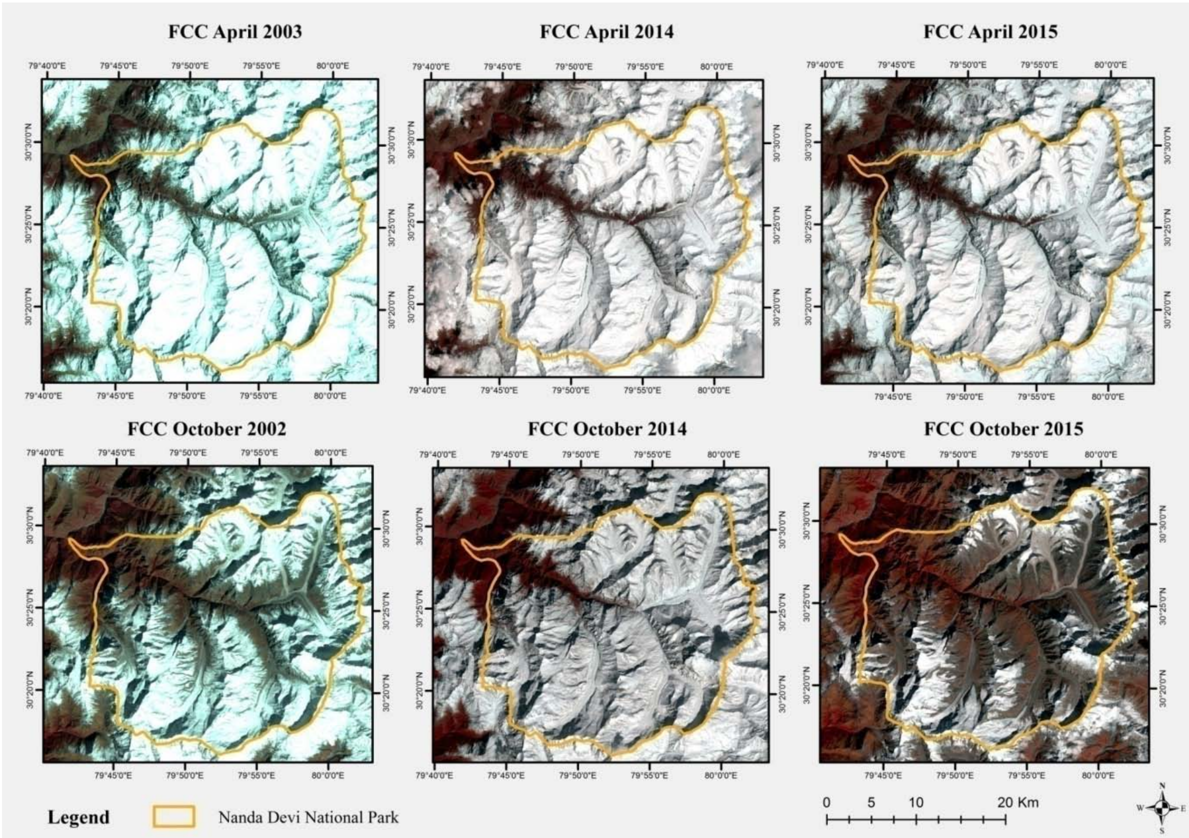

Figure 2 : Compression of successive year satellite imagery FCC of pre and post monsoon timeframe

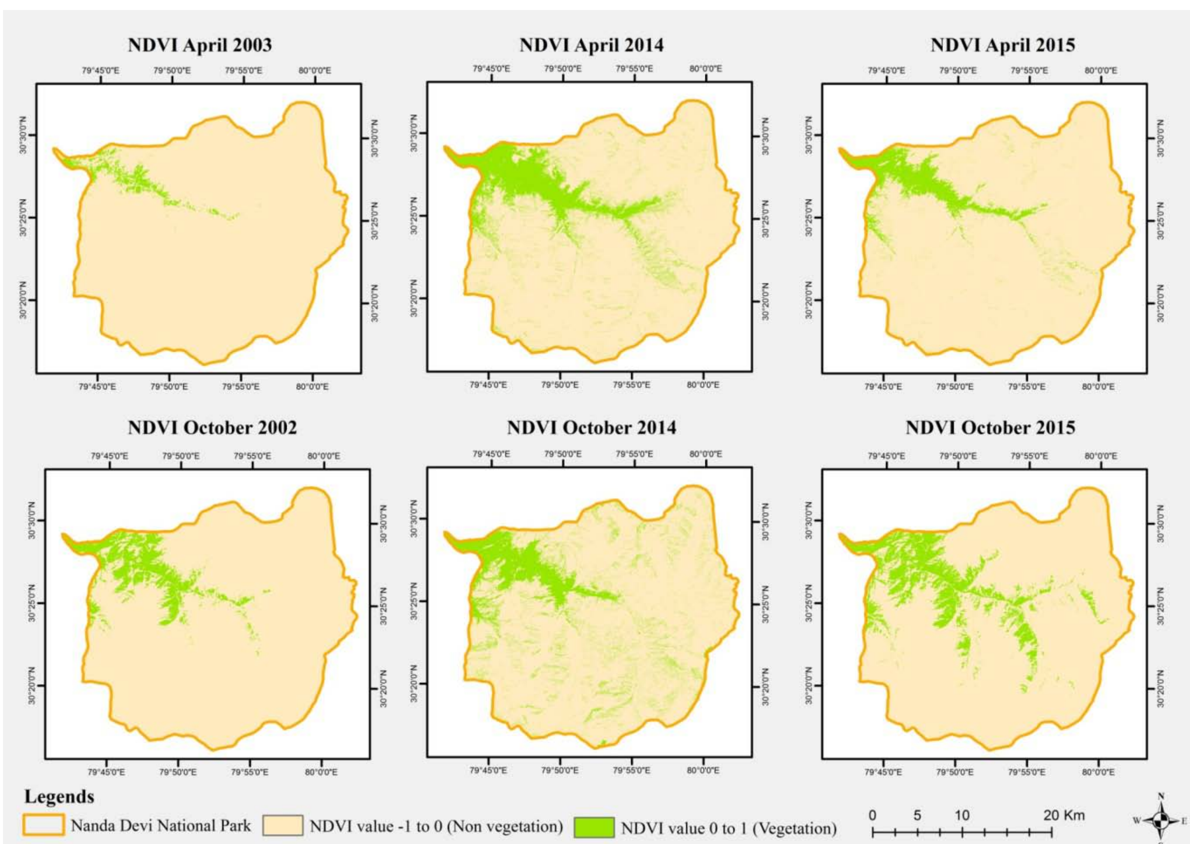

Figure 3 : Compression of successive year satellite imagery NDVI of pre and post monsoon timeframe.

V. Acknowledgement

The study is conducted under a research project funded by ICIMOD with collaboration of Wildlife Institute of India (WII). First of all, we are thanking to director WII, ICIMOD of allowing me to do this study. We are also thankful to Dr. G S Rawat Scientist WII for their timely guidance support. We don't forget to thanks Dr. Panalal and our Lab mates GIS Lab WII, Dehradun for shearing their GIS knowledge and moral support whenever we needed. And in last we also thanking our friends, parents and almighty god.

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Public Housing Supply in Moremi Estate, Ile-Ife, Nigeria

By Dr. O. A. Adeleye
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Abstract- This paper assessed public housing supply in Nigeria with a specific focus on Moremi Estate, Ile-Ife, Osun State. With the discussion of the indispensability of housing as the background, the evolution of public housing supply in the country is surveyed vis-a-vis the contribution of the various development plans and housing policy of the federal government. A look is then taken at how Moremi Estate fares in meeting the housing needs of the inhabitants. It was discovered through field survey that there are some inherent fundamental functionality flaws in the land use pattern of the estate. These include the lack of low-density residential plots, adequate security, standard commercial centre and organized open space. Besides, the roads in the estate are not tarred public/semi-public facilities are not fully developed; and the already allocated plots are characterized by a low level of development. Recommendations are proffered towards the realization of the full potentialities of the estate in particular, and more effectiveness of public housing delivery in the nation at large.

Keywords: housing, housing supply, public housing supply, Moremi estate, Ile-Ife.

GJHSS-B Classification : FOR Code: 969999

PUBLICHOUSINGSUPPLYINMOREMIESTATEILEIFENIGERIA

Strictly as per the compliance and regulations of:

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Keywords: housing, housing supply, public housing supply, Moremi estate, Ile-Ife.

I. Introduction

As a veritable unit of the environment, housing has a profound influence on the health, efficiency, social behaviour, satisfaction and general welfare of the community (Adeleye, 1988, 2011 and Onibokun, 1998) as it constitutes one of the best indicators of a person's standard of living and place in society (Nubi, 2008). As such, the fundamental function of housing is not limited to being just a shelter; it is a space within which generations of families express their lifestyle, and preserve their history and identities of lineage (Awotona and Ogunshakin, 1994; Jiboye, 2004; Olayiwola, 2012).

This explains why housing is deemed very relevant in the attainment of a high living standard among rural and urban dwellers alike. Consequently, these attributes make demand for housing to know no bounds as population growth and urbanization skyrocket, and the gap between housing need and supply becomes widened.

The arguable significance of housing notwithstanding, adequate supply has remained largely a tall dream in. Nigeria and many developing countries where population grows at an exponential rate, unrelenting urbanization constitutes a norm, and discrepancy in housing need and supply is high. This has led to various authorities working out strategies for ensuring housing supply. In Nigeria these include, among others, Fasakin (1998) who suggested the cooperative housing model and Onibokun (1998) who advocated land allocation.

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However, housing problem can be said to be one that could not be resolved permanently for the fact that what is considered to be luxurious dwelling today loses its quality in fifty years time owing to advancement in technology. Besides, the proportion of Nigerian urban population has been constantly increasing over the years. Whereas only 7 per cent, 10 per cent, 20 percent, 27 per cent and 35 per cent of Nigerians lived in urban centres in the 1930s, 1950s, 1970, 1980 and 1990 respectively. Today, over 40 per cent of Nigerians now live in urban centres of varying sizes (Okupe, 2002). This has brought about severe housing problems resulting in overcrowding in inadequate dwellings, and a situation in which 60 per cent of Nigerians can be said to be homeless persons (Federal Government of Nigeria, 2004). Furthermore, almost 75 per cent of Nigeria's urban dwellers live in slums (Olotuah, 2005).

In response to the conspicuous nagging housing debacle, the government of every nation-developed or developing-tries to find a lasting solution as far as its financial and technological capacities could allow it. In other words, governments all over the world embark on the provision of public housing to accommodate their (homeless) citizens. This paper assesses how the Nigerian government fares in meeting the housing need of the people in this regard.

Specifically, it takes a look at what obtains in Moremi Estate, Ile-Ife, one of the public housing estates owned by the Osun State Property Development Corporation.

II. Literature Review of Public Housing in Nigeria

Government intervention in public housing dates back to the period of colonial administration in Nigeria, even though the policy was majorly directed at the provision of housing for the white colonial administrators who were settled in specially protected and developed areas, referred to as Government Reservation Areas (GRAs). The post-independence period saw the extension of the GRAs and the introduction of special public housing programmes exclusively for the new national elite in the higher hierarchy of the state apparatus.

Later the First National Development Plan (1962-68) was introduced so that low, medium and high-income people could also benefit from public housing programmes of governments. However, the outbreak of civil war thwarted the success of the plan. In the Second National Development Plan (1970-74), the government accepted housing as part of its social and political responsibilities. It emphasized housing provision for all social groups.

In 1976, consequent upon the ousting of the military regime of General Yakubu Gowon, a reappraisal of the housing policy was made, and was incorporated into the Third National Development Plan (1975-1980). The boost experienced in the national economy as brought about by oil exploration influenced this reappraisal. Among other things the Third National Development Plan provided that the federal military government would build 202 000 housing units per year: 46 000 in Lagos, 12 000 in Kaduna and 8 000 units in each state capital. The development of Festival Town, Amuwo Odofin Phase I Estate and Ipaja Town in Lagos was carried out under this programme. In 1978, the estates were transferred to the various state governments for purposes of control and management. This was the first significant federal government's effort at providing affordable housing to Nigerian citizens on long-term mortgage repayment terms. It was also during this period that the Nigerian Building Society was transformed into the Federal Mortgage Bank of Nigeria.

The temporary departure of the military from power in 1979 saw another reappraisal of the housing programme. This was done under the excuse of the huge economic and financial burden of the numerical dimension of the exercise. However, the new capital, Abuja, was to be rapidly constructed during the same period. The Federal Government during the 1981-1985 plan period was to embark on the provision of 2 000 housing units yearly in each of the then 19 states of the Federation, with about 1.6 billion naira allocated to housing.

In 1979, the civilian government of Lagos State announced a state housing programme of 50 000 units to be constructed between 1979 and 1983. However, the 1984 re-arrival of the military witnessed a reappraisal of the housing units to be constructed by the Lagos State Property Development Corporation. Instead of the on-going exercise of 50 000 units, 8 000 units with new design models were to be constructed between 1983 and 1986 by the state's military government.

With change of government through a military coup in 1986, the public housing exercise was terminated across the country. The military government decided to no longer provide housing for Nigerians on the excuse of restraining economic situation. House ownership was then left to hardworking Nigerians, although efforts were made by the government to reduce costs of building materials and control land speculations. This policy deviation placed the urban poor and middle-class in further displacement from the housing market (Olayiwola and Ogunshakin, 1992).

In response to the enormity and perpetual nature of housing problems facing the country, the government took another look at housing and thus launched the National Housing Policy in February 1991. This was a comprehensive document aimed at ensuring that all Nigerians own or have access to decent housing accommodation at affordable cost by the year 2000 AD. This goal as consistent with the United Nations' resolution of 'Housing for All by the Year 2000 AD and thus required that 700 000 housing units be constructed annually in Nigeria in order to meet the target of 8 million units by the target year.

The policy provided for encouragement and promotion of active participation in housing delivery by all tiers of government, strengthening of institutions within the system to render their operation more responsive to demand, emphasizing housing investment which satisfies basic needs, and encouraging greater participation by the private sector in housing development. However, the policy also suffered major setbacks in its implementation.

The year 1994 marked a rethink of the military government to addressing housing provision. On January 20, 1994 a National Housing Programme for 1994-1995 was unveiled to be executed under the Ministry of Works and Housing. During the period a total of 121 000 housing units were to be constructed for all income groups. Priority was given to newly created states; each was to have 5 000 housing units while the rest and Abuja shared 76 000 units.

To ensure proper execution of this programme, the Government formed a 16-man committee to study the National Housing Policy in terms of its provision compliance and implementation. The issue of housing finance was addressed through the establishment of the National Housing Fund in 1992, which was granted a take-off fund of 250 million naira. Also the Federal Mortgage Bank (FMB) put in place three schemes: voluntary, mandatory and budgetary allocations and financial transfer schemes to curb the problem of housing finance.

In 2002, the federal government set up a new ministry, Ministry of Housing and Urban Development, to deal with housing and urban development. The government identified under the National Housing Policy a prototype-housing scheme, which was launched in order to increase the nation's housing stock. The scheme was on a revolving fund basis and ensured that proceeds from sale of completed units were ploughed back into the scheme. Within the first two to three years of its inception, the ministry had completed 500 housing units in Abuja, and had entered into partnership with private developers to complete 1 127 units in Abuja and Port Harcourt (Komolafe, 2010).

It is a fact that despite the intervention of the Nigerian government in housing supply, the housing problem is far from being solved. This can be attributed to flaws in the strategies adopted by the government. Principal among such flaws is government's intervention through direct housing construction. Even though the government possesses the resources and executive capacity to embark on direct home construction, it should not have done so given the past experiences of the high cost and slow pace of construction of government projects. Besides, more often than not, houses built were usually very expensive which put them beyond the reach of the low-income group. Also, the houses did not meet the requirements of the people, for example, providing one-bedroom houses for low-income group when the average family size was put at 6 persons. Moreover, the adopted practice and system of granting loans makes it difficult for the really low-income people to benefit. The bulk of the mortgage loans went to families in the upper class.

Furthermore, many government housing projects were embarked upon without effective programme of action and appropriate institutional arrangement for their execution. This means that the project lacked adequate planning, which led to their failure. In addition, there was too much corruption in the system. Money meant for housing project was diverted into private hands, thereby allowing the projects to suffer.

Also, there was the problem of party politics in Nigeria, which affected the Federal Housing Project coverage. For instance, the exhibited uncooperative disposition of some state governments was simply because a different party other than their own controlled the federal administration. These states saw themselves as competing with the federal government and did all they could to slow down the pace of the federal housing projects.

In summary, one can reasonably conclude that the lack of financial prudence, public probity and accountability, inefficient and ineffective administrative machinery, mass importation of foreign technology and material, personnel and inflation, as well as incomprehensive analysis of the nation's housing requirements caused the low performance of the public housing programmes of the Nigerian government. In addition, the planning, programming and implementation of the public housing policy and programmes suffered grossly from planning inconsistency and organizational structure owing to political instability and an over-centralised mechanism of decision and execution.

III. Public Housing Programmes of Osun State

Osun State Property Development Corporation inherited fifteen housing estates from the old Oyo State Property Development Corporation consequent upon the carving out of Osun State from the old Oyo State in 1991. Located in the six administrative zones of the state, the estates are Oroki Estate, Osogbo; Moremi Estate, Ile-Ife and Ajaka Estate, Ilesa. Others are Agunbe Estate, Ikirun; Oroki Extension Estate, Osogbo; Akoda Estate, Ede; Oluwo Estate, Two; Ile-Ogbo Estate, Ile-Ogbo; Olufi Estate, Gbongan; Owa Ooye Estate, Imesi-Ile; Ipetumodu Estate, Ipetumodu; Owamiran Estate, Esa-Oke; Aiyegunle Estate, Ode-Omu; Okinni Estate, Okinni and Okuku Estate, Okuku (Komolafe, 2010).

These estates were designed to cater for the residential, commercial and industrial needs of the inhabitants of the state which, according to the National Population and Housing Census exercise of 2006, has a population of 3 423 535 people. The Osun State Property Development Corporation was established to manage the public estates in Osun State with the following objectives:

- to provide serviced lands, industrial plots, public/semi public plots and low cost houses for the general public;
- to develop estates in various parts of the state and services for residential, industrial, public and semi-public purposes;
- to provide modern dwelling houses at reasonable cost for sale to members of the public;

  and;
- to construct office and commercial buildings for letting to members of the public.

However, at present only three of the fifteen estates are functioning. With the exception of Moremi Estate, the focus of this paper, each of these three estates has provision for residential, industrial, commercial, public and recreational facilities.

IV. Moremi Estate

Moremi Estate is located along the Ife-Ibadan Expressway, close to the Obafemi Awolowo University's main entrance. It came with a policy that was proposed by the Federal Government for the State Government to execute. The policy allows people to build their houses according to the Osun State Property Development's (OSPDC's) procedure, and it provides services for the people who are interested in buying houses and plots of lands. It is a developing estate with infrastructural facilities like pipe-borne water, electricity and roads. Water is supplied by the Osun State Water Corporation, while electricity is supplied by the Power Holding Company of Nigeria (PHCN). The roads in the estate are not tarred; however, each building plot is accessible by an access road.

Moremi Estate has a land area of about 67 hectares, and it comprises five land use types: residential, commercial and public/semi-public uses as well as road network and open space. There is no provision for industrial land use. The identifiable land uses in the estate are as presented in Table 1.

Table 1 : Land Use Analysis of Moremi Estate

S/No	Land Use	Size (Hectare)	Percentage (%)
1.	Residential	31.65	47.07
2.	Commercial	6.64	9.88
3.	Public/Semi-Public	3.63	5.46
4.	Open Space	4.78	4.23
5.	Roads	20.54	33.36
6.	Total	67.24	100.00

Source: Osun State Property Development Corporation (OSPDC), 2010

a) Residential Zone

The major function of the estate is to provide serviced plots and develop some of the plots into buildings that are sold to interested people. To this end, 50 houses have been built and sold in the estate. They consist of 25 2-bedrooms, 24 3-bedrooms and 1 4-bedroom housing units. Serviced plots make up 23 blocks of 270 plots. These plots exclude the already constructed and sold out ones. They are of 2 types: high- and medium-density 'plots. There is no low-density plots. Generally, the residential zone of the estate is just partly developed as the majority of the buildings are yet to be completed.

b) Commercial Activities

The commercial zone of Moremi Estate occupies 2 plots of land, located in Block VII. However, it is yet to be developed. Meanwhile, there are two corner shops that serve the developed part of the estate. With the size of the estate, it appears that it is not well served in terms of commercial outlets.

c) Public/Semi Public

Provision is made for public/semi-public facilities for the residents of Moremi Estate. These are a nursery and primary school, community centre, club house, administrative office and a health centre, some of which are yet to be put in place. However, the OSPDC's Administrative Office and Water Corporation are already performing their functions, even though electricity and water distribution is yet to cover the estate in its entirety.

d) Open Space

Despite the importance of open space to neighborhood dwellers, the open space provided in the estate serves as a multipurpose space at present. However, only one plot of land is reserved for this purpose.

e) Road Network

There are three types of roads in the estate. The first is the largest and the most important as it connects the estate to the Ibadan-Ile-Ife Expressway. It is about 500 metres long, and is named after the Late Sir Adesoji Aderemi (former Ooni of Ife). The road is not tarred; neither does it have drainage or walkway. The second type of roads is named 'Avenues'. Measuring 300 metres, they are not as long as the first type. There are three of them. The third in the hierarchy of roads in the estate consists of access roads. Each is about 200 metres long; and there are 25 of them: 14 streets and 11 closes. All the identified types of roads in the estate are still at the 'open-up' stage: none has been tarred. They all lack sidewalk and drainage.

V. An Assessment of the Land use Pattern in Moremi Estate

It does not require more than just a cursory look at the land use pattern in Moremi Estate to conclude that there are some inherent fundamental functionality flaws in the land use pattern of the estate. To start with, the existing layout of the estate does not provide for a defined or recognizable centre in the estate. For one thing, a residential estate with 328 plots is big enough to accommodate a threshold population that can support varied land uses. For instance, public/semi-public land use is supposed to be reasonably centralized to form a sort of neighborhood centre along with commercial land uses. Inasmuch as Moremi Estate can be considered to be a small neighbourhood there is a need for a well defined centre. This is conspicuously lacking in the estate.

The road network is well designed with each road joining the other in a hierarchical manner. The 'Way' joins the 'Avenue' which links the 'Way' to the streets. This type of design can be said to be a functional one. However, none of the roads has been tarred fully developed. Also, there is no low-density plot in Moremi Estate. This might be contributing in a way to the slow pace of infrastructural development of the estate; more so that the estate is so close to the Obafemi Awolowo University campus. With just one official corner shop in the estate it can be said that the population of over 1000 inhabitants of the estate are to a large extent commercially underserved. This is because a fully fledged commercial centre is what is needed rather than a corner shop. Meanwhile, the estate is large enough to accommodate a standard commercial centre the nonexistence of which may lead to the proliferation of corner shops in the estate. This will end up bastardizing the layout plan of the estate.

The state of public/semi-public facilities in the estate is nothing to write home about as most of the planned facilities are yet to be constructed, to say nothing of their taking off. This might be contributing to the unwillingness of potential developers in not embarking on construction in the estate as vital services are yet to be provided. Furthermore, there is opulence of open space in Moremi Estate. However, the open space is not organized as it should be. Really what the estate needs is organized open space which could be in form of gardens and play lots for recreation.

VI. Level of Housing Development in the Estate

Table 2 revealed the level of housing development in the estate. It was discovered from Table 2 that 46.1% of the high density plots have been completed and occupied. This is in contrast to what is obtained in the medium density plots where only 16.9% of the plots have been completely developed and occupied. The Table also shows that 2.4% of the entire plots in the estate were at the foundation level; 1.8% of the buildings were at the lintel level and 7.4% have been roofed but not yet occupied.

From this analysis, it can be safe to conclude that a significant proportion of the plots in the estate are yet to be fully developed.

Table 2 : Building Development Status in Moremi Estate

Index	Building State	High density plots	%	Medium density plots	%	Total	%
1	Vacant land	80	44.4	102	68.9	182	55.5
2	Foundation	04	2.2	04	2.7	08	2.4
3	Lintel stage	02	1.1	04	2.7	06	1.8
4	Roofed but not occupied	11	6.1	13	8.8	24	7.4
5	Completed and occupied	83	46.1	25	16.9	108	32.9
	Total	180	100	148	100	328	100

Source: Field Survey, 2015.

VII. Factors Influencing the Pace of Development of the Estate

There are questions that tend to appear pertinent at this juncture, and they are directed towards getting to know the factors responsible for the slow pace of development of the estate, in spite of the fact that all the plots have been fully allocated. To this regard, the perception of the residents was sought on the causes of the slow pace of development of the estate. As shown in Table 3, it was revealed that lack of low density plots ranked highest with 3.60 (agreed). The unavailability of low-density plots might be responsible for potential property developers among the staff of the university not having interest in seeking accommodation in the estate.

Security comes next with 3.51 (agree). Although, there were some hired private security guards, they were not adequately equipped for people to feel a high sense of security. Aptly followed by security were inadequate facilities in the estate (3.31); lack of commercial activities (3.19) poor state of the estate roads (3.13) and location of the estate (3.07). Factors that ranked lowest as being responsible for the ineffective development of the estate were activities of land speculators (2.76) and economic situation of the country (2.75).

Table 3 : Perception of the causes of the slow pace of development of the Estate

S/N	Perception	Rating and Weighted Values					SWV	MWV
		1 SD	2 D	3 U	4 A	5 SA		
1.	Poor state of roads	15	19	30	30	15	338	3.13
2.	Size of plots	8	10	25	39	26	389	3.60
3.	Security	8	11	27	42	20	379	3.51
4	Inadequate facilities	7	16	32	41	12	359	3.32
5.	Location	9	32	12	52	3	332	3.07
6.	Activities of land speculators	22	29	22	28	8	298	2.76
7.	Economic Situation	18	30	28	25	7	297	2.75
8.	Absence of Commercial Activities	15	18	22	42	12	345	3.19
	Total							25.53
		Mean of ∑MWV = 25.53/8 = 3.2						

Key: SD-Strongly Disagree, D-Disagree; U- Undecided; A-Agree; SA-Strongly Agree
Source: Author's Field Survey, 2015.

VIII. Conclusion and Recommendations

From the assessment so far of what obtains in Moremi Estate, it is apparent that the estate is quite far from living up to expectations. As such it is imperative that measures be taken to make the estate become what it was expected to be, bearing in mind the philosophy behind its establishment. First, it is necessary to formulate a policy that will encourage all those to whom plots have been allocated in the estate to develop their sites. This could be in form of deadlines as to when the building up of each plot should be. Failure to comply with the given deadlines should translate to the defaulters losing their right on the allocated plots.

Besides, there should be a kind of centre for the estate that will comprise such public facilities as nursery/primary school, community centre, health centre, club house and central park or garden. This may mean embarking on some rearrangement, but the effort is well worth the while as the estate will be able to easily render vital social services to the inhabitants. Private developers should be involved here for effectiveness and timely funding.

In addition, security should be enhanced and all the roads in the estate should be made more suitable for smooth vehicular movement. Such street furniture as lights should also be provided, especially to aid security and safety at night as the estate is to a large extent secluded. This may start with the 'Way' (the main road that connects the estate to the expressway), while others may come in later as funds are made available by the government.

Over and above all, moribund sister estates in the state that are controlled by the Osun State Property Development Corporation should be rejuvenated and effectively managed so as to solve part of the housing problem with which the country is battling to resolved.

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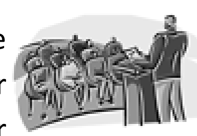

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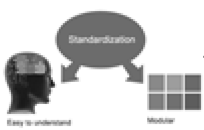

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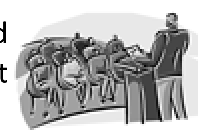

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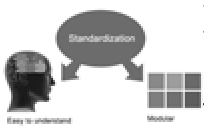

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.

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Note :

"

- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
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"

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1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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- Please note the criterion for grading the final paper by peer-reviewers.

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Mistakes to evade

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

In every sections of your document

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

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

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

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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

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

Title Page:

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

Abstract:

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

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

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

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

Approach:

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

Introduction:

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

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

Approach:

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

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

Procedures (Methods and Materials):

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

Materials:

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

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.
- Leave out information that is immaterial to a third party.

Results:

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

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

Content

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

What to stay away from

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

Approach

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

Figures and tables

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

Discussion:

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

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

Approach:

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

The Administration Rules

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

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