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Land Suitability Analysis for Cassava

Discovering Thoughts, Inventing Future

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Land Suitability Analysis for Cassava *(Manihot SPP.)* Cultivation in Southern Part of Adamawa State, Nigeria

By Kefas, J & Zemba, A.A.
Concordia College Yola P.M.B.

Abstract- The study assessed the physical land suitability for cassava cultivation in southern part of Adamawa State using Multi-criteria evaluation and GIS technique. Within the study area, the production of cassava is mainly for food and there are only little opportunities for its commercial development. This therefore makes it necessary to carry out land suitability analysis in order to provide information on the study area that would guide in sustaining long term production of cassava. The environmental variables examined were Mean Annual rainfall, Mean Temperature, Length of rainfall, Relief and Soil which were obtained from the Upper Benue River Development Authority (UBRDA), Yola. The primary data were sourced by means of field survey to obtain the coordinates of the current cassava growing areas for mapping. The five factor maps were reclassified based on environmental requirement of cassava crop in the IDRISI Taiga environment and different weights were assigned to each factor to represent their relative importance using the pair-wise comparison Matrix.

Keywords: land suitability, cassava cultivation, multi-criteria evaluation, pair-wise comparison matrix, idrisi taiga.

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Land Suitability Analysis for Cassava *(Manihot SPP.)* Cultivation in Southern Part of Adamawa State, Nigeria

Kefas, J [α] & Zemba, A. A.[σ]

Abstract- The study assessed the physical land suitability for cassava cultivation in southern part of Adamawa State using Multi-criteria evaluation and GIS technique. Within the study area, the production of cassava is mainly for food and there are only little opportunities for its commercial development. This therefore makes it necessary to carry out land suitability analysis in order to provide information on the study area that would guide in sustaining long term production of cassava. The environmental variables examined were Mean Annual rainfall, Mean Temperature, Length of rainfall, Relief and Soil which were obtained from the Upper Benue River Development Authority (UBRDA), Yola. The primary data were sourced by means of field survey to obtain the coordinates of the current cassava growing areas for mapping. The five factor maps were reclassified based on environmental requirement of cassava crop in the IDRISI Taiga environment and different weights were assigned to each factor to represent their relative importance using the pair-wise comparison Matrix. Descriptive statistics in form of simple percentage and charts were used to present the result which reveals explicitly on a single map; the areas that are suitable (65.92%) and those that are not suitable (34.08%) for cassava cultivation. Similarly, the current cassava growing areas were mapped and the areas identified are Dissol, Mbulo, Maitani, Farang, Timdore and Wadore which fell within the suitable category. The study has therefore recommended that institutions of learning and agencies in the state should encourage the use of GIS in their various research works because it is accurate and time saving as it is evident in this study. Cassava production should also be encouraged among farmers so as to utilize the proportion of land area found to be suitable for cassava production in Southern Adamawa State.

Keywords: land suitability, cassava cultivation, multi-criteria evaluation, pair-wise comparison matrix, idrisi taiga.

I. Introduction

Crop-land suitability analysis is a prerequisite to achieving optimum utilization of the available land resources for sustainable agricultural production. One of the most burning needs in both developed and developing nations is to improve agricultural land management and to impart suitable cropping patterns in order to increase agricultural production with efficient use of land resources (Perveen *et al*., 2007). Hence comprehensive, reliable and timely information on agricultural resources is necessary for Nigeria where agricultural potential of the land resources is being pressurized by high population growth and environmental hazard like drought and soil erosion.

On the other hand, Nigeria has been faced with food supply deficiency which has almost become an intractable problem in the past decades (Mathias, 2014). This situation is highly pronounced in urban areas due to high population density with agricultural land being frequently in short supply and more mouths to feed. In order to meet the increasing demand for food, the farming community has to increase production so as to meet the growing demand of the growing population (Venkatesan *et al,* 2010).

However, Nigerian soils have a substantial agricultural potential but a fundamental constraint to its development is the unreliable method of data acquisition and management on agricultural land (Joshua *et al,* 2013). The consequence is poor knowledge and unreliable data for agricultural planning. In addition, the use of land is not only determined by the user but also the land suitability which is governed by different land attributes such as the soil types, underlying geology, topography and hydrology (FAO, 1993). These attributes can limit the extent of land available for various purposes. To get the maximum benefit out of the land, its proper use within the context of suitability is inevitable. In Nigeria however, the productivity of soil is decreasing because lands have been utilized for all purposes at the expense of their suitability thereby resulting in land degradation (Senjobi, 2007).

In view of the above, the importance of cassava (*Manihot spp.*) in mitigating hunger and providing food security is timely and cannot be over emphasized. Its food security features have attracted interest for some time and being known to be common within the tropical environment, cassava has the potential to combat hunger and address food security issues (Harvest Plus, 2012). Hence, the suitable areas for agricultural use are determined by an evaluation of the climate, soil, topography as well as understanding of local biophysical restraints. But where many variables of this nature are involved, Geographic Information System (GIS) technology offers a dynamic tool for

Author α: Department of Geography, Concordia College Yola P.M.B. 2031, Adamawa State, Nigeria. e-mail: jonahkefas14@gmail.com
Author σ: Department of Geography, Modibbo Adama University of Technology, P.M.B. 2076 Yola, Adamawa State, Nigeria.

multidimensional process of land use evaluation with a powerful tool for geo-environmental analysis (Pereira & Duckstein, 1993; Perveen *et al*, 2007). It allows the user to integrate database generated from various sources and analyze them efficiently in a spatio-temporal domain by overlaying different map layers.

Within the study area the demand for cassava-related products are on the increase but its production is basically for food. Hence, more areas of cassava cultivation need to be discovered so as to attract investors in the commercialization of cassava in this region. Thus, in mapping out the distribution of major food crops in Adamawa state; Sajo & Kadams (1999) posited that "the southern agricultural zone of Adamawa state receives annual rainfall of 1400mm; and is therefore important for root and tuber crops". Land suitability is however not determined by single environmental factor, but the collection and analysis of information which may have significant influence on the use that can be made of the soil (Joshua et al, 2013). Moreover, the study of how the combination of these environmental factors affect the cultivation of cassava has never been delved into within the study area. This therefore makes it necessary to carry out land suitability analysis in order to unravel its suitability and capability for sustaining long term production of cassava in southern part of Adamawa State.

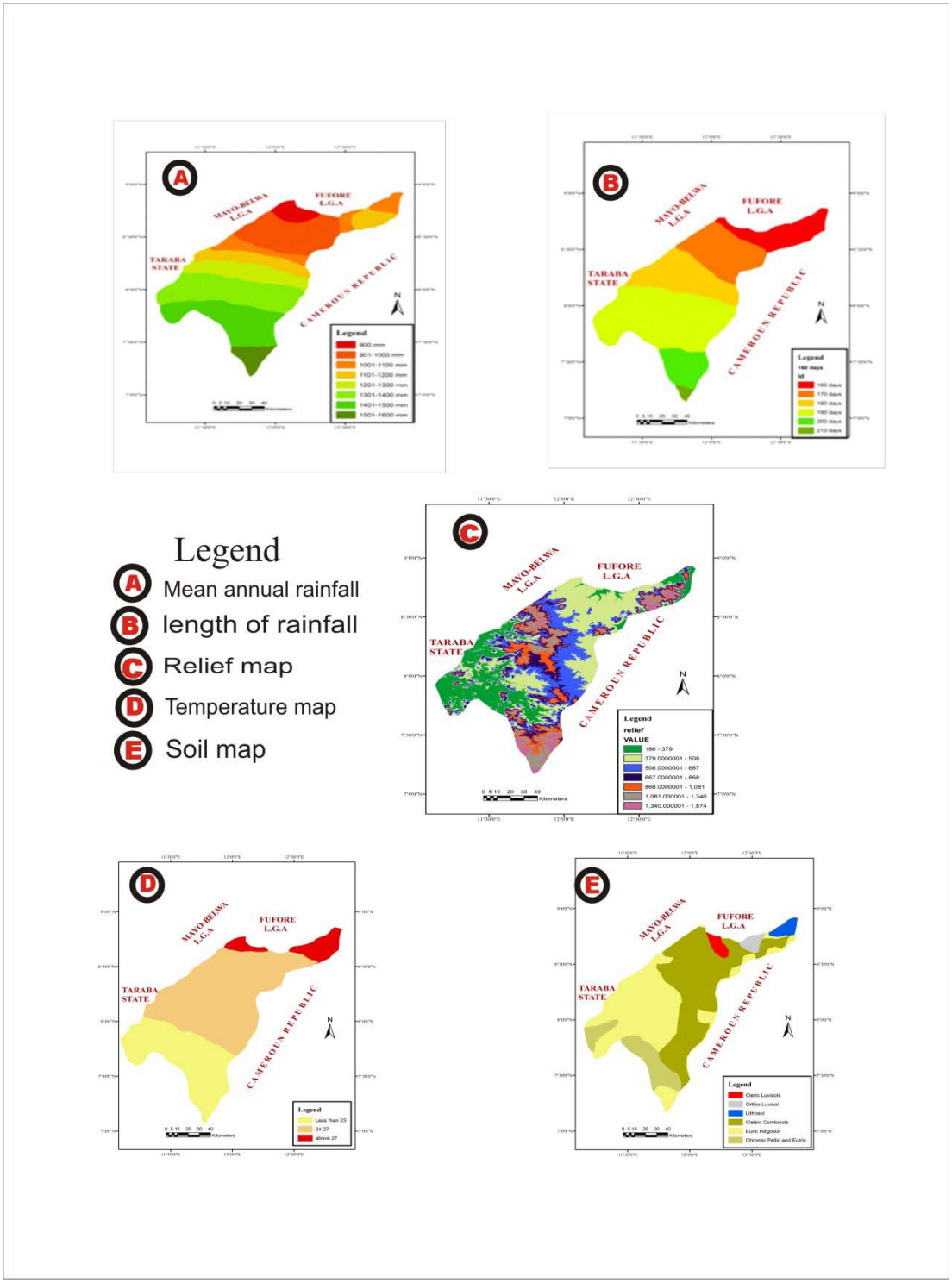
II. The Study Area and Methodology

a) *The Study Area*

The study area is located between Latitude 7̊0 ' to 9˚0' N and Longitude 11˚0' to 13˚ 0' E. It has a total landmass of 10602.95 km^2 with a population of 507047 people (projected from 2006 Census to 2015). It comprises of Jada, Ganye and Toungo Local Government Areas of Adamawa State. It is bounded by Mayo-Belwa and Fufore Local Government Areas to the North, the Cameroon Republic to the eastern side and Taraba state borders the area to the South and West as shown in Figure 1.

The movement of the Inter Tropical Discontinuity (ITD) and altitude are the basic elements controlling rainfall distribution in the study area. Rainfall decreases form the south (1600mm) towards the north (900mm) within the study area. The mean onset date for rainfall within the study area is 10th April while the cessation date is 6th November. The temperature is high throughout the year because of the incoming radiation with a sharp drop at the onset of rains due to the effect of cloudiness. The maximum temperature usually occurs in April to about 38˚C while the minimum temperature can be as low as 18˚C between December and January (Adebayo, 1999).

Geologically, the study area falls within the eastern extension of the Nigerian Precambrian rocks. It has several high-level plateau surfaces which are part of discontinued mountain ranges. The most striking landform feature in the area is the mountain ranges, which in most cases appear as grouped hills and generally, trending from north to south particularly along the eastern border lands of Nigeria with Cameroon. The most popular of these ranges is the



Source: Adapted from the Upper Benue River Development Authority, Yola (2014)

Figure 1: The Study Area and its Environmental Characteristics

Alantika and the Mangia hills south-west of Jada (Tukur, 1999). The soil is derived from a soil survey of a former Gongola state under different map units, ranging from units 201-242. The soils include luvisols, lithosols, combisols and vertisols. These soils have different characteristics ranging from high base saturation, deep and well drained, high organic matter content, low to moderate saturation, poorly drained and dark colored among others (Ray, 1999).

b) Data Types and Sources

The physical parameters (factors) directly related to cassava crop production were considered for analysis. These factors include relief, soil, annual rainfall,

length of rainy days and temperature of the study area. Both primary and secondary data were considered for the study. Primary data were collected from the field by means of physical observation and picking of geographic coordinates of the current areas of cassava cultivation using the Global Positioning System (GPS) as presented in Table 1. The secondary data which is basically concerned with the five factor maps were generated from thematic map of Adamawa State which was obtained from the Upper Benue River Development Authority, Yola (2014).

c) Equipment and Materials

The hardware component consists of Garmin 12 GPS receiver (hand held) which was used to obtain the geographic coordinates of cassava cultivation sites. Pavilion 15 HP Laptop Computer, HP 4400 Series Scanner, DeskJet 2510 Series Printer and a Photocopier were used in carrying out the analysis. The software consists of IDRISI Taiga and ARC GIS 10.0. The IDRISI Taiga was used for overlay operations and calculations of areas while the ARC GIS 10.0 was used for geo-referencing and digitization of maps.

Table 1: Current Cassava Cultivation Sites

Location	Coordinate	Site
Lat. / long.	08˚07'51.7"N, 12˚01'29.3"E	Maitani
Lat. / long.	08˚32'21.9"N, 11˚59'08.6"E	Timdore
Lat. / long.	08˚37'36.8"N, 12˚01'17.2"E	Mbulo
Lat. / long.	08˚44'22.1"N, 12˚02'26.0"E	Farang
Lat. / long.	08˚19'19.1"N, 12˚03'24.4"E	Dissol
Lat. / long.	08˚25'53.7"N, 12˚06'25.3"E	Wadore

Source: Reconnaissance and Field Data Acquisition, (2015)

d) Data Processing

The five parameters (annual rainfall, annual rainfall length, air temperature, soil and relief maps) were geo-referenced by transforming their LATLON to Universal Transverse Mercator (UTM) coordinate System in the ArcGIS 10.0. The 'X' and 'Y' minimum and maximum values of the coordinates were used to create map boundary. The LATLON of the tie-points were inserted one after the other to ensure the true coordinates of these points. After geo-referencing, the maps were re-sampled in order to take their exact cell size as well as to enable the overlay process. The re-sampled maps were later digitized and saved as project map which were being imported to Idrisi Taiga for overlay analysis.

e) Method of Data Analysis

The map algebra (overlay) method of analysis using GIS was employed for data analysis. This method combines information from one GIS layer with another to derive an attribute for both of the layers. This overlay or spatial join can integrate data of different types such as soils, vegetation, land ownership, jurisdictions and other data available for analysis (Samuel, 2014). Hence, the suitability criteria for cassava production were defined on the basis of literature reviews and experts knowledge as presented in Table 2.

f) Assigning Criteria Weights for Cassava Suitability

Different weights were assigned to each factor to represent their relative importance using the pair-wise comparison analysis developed by Saaty (1980). The purpose of the criteria weighting was to express the importance of each criterion relative to other criteria in determining the suitability for cassava growing sites. The more important criterion had the greater weight in the overall evaluation as presented in Table 3. Finally the weighted criteria were processed to generate the composite suitability map. This method of analysis was selected because it allows

Table 2: Criteria Definition of Environmental Factors for Cassava Cultivation

Factors	Criteria
Rainfall length	≥107 rainy days
Annual rainfall	1000-2000mm
Temperature	≤27˚C
Relief	150-1000m.
Soil	Light sandy loams

Source: USDA (1997), NRCS Plants Database 2008; Adjei, 2012

Table 3: Weighting Criteria by Pair-wise Comparison

Criteria	Temperature	Rainfall length	Soil	Annual rainfall	Relief
Temperature	1	5	5	7	3
Annual rainfall	1/5	1	1	5	1/3
Rainfall length	1/5	1	1	5	3
Relief	1/7	1/5	1/5	1	1/3
Soil	1/3	3	1/3	3	1

Source: Adapted from Saaty, (1990)

the decision makers to assign different levels of importance to the different factors involved in land suitability (Qiu *et al*, 2013).

After applying the AHP generated weights in the data, the additional subroutine (overlay modules) of IDRISI Taiga using image calculator was used for the analysis. The process involves the summation of a continuous multiplication of each criterion by its weight (Temperature × 0.480) + (Rainfall Length × 0.194) + (Soil × 0.156) + (Annual rainfall × 0.124) + (Relief × 0.042). This process was carried out in order to produce a fuzzy suitability map which was later reclassified to produce the cassava suitability map.

g) Mapping Cassava Suitable Areas

The suitable site for cassava cultivation on the composite map is concerned with areas that met the five (5) criteria for cassava suitability evaluation. Any area that fails to meet one of the five criteria was considered not suitable for cassava cultivation (fuzzy concept). Thus, two classes of suitability for cassava cultivation were derived from the algebra. This was revealed explicitly on a single map, the areas that can support the production of cassava and those that are not suitable for cassava cultivation.

h) Mapping of Current Areas of Cassava Cultivation

The processes of mapping out current areas producing cassava in the study area were carried out in ArcGIS environment by inserting the coordinates of the identified cassava production areas on a geo-referenced and digitized map of the study area. This process explicitly shows the distribution of the current cassava production areas on the map of the study location.

III. Results and Discussion

To assess whether or not the five variables are suitable for cassava cultivation, the land suitability order by FAO 1983 was adopted which indicate in simplest form whether land is suitable (S) or not suitable (NS) for the specified use. Hence, the overall suitable area for cassava cultivation covers 6989.46 km² (65.92%), whereas about 3613.49 km² (34.08%) of the study area falls within the unsuitable area as presented in Figure 2.

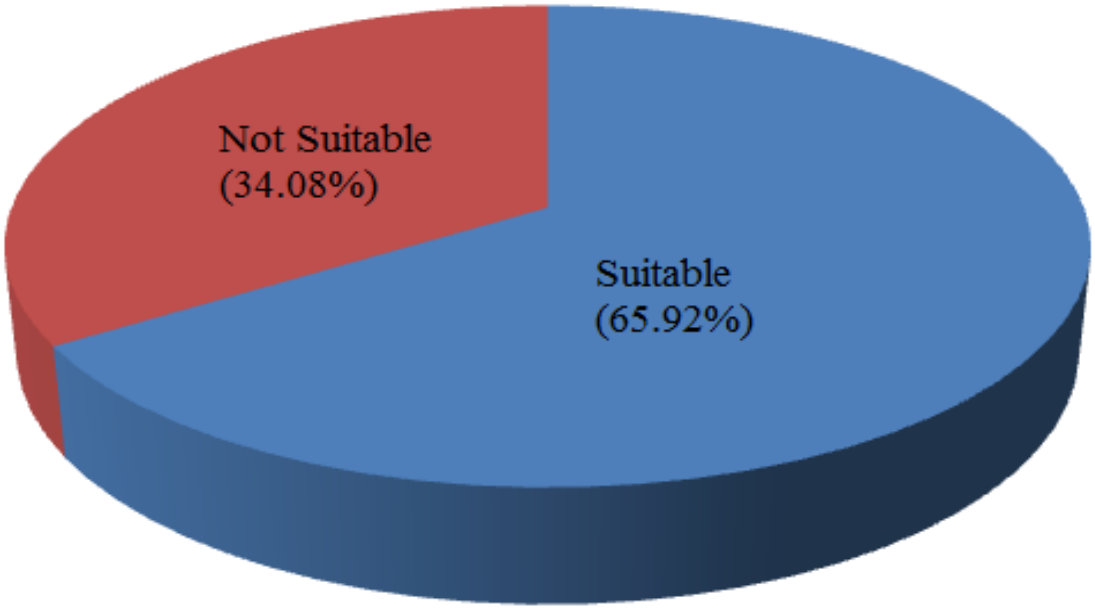


Figure 2: Suitability Status of Land for Cassava Cultivation in Southern Part of Adamawa State

a) Suitable Area (S)

The "suitable area" which is mostly in the central part although, cutting across the three Local Governments of the study location covers the largest portion of the map with a total area of 6989.46 km^2 (65.92%). This area has satisfied the requirements of the five variables used in the analysis and one of the reasons for such is attributed to the good soils of the region which is mostly loamy sands. These soils are well drained, moist and fertile with light to medium textures such as sandy loam, silt loam and clay loam (Ray, 1999). Such fertile soils tend to have a deep horizon that is friable enough to allow the development of the tubers (Cassava Production Guidelines, 2010). The Mean Rainfall of more than 1500 mm with up to 200 days of rainfall is another factor that supports the growth of cassava at all levels within the study location. The rainfall amount and duration is sufficient enough to give support during the critical period in cassava growth which is between 30 to 150 days after planting (Cassava Production Guidelines, 2010).

The Mean Temperature of the study area within the Suitable (S) category has a considerable effect on cassava production. According to Alves *et al* (2000), the highest root production for cassava crop can be expected in the tropics where temperature average 25-27˚C which corresponds with the condition obtainable in most part of the study location.

b) Not Suitable Area (NS)

The unsuitable area includes places in the western/eastern border, the extreme south and the north-eastern part, with some traces in the central part of the study area. In this part of the study location Relief, Temperature and Mean Annual Rainfall are responsible for the unsuitable category as they tend not meet the environmental requirements for cassava production hence, fell outside the suitability range for cassava cultivation.

Firstly, the striking landform features of the Atlantika, Verre and Shebshi Mountain ranges which are evident within the unsuitable area can inhibit the growth of cassava especially at the root development stage. This corresponds with recommendations of the Guidelines for Cassava Assembler Programme of the SMFI (2012) that cassava does not perform well with elevation exceeding 1000 meters above sea level. The Atlantika Mountain (1000-1400m) East of Ganye and Jada forms a natural boundary between Nigeria and Cameroun, the Shebshi mountain range (highest elevation 2,042m.) is South of Ganye and the Verre hills are found East of Jada (Tukur, 1999). Soils on these platform can pose a limiting factor that can lead to scanty growth potential (Ray, 1999); of cassava crop.

Mean Annual Rainfall is another factor responsible for the unsuitable nature of land for cassava production. This is because the northern part of the study area with less than 1000 mm of rainfall has fallen out of suitability range for cassava production. This assessment is imperative because cassava responds to water deficiency at different levels of development-morphological, physiological, cellular and metabolic (Augusto, 2002). For instance, cassava responds to water deficiency by rapidly reducing its evaporating leaf area and partially closing the stomata (Vincent, 2009). The reduction in storage root yield depends on the duration of the water deficit and is determined by the sensitivity of a particular growth stage to water stress.

The temperature condition in some part of the study area is above 27˚C which is beyond the suitability

range of temperature for cassava production. This will have negative effects on cassava growth because temperature affects sprouting, leaf formation, leaf size and storage root formation.

c) Current Cassava Growing Areas (Mapped)

The areas currently under cassava cultivation are depicted in Figure 3. The essence is to determine whether or not they match with the suitable growing areas as revealed by this study. Thus, the areas identified as the current cassava cultivation areas at the time of investigation include Maitani, Dissol, Timdore, Wadore, Mbulo and Farang. The study therefore reveals that all the six areas identified fell within the suitable area of cassava cultivation. Thus, the study has corresponded with the postulations of Sajo and Kadams (1999) that "the southern agricultural zone of Adamawa state receives an annual rainfall of 1400mm is therefore important for root and tuber crops".

d) Decision Making Guide for Current and Potential Farmers of Cassava

Beside the general suitability evaluation, individual criterion for securing agricultural land use plays an important role. This is because calculation of relative weights of factors for the production of cassava was based on the expert opinion and local knowledge obtained from field surveying. It was found that the highest weights were assigned to temperature and length of rainfall. Soil and annual rainfall were also found effective while relief was identified as the least important factor to be considered in cassava crop suitability.

Temperature is the most important because sprouting of the stem cutting in cassava often has a temperature range within which it germinates, and they will not do so above or below such range (George and Rice, 2000). At low temperatures 16°C sprouting of the stem cutting is

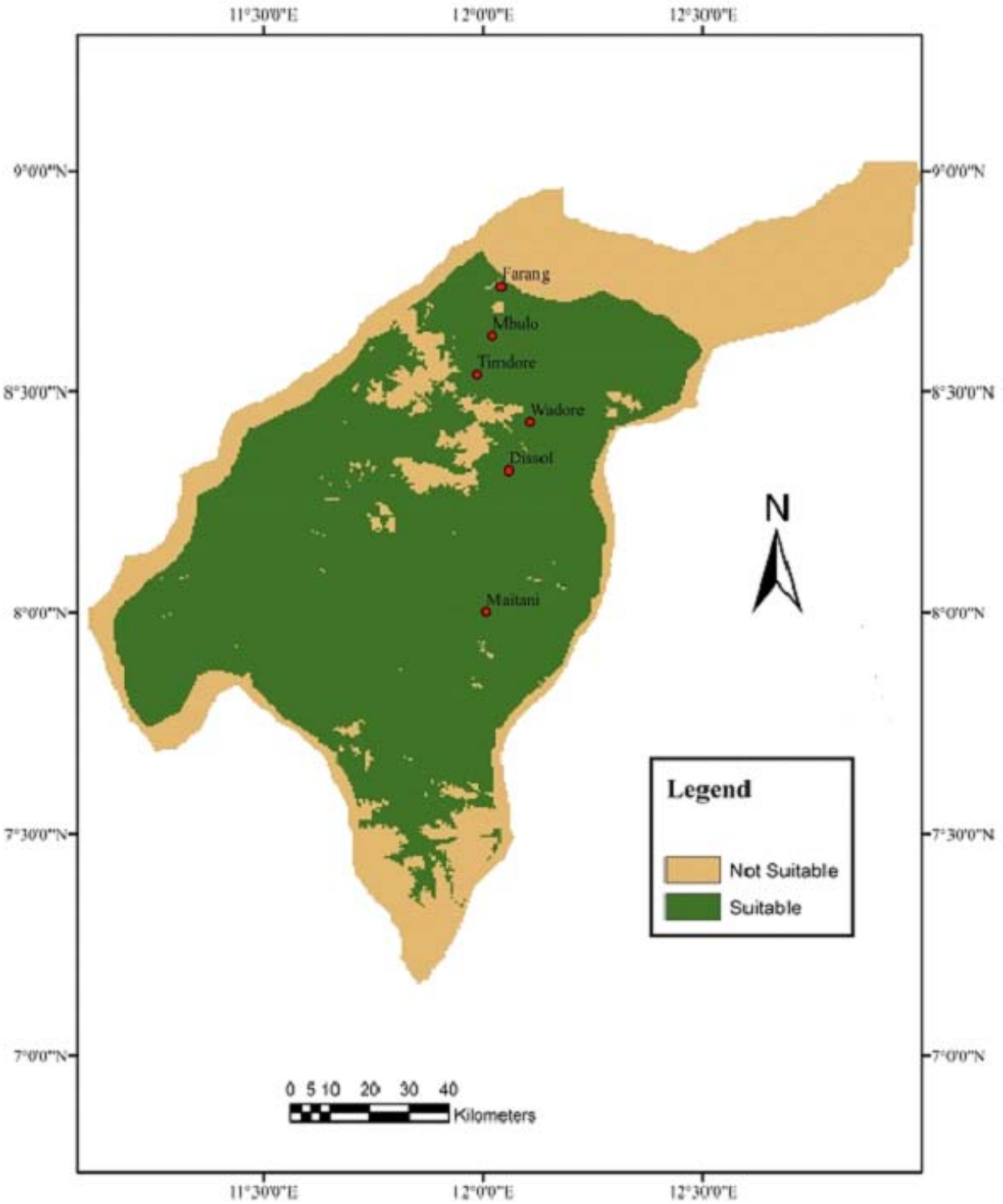


Figure 3: Areas Currently under Cultivation of Cassava in Southern part of Adamawa State

Source: Derived from Overlay Analysis of the Idrisi Taiga

delayed and the rate of leaf production is decreased. Sprouting is hastened when the temperature increases up to 30°C but is inhibited with temperatures greater than 37°C (Augusto, 2002).

After germination, rapid growth of cassava results in a high demand for light and moisture especially during the first critical stage. Matured seed need to take in significant amount of water before growth can resume. In addition, exposure to prolonged length of rainfall is required to shorten the length of dormancy in cassava growth and development.

The not suitable category includes mountainous areas of the region at high degree of physical limitation which could not be easily overcome. It is therefore not

economical to put such land under production. Such a qualitative evaluation is to help decision makers (local farmers and agricultural development institutes) to select the most appropriate site for cassava cultivation.

Comparison of the present land use for cassava cultivation with the analysed suitability classes was conducted to examine the degree of mismatch. It was noted that the "suitable class" has no constraint as all the identified areas of current cassava cultivation fell within the said category.

IV. Conclusions

In this study, Multi Criteria Evaluation with GIS technique was applied to identify suitable areas for cassava cultivation in Southern Adamawa state. The result obtained from the study indicates that GIS technique could provide a superior guide map for decision makers which could be used to consider crop substitution in order to achieve better agricultural production. The study clearly brought out areas suitable for cassava cultivation which was derived from the five criteria maps. These maps were analysed within the context of GIS after a pair-wise comparison of each factor relative to the other. Many inputs into the GIS based land suitability evaluation are the maps of the criteria (mean annual rainfall map, annual rainfall length map, air temperature map, soil map, and relief map) which represent the complex information in a simple, classified map.

V. Recommendations

Based on the findings of this study, the following recommendations are made:

i. Potential cassava farmers should allocate their resources in ensuring that the 65.92% of the total landmass suitable for cassava production is well utilized whereas, the "not suitable" category for the said crop should be allocated to other crops.
ii. Agricultural Development Agencies should provide loans for potential cassava farmers so as to encourage abundant supply of cassava.
iii. The institutions of learning and agencies in the state should encourage the use of GIS in conducting researches because it is accurate and time saving as it is evident in this research.
iv. Resource planners and decision makers should rely on this assessment so as to avoid the complex problem that involves subjective assessments with multiple criteria.

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Comparative Study of BRICS Countries on Renewable Energy

By Dr. Ashok Kurtkoti

Abstract- One of the greatest challenges mankind faces today is environmental pollution, which is seen as a major threat and can cause global warming. The major causes of pollution are energy, automobiles and electrical appliances. Approximately 40% of the pollution is caused by the energy sector. Reducing this kind of pollution has given opportunity to researcher to carry out research in natural sources of energy like water, wind, solar, bio-gas etc. This paper examines the requirement on energy consumption and the efforts of BRICS nations towards shifting to renewable energy. In addition, this paper conducts a comparative study of the electricity mix, energy consumption and carbon emissions that BRICS countries have carried out. This study reveals that the main reason in power production is the rise of renewable energy in India and Brazil and these countries have been active in shifting to renewable energy. Russia had not made any efforts, whereas South Africa was just getting involved. India had initiated trade deals with BRICS countries through 'Make India' for renewable energy products. Among BRICS countries, China had carried out maximum trades for renewable energy.

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Comparative Study of BRICS Countries on Renewable Energy

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Abstract- One of the greatest challenges mankind faces today is environmental pollution, which is seen as a major threat and can cause global warming. The major causes of pollution are energy, automobiles and electrical appliances. Approximately 40% of the pollution is caused by the energy sector. Reducing this kind of pollution has given opportunity to researcher to carry out research in natural sources of energy like water, wind, solar, bio-gas etc. This paper examines the requirement on energy consumption and the efforts of BRICS nations towards shifting to renewable energy. In addition, this paper conducts a comparative study of the electricity mix, energy consumption and carbon emissions that BRICS countries have carried out. This study reveals that the main reason in power production is the rise of renewable energy in India and Brazil and these countries have been active in shifting to renewable energy. Russia had not made any efforts, whereas South Africa was just getting involved. India had initiated trade deals with BRICS countries through 'Make India' for renewable energy products. Among BRICS countries, China had carried out maximum trades for renewable energy.

Keywords: CO2 emissions, renewable energy, BRICS countries, thermal power plants, electricity mix, energy consumption.

I. Introduction

Every year, we feel the temperatures increase in comparison to the previous year due to global warming. The main reasons for global warming are increase in automobiles, electrical appliances and pollution caused by industries. The conventional way of power generation is thermal and nuclear power plants. Nuclear power plants are costly and have limitations. Due to heavy carbon emissions causing air pollution, there is a shift to cleaner sources of power generation such as solar, hydro and wind energy globally. Due to climate change targets set it is essential to reduce CO_2 emissions by reducing dependence on thermal power plants and shifting to renewable energy. In this paper, a brief comparative study of the electricity mix, energy consumption and carbon emissions of BRICS countries was carried out. Study was also carried out on India's initiative on trade deals with BRICS countries through 'Make in India' for renewable energy products.

a) Need for study of Renewable Energy Sector

The various methods of power generation are:

1. Thermal
2. Hydro-Electric
3. Nuclear.
4. Solar.
5. Wind Energy.
6. Bio-Gas.

Among the above methods of energy generation mix the dependence is on coal based thermal power plants in many countries. However coal based power plants are harmful to the environment and human life as these plants emit heavy carbon dioxide (CO_2) and they are one of main cause of pollution. Also as these thermal power plants have become old and proper maintenance is not carried out, they operate at very low efficiency. Nuclear power plants are costly. Globally, nuclear is not a preferred option due to problems in nuclear disposables and Chernobyl accidents. Germany has plans to decommission all their nuclear plants by 2025 and replace them with wind turbines solar, wind energy and bio-gas are clean source of energy and due protection of surrounding environment there is a need to either shift or go for renewable energy.

Key issues encountered in Energy Production and Consumption in BRICS countries

There are some key issues to be encountered in Energy Production and Consumption in BRICS countries are:

Balance of interests, transparency predictability of supply and demand area on top priority. Due to substantial increase in energy consumption and supply being restricted matching demand becomes very difficult task for power distribution companies in BRICS country. Also if excess electricity is produced it becomes a waste and electricity is to be supplied and consumed immediately and cannot be stored.

In BRICS countries the demand for electric supply is growing every year due to urbanization and industrialization. The BRICS countries need to share their knowledge and experience in the related areas of energy planning, production and promoting mutual energy cooperation.

BRICS countries should address the following priority areas to enhance their energy security.

1. Enhancing awareness of the needs of the energy – producing and energy- consuming counties.
2. Extending mutual support for diversification of energy supplies
3. Promoting universal access to energy.
4. Increasing energy efficiency.

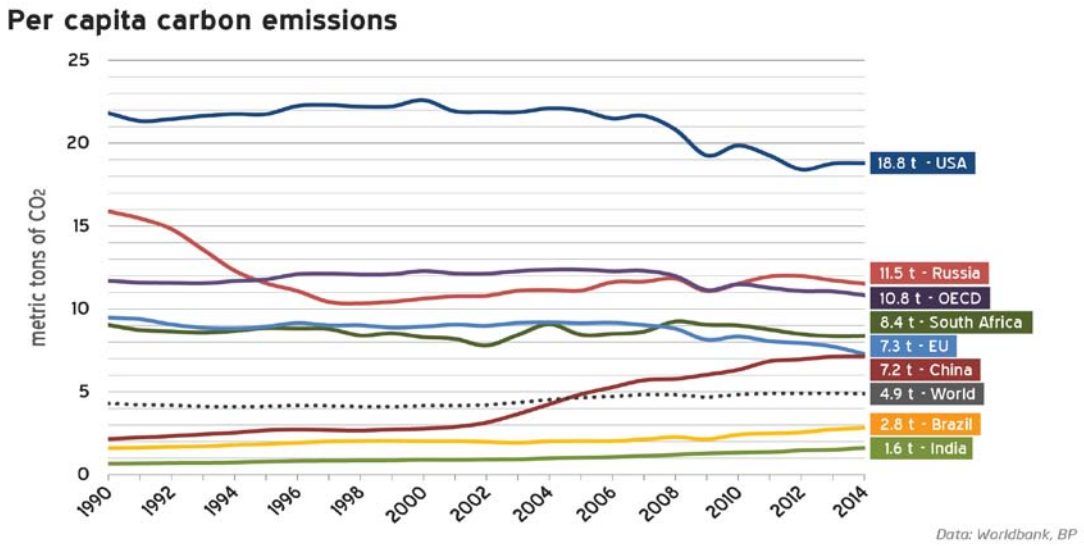
Author: e-mail: ashokkurtkoti@gmail.com

5. Introducing environmentally friendly technology of energy production, storage and consumption.
6. Promoting the use of renewable energy.
7. Improving the utilization of natural gas which is a clean source of energy.

To achieve the above goals BRICS countries should do the following

a. Promote efficient and environmentally friendly use of fossil fuels including proper cooperation in exploration.
b. Expand long term energy supplies.
c. Regular energy dialogue between the BRICS countries need to established so that long –term and medium -term strategies and energy security issues will be discussed.
d. BRICS countries to encourage cooperation for the investment in cleaner energy projects.
e. Encourage research on practical implementation of sustainable development in the BRICS countries, taking into account national interests.
f. Promoting universal access to power.
g. Joint development and sharing of knowledge on cleaner energy technology.
h. To strengthen public and private partnerships to stimulate energy efficient technology.
i. Exchange statistical data and forecast of development of national energy systems as well as information on best practices and regulatory framework.
j. To conduct research and development and studies on advance energy technologies in sectors which are mutually beneficial and will contribute in energy efficiencies[16]

Per capita carbon emissions is given in the following Figure 1



Source: www.greenpeace.de

Figure 1: Per capita carbon emissions

Globally all countries are realizing that coal-based thermal power generation is costly and also harmful to the environment and human health as it causes heavy pollution. The BRICS counties together contributed to about 38 percent of the global carbon emissions in 2014. The biggest share of 24 percent is China's, followed by India in the above study of carbon emissions of BRICS countries. Figure 1 show that only Brazil and India remain below world average in terms of per capita emissions. The reason being India's energy consumption is relatively low and Brazil uses hydro power and bio-fuels. Roughly the same emissions China emits as Europeans per person. The highest per capita carbon among BRICS countries is Russia, followed by South Africa. Considering aspect of reducing pollution has there is growing demand for shift to renewable energy.

The researcher had carried out SWOT Analysis of renewable energy sector and the same is indicated in Table 1-

Table 1: The Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis of the Renewable Energy Sector

Strengths	Weaknesses
• Solution to reduce global warming	• Depends on vagaries of nature
• Effective utilization of natural resources	• Less efficient
• Pollution can be controlled	• Changing consumer's mind set is difficult
• The initial higher costs can be set off due to benefits of cleaner energy	• Farmers and rural consumers may get affected due to dams built
Opportunities	**Threats**
• Effective ways to reduce carbon emissions	• Due higher costs involved, the consumers are reluctant to shift
• To innovate new ways of energy generation	• Threats from social activist
• To save the earth from environmental pollution	
• To serve mankind	
• To save trees being cut	
• To market green products	

Source: 'Develop clean energy and save energy or perish[4].

II. Research Methodology

a) Objectives

1. To examine the various resources available in BRICS countries for electricity generation.
2. To study trade between India and BRICS countries for renewable energy products.
3. To carry out SWOT analysis of renewable energy sector.
4. To carry out Comparative study of BRICS Countries on Renewable Energy
5. To study the challenges faced by power sector in India

b) Scope of the study

Comparative study of BRICS Countries on Renewable Energy Major parameters considered for study were Energy generation mix, Major method of power generation, present methods of producing Renewable Energy with their emphasis on shifting to Renewable Energy for BRICS countries.

III. Method of Data Collection

Secondary data collected by visiting web sites and research articles/papers.

a) Limitation of the study

Except India it was not possible to gather data on challenges faced by power sector from other BRICS countries

b) Scope of the further research

Comparative study of the remaining countries on Renewable Energy can be carried to reduce pollution and global warming

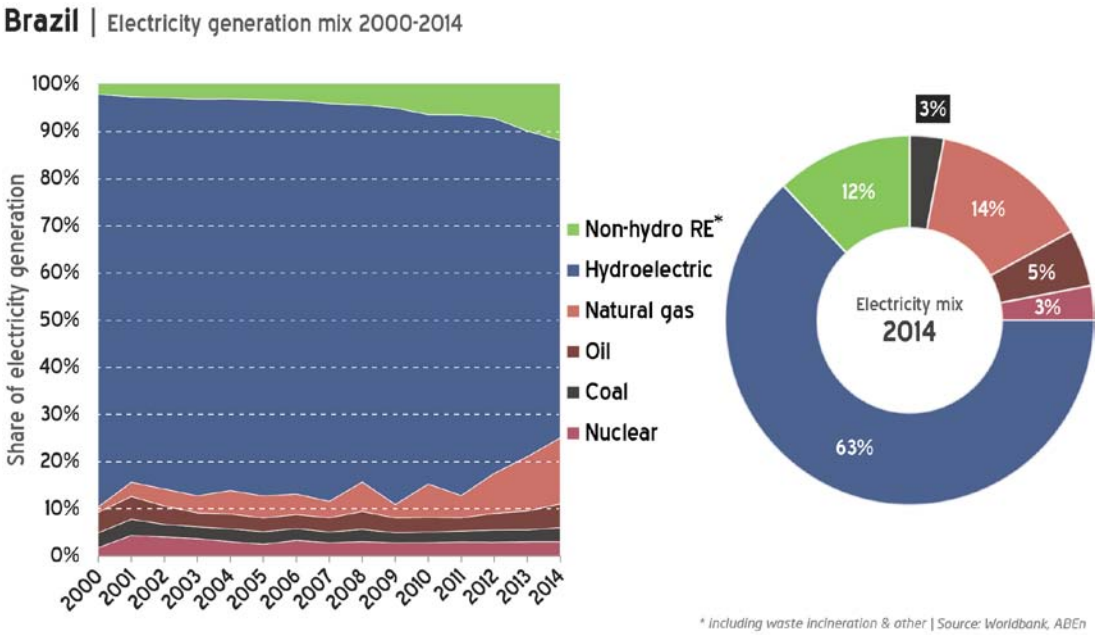
c) Comparative study of BRICS Countries on Renewable Energy

The researcher considered the following sequence for comparative study of BRICS Countries on Renewable Energy

1. Brazil
2. Russia.
3. India.
4. China
5. South Africa.

1. Brazil

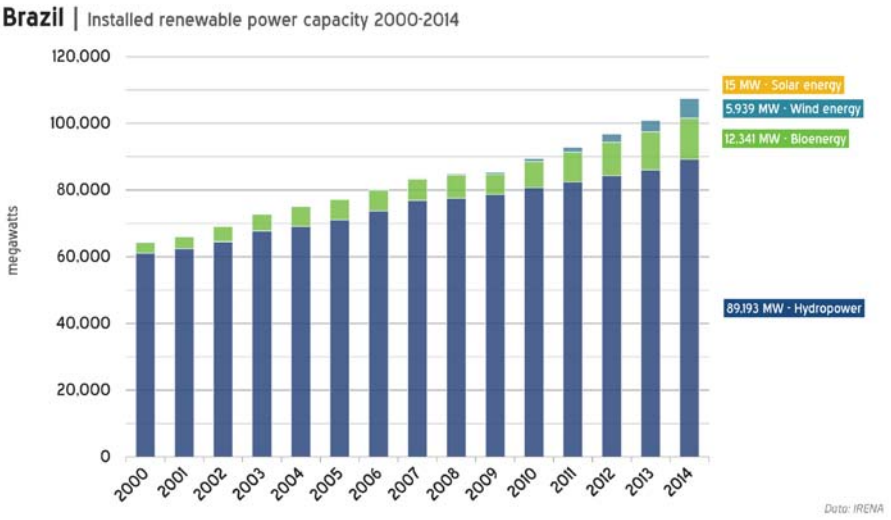
The following Figure 2 shows Brazil's electricity generation mix



Source: www.greenpeace.de

Figure 2: Brazil's electricity generation mix

The following Figure 3 shows the installed renewable capacity in Brazil



Source: www.greenpeace.de

Figure 3: The installed renewable capacity in Brazil

Key findings

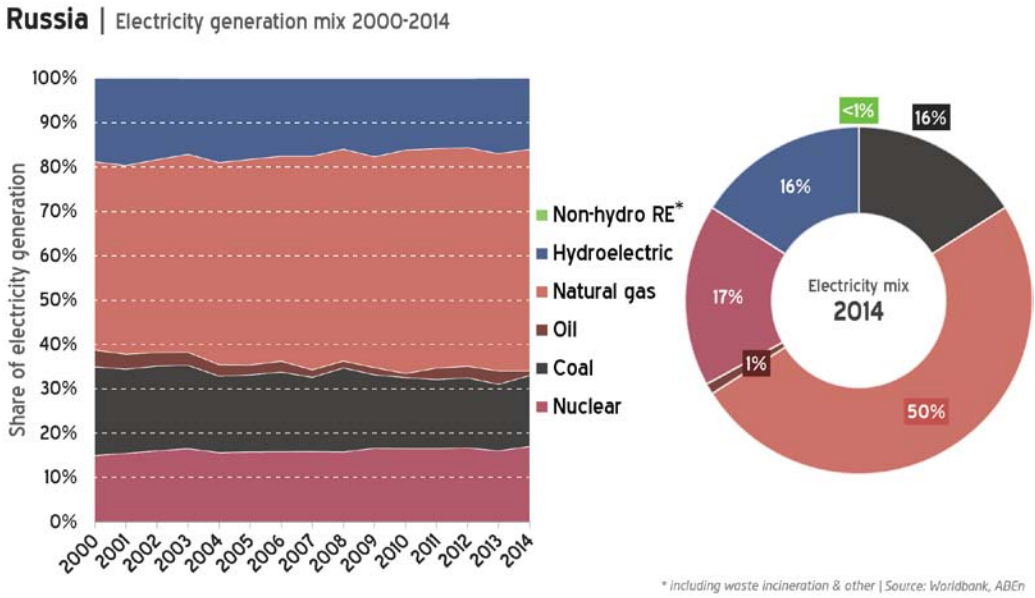
1. The main energy generation in Brazil was hydro power.
2. Brazil was focusing attention on building hydro power since2000.
3. In 2014, brazil built roughly 3 Giga watts of hydro power and therefore totaling to 84 Giga watts of hydro power
4. Brazil had shared the Itaipu dam hydroelectric facility with neighboring Paraguay. This was the second largest hydroelectric facility worldwide.
5. Hydro power plants are based on the natural resources and are clean source of energy. However there are great objections and protests by environmentalists on this issue. This type of power generation depends on rain fall which will be purely

depending on nature and carry a great amount of uncertainty. With environment destruction, the river water levels are decreasing year –by-year. From the farmer's point of view they lose employment and livelihood if the land is grabbed by the government for building of dams

6. A number of plants were in the middle of Amazon forest directly in and therefore local communities
7. The wind farms were installed in Brazil and the capacity of these wind farms was 6 Giga watts by end of 2014.
8. The wind farms may reach 16.5 Giga watts by end of 2019.
9. The ten year plan of Brazil's energy sector published in September 2015 was with focus on increasing solar plant capacity for 23.6 Giga watts by 2023. Brazil had installed only 15 megawatts solar plants by end of 2014.The solar power plants are dependent on heat spots and may be operative during part of the year and during monsoon and winter the solar plants will partially give output. Also the photo voltaic cells are costly and due to heavy taxation and duties the consumers are reluctant in using them.

2. Russia

The following Figure 4 shows Russia's electricity generation mix 2000 2014



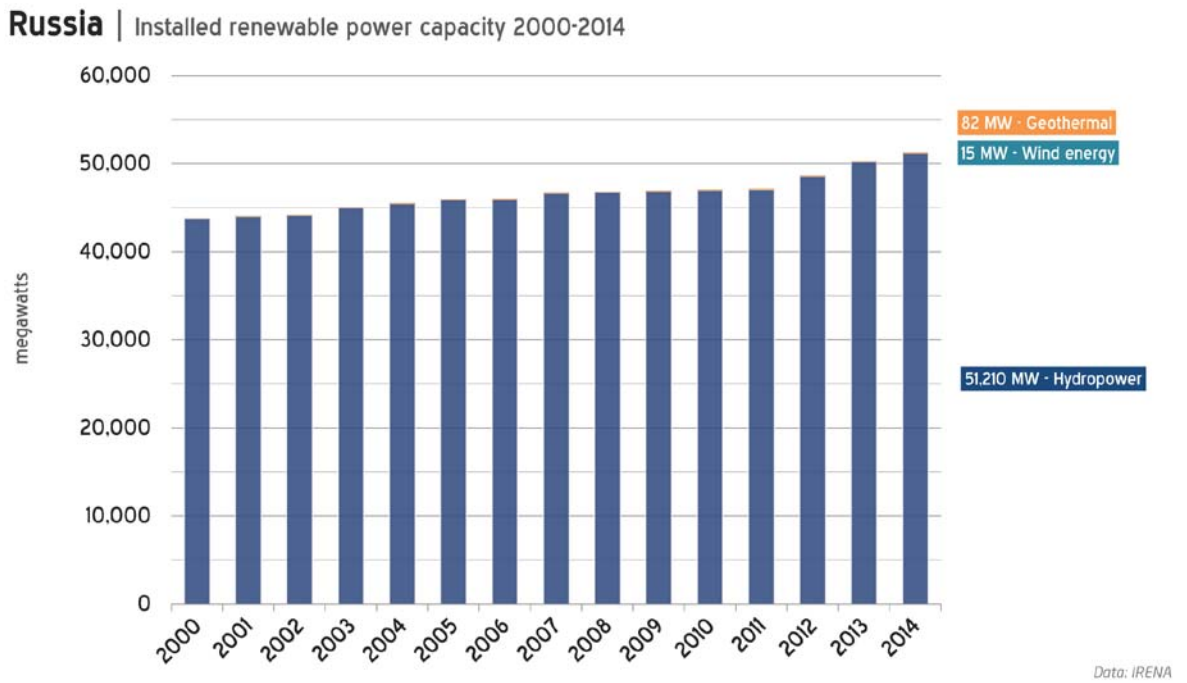
Source: www.greenpeace.de

Figure 4: Russia's electricity generation mix2000 2014

Key findings

1. Russia is a major exporter of oil, natural gas and coal to the world. Russia is a major exporter to Germany whom Russia the largest supplier of fossil fuels.
2. Russia is the largest in terms of land area and has large resources but has not concentrated on renewable but has focused their attention on producing the electricity by conventional means.
3. Carbon emissions dropped in Russia mainly due collapse in economy in 1990 and financial crisis in 2008.
4. 50 percent of electricity is generated by natural gas as a result the coal consumption has dropped slightly to 16 percent.
5. In terms of dominance of primary energy consumption, about16 percent of electricity is generated by conventional energy.
6. The share of nuclear had fallen to 1 percent from 17 percent of the total energy
7. The hydroelectric power accounted to about 16 percent.
8. The Coal based thermal power were amounting to 16 percent of electricity generation

The following Figure 5 shows the installed renewable capacity 2000 2014 in Russia

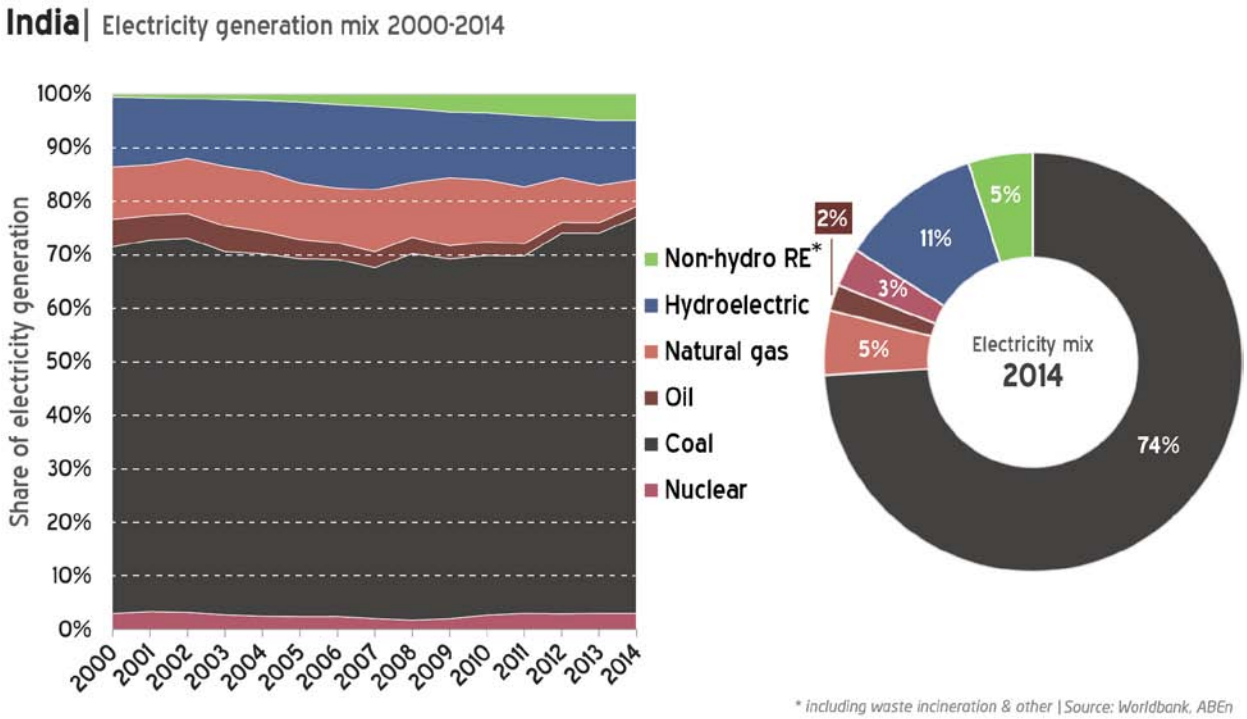


Source: www.greenpeace.de`

Figure 5: The installed renewable capacity in Russia2000 2014

4. India

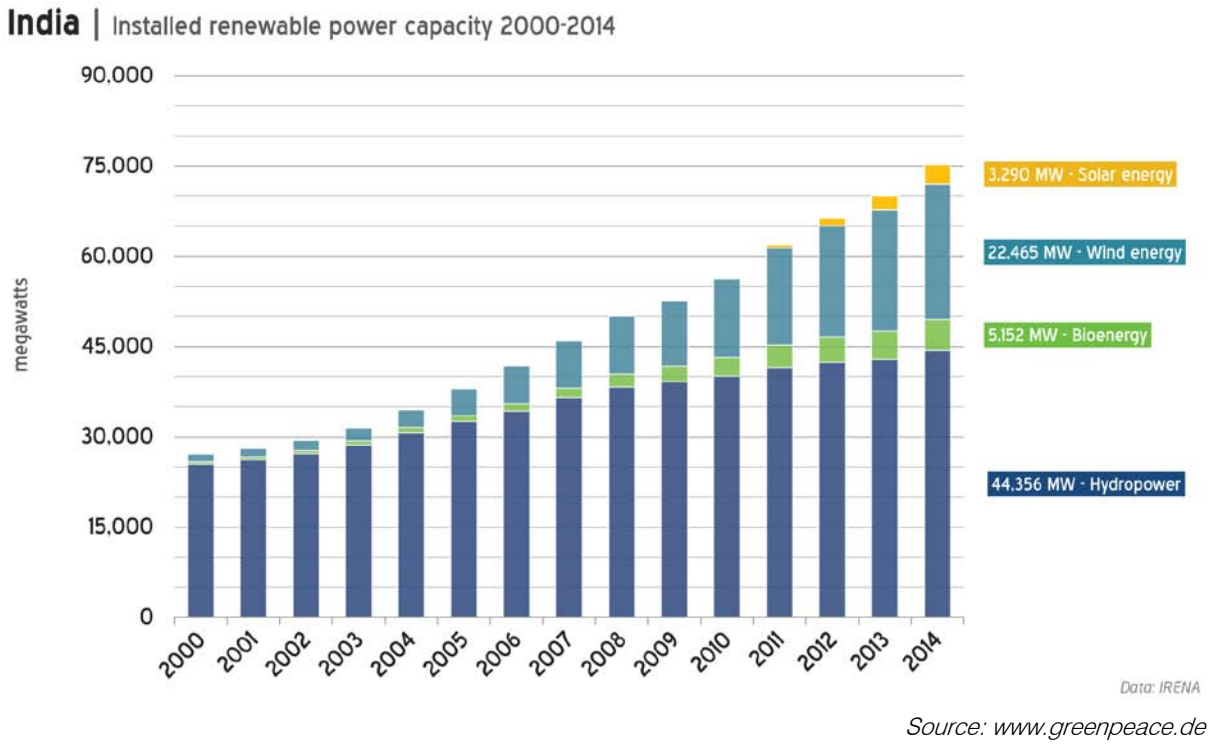
The following Figure 6 shows India's electricity generation mix 2000–2004



Source: www.greenpeace.de

Figure 6: India's electricity generation mix 2000 2004

The following Figure 7 shows India's renewable power capacity 2000–2014



Source: www.greenpeace.de

Figure7: India's renewable power capacity 2000–2014

d) The Power scenario in India

India had 306 GW of total generation capacity as of March 2015 and the government plans to add another 250 GW of total generation capacity by 2025.Frequent supply interruptions and poor power quality has driven many industries to develop captive generation plant having combined capacity of about 25,000 MW. Thakur, T, Chairman and Managing Director, Power Trading Corporation (PTC), foresee electricity demand growing 7.2 percent per annum, assuming GDP growth of 9 percent per annum and on an elasticity of 0.8 due to energy efficient technologies and other energy conservation and demand-side management measures. "Keeping this in view, energy generation will need to increase to a level of 1,470,000 million units (MU) by 2016–17 from a level of 1,038,000 MU in 2011–12 to service the increased demand", he calculated[1]. Presently, "Six millions Indians do not have access to electricity", stated Mr. Sethi, S, Principal Advisor (Energy), Planning Commission.[2]

e) Challenges faced by power sector in India

Following are some of the challenges faced by power sector in India-

1. Coal Shortage—presently about 74% of power generated is by thermal power plants. There is a severe coal shortage and it is a big political issue on assignment of coal blocks.
2. The demand for power is going up every year with urbanization and industrialization. There are hardly any power plants built up. The power plants require huge investment and the returns are after many years. This aspect makes investment very unattractive for private players and the investors are reluctant to make investments.
3. Presently many industries have their own captive power plants as the availability of power is uncertain .If no power supply is available industries, it can lead to labor unrest. These captive power plants are economically unviable for SMEs as the costs of operation will go up and they will not be able to compete in the market.
4. The distribution companies are making huge losses.
5. Majority of power plants are very old and running at almost 50% of capacity. Electricity boards have no money to modernize them.
6. Load shedding—one of the main reasons for power failure is load shedding which is result of inadequate power supply vis-a-vis power generation.
7. Price volatility—the supply tends to become constrained as generation and transmission reach their physical limit and electricity demand is very inelastic
8. Irrational tariffs- The tariff is fixed by State Electric Regulatory Committees and revision is possible only on the sanction from SERCs the State Government

have constantly interfered in tariff setting without SERCs subsidizing State Electricity Boards for the losses arising out of the State Government's desire to provide power at concessional rates to certain sectors like agriculture and domestic customers.

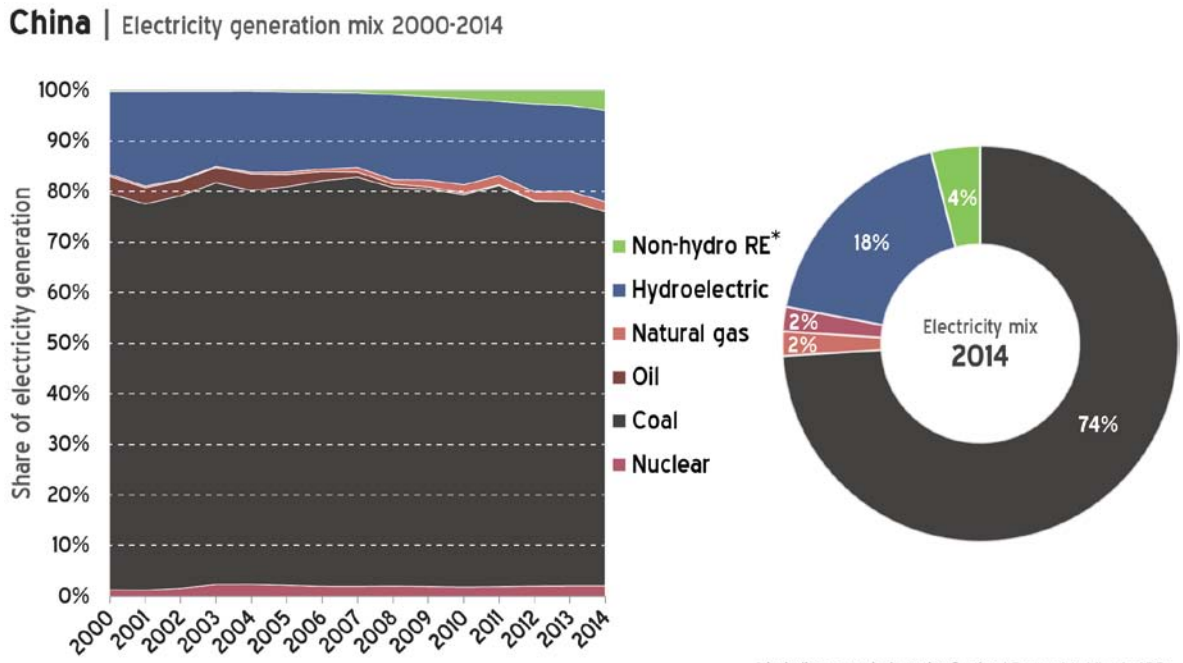
9. Corruption—the energy sector is a source of corruption. Asian Development Bank report stated, corruption in the sector is difficult to prove and determine because of the complex system and the multidimensional scale at which they operate in the development of a country.
10. Energy audit Energy audit is not carried out and there is a need for reducing excessive transmission and distribution (T & D) losses in the Indian Power Sector.
11. Inaccurate billing and metering The meters are easy to tamper. Many places the power is drawn without any meters and directly drawn from the pole.
12. Solar power is expensive. The consumers are not willing to shift to solar power due to higher cost.
13. The customers are not informed about non availability of power and are taken off guard. This hampers their regular planning and for continuous processes and top and bottom lines gets affected.

Key findings

1. The most common method used for power generation is by building thermal power plants. India had 306 GW of total generation capacity as of March 2015 However, the major drawback of thermal power generation type is environment pollution. According to world reports, 40% of air pollution is due to thermal energy. Another limitation of using coal is heavy reliance on imported coal in India due to inferior quality available in local market. Thermal plants have become old and need to modernize as present plants operate at50% less efficiency compared to the plants in other countries. By the end of 2014, coal based thermal plants account to about 74 percent of electricity generation mix.
2. Natural reserves in India is around 0.6% of world reserves. There is heavy reliance on import of liquefied natural gas which has become very costly. Even world natural gas production will reach its maximum limits in the next 15–20 years.
3. Nuclear Power: In India, the 'vision 2020, for nuclear energy foresees addition of 20.000 MW by 2020.New uranium mining sites in the north-east India are facing stiff resistance from local people. Even though it a known fact that India has a vast reserve of thorium, these thorium reactors are not proven. Also globally, nuclear is not a preferred option due to problems in nuclear disposables and Chernobyl accidents. Germany has plans to decommission all their nuclear plants by 2025 and replace them with wind turbines. With Fukushima blasts in Japan, has raised some red flags on India's nuclear programmes, including safety of multi –nuclear parks like Jaitapur India has a target of 63 GW by 2024.The problems faced in India is that planned nuclear are not completed in time. Nuclear Power of about 5 percent of electricity generation mix. Also nuclear power is more expensive as compared to coal or renewable energy. The council of Scientific and Industrial research (CSIR) estimated the cost of electricity from nuclear to be Rs 1/Kwh, compared to Rs 0.80/kwh form coal and Rs 0.80/Kwh from solar and Rs 0.60/Kwh from wind energy.[4]
4. Hydro Power: Hydro plants are based on the natural resources and are clean source of energy. However there are great objections and protests by environmentalists on this issue. With environment destruction, the river water levels are decreasing year –by-year. From the farmer's point of view they lose employment and livelihood if the land is grabbed by the government for building of dams.
5. With the above facts it high time to develop renewable power in India in the form of: a. Wind Energy. b. Small Hydro Power, c. Co-generation, Bagasse, d. Bio-power , e. Wind Energy and f. Solar Photovoltaic system.
6. Renewable sources like wind, solar photovoltaic, solar thermal and bio-energy sources like municipal solid and liquid waste, industrial waste, Bagasse and tapioca (bio-methanation) and small hydro plants have potential to develop in future. The clean energy technology action plan for Maharashtra, prepared by Pune-based World Institute of Sustainable Energy (Wise), has estimated that Maharashtra State has a potential to generate 57,000 MW to 2, 13,000 MW of renewable energy. Wise has recommended that Maharashtra make optimum use of its land and water resources to achieve low carbon and sustainable energy for future development.[3] The total target for 2022 is 175 Giga watts of renewable energy, 60 Giga watts will be wind power, 10Giga watts of bio mass and new hydro consist of about 5 Giga watts.

5. China

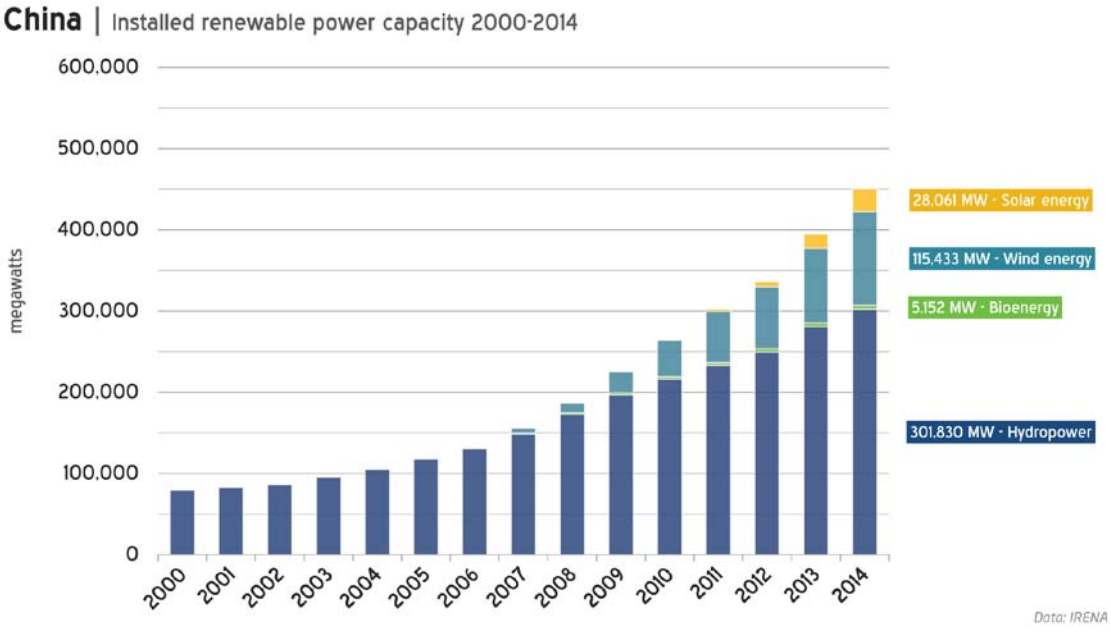
The following Figure 8 shows China's electricity generation mix 2000 2014



Source: www.greenpeace.de

Figure 8: China's electricity generation mix 2000 2014

The following Figure 9 shows India's renewable power capacity 2000–2014



Source: www.greenpeace.de

Figure 9: China's renewable power capacity 2000–2014

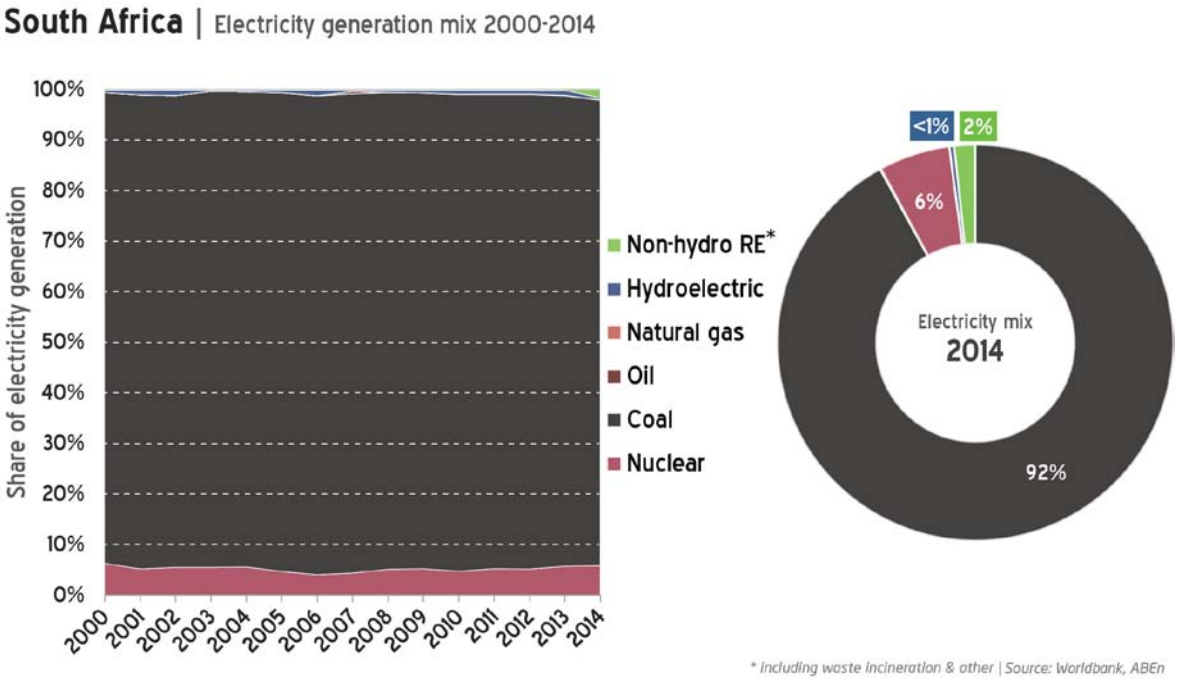
Key findings

1. China has built new coal fired power plants. From 2011 to 2015 China has added 190 GW of thermal generating capacity. Coal fired power plants account to about 74 percent of the electricity generation mix.

2. Due to air pollution from coal, Chinese officials are exploring to other renewable energy options seriously There wind and solar energy are still less compared to coal and hydro.

5. South Africa

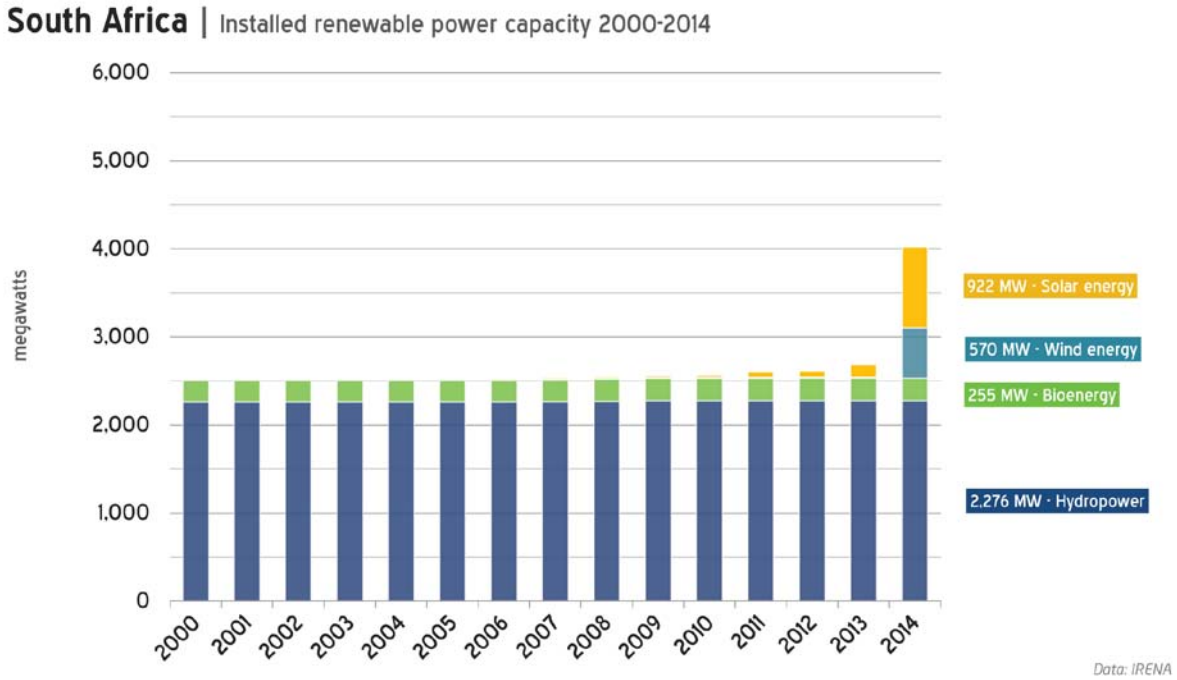
The following Figure 10 shows South Africa's electricity generations mix 2000 2014



Source: www.greenpeace.de

Figure 10: South Africa's electricity generations mix 2000 2014

The following Figure 11 shows South Africa's renewable power capacity 2000–2014



Source: www.greenpeace.de

Figure 11: South Africa's renewable power capacity 2000–2014

Key findings

1. South Africa depends heavily on coal based power plants as about 92 percent of electricity generating mix and this level has remained unchanged since last 15 years.
2. South African government planned for 9600 MW of nuclear power.
3. South Africa's per capita carbon emissions were found to be above level of European Union since 2008.
4. A study by an impendent consultancy from 2006 found that South Africa has a potential to get 75 percent of its electricity by mid-century.
5. In 2010, a report from UNEP found that South Africa has a potential to get 50 percent of its renewable electricity by 2030.
6. Since 2010 the cost of both solar and wind power have drastically come down in South Africa and have become cheaper than coal and nuclear power.
7. An impendent study by CSIR found that renewable energy from South Africa's first wind and solar projects created 4 billion and more financial benefits to South Africa than they cost during first six months of 2015.

f) Trade between India and BRICS Countries for Renewable Energy Products

With 'Make in India' imitative of Indian Government has given boost to trades between India and BRICS countries for renewable energy products

Key findings

a. Joint statement on 7thIndia-Brazil joint commission meeting and agreement on November 18- 19, 2015India expressed satisfaction with Brazil Investment in renewable energy. India apprised Brazil on the relaxed FDI policies and 'Make in India, initiative. India invited more investments from Brazil during this meeting. The ministers of both countries stressed the need for consolidation strategic partnership that strives for equity and transparency in the spheres of international finance, trade, climate change and sustainable development. Both country representatives acknowledge the complementarities in the mining sector and agreed to expedite signing of the MOU on cooperation in miming between their respective Geological Surveys. The Ministers of both countries emphasized the importance of increasing the share of renewable sources in the global mix. They expressed interest in the area of biomass, hydro-power, solar and wind energy technology.
b. In relation to sustainable growth BBC considered that the climate change is a real issue that comforts all countries and is a collective responsibility to contribute to mitigation efforts. On the path towards energy efficiency and the use of renewable sources of energy, the achievement of balance agreement on climate change and the use of renewable sources are equally important. The focus of all countries should be on adaptation, emission reduction, availability of finance, and transfer of technology at affordable costs. The energy sector should be based on three principles such as affordability, reliability and sustainable development. The energy should act like a catalyst to create sustainable development and economy there by attaining energy security in the BRICS region.
c. India will seek cooperation between BRICS countries on standards. Russia and Brazil are demanding a mechanism to link schemes such as Make in India, Digital India, and Smart City Mission with special emphasis on sectors like renewable energy and infrastructure.

Comparative study of BRICS countries based on the energy and green economy report with reference to renewable energy

The primary objective of the green economy working group was to address the challenges relating to energy security of supply, energy social equity and environment sustainability within BRICS countries, to achieve the goal of secure and sustainable energy for all.

This objective was to be achieved through the following

a. Promotion of Trade and Investment.
b. Promotion of Business Co-operation.
c. Technology transfer and Development.
d. Forming multilateral Parternerships to invest in Third Party Countries and multilateral business projects
e. Advisory role.

Key findings

a. The following table 2 shows the specific industries and sectors wanted to promote ,trade and have investment ties with the other BRICS countries and Africa

Table 2 : The specific industries and sectors wanted to promote ,trade and have investment ties with the other BRICS countries and Africa

Brazil	Russia	India	China	South Africa
Greater focus on sustainable fuels such as bio fuels	Focus on Hydro power, bi fuels, technology transfer on energy saving technologies, hydro power, bio fuels hydro power, bio fuels	Renewable like Solar, wind and bio energy	Renewable especially hydropower power	Renewable energy research & development, off grid solutions linked to renewable energy, hydro-power, manufacturing Solar PV' and Wind for local and exports

Source: www.brics.tpprf.ru/download.php?GET=6LPAY%2F81Bmw4jugd58EVrg%3D%3D

b. Among BRICS countries, China had carried out maximum trades for renewable energy[17]
c. The following table 3 shows the specific companies or corporations that had key and important promotion trade and investment ties with the other BRICS countries and Africa for renewable energy.

Table 3 : The specific companies or corporations that had key and important promotion trade and investment ties with the other BRICS countries and Africa for renewable energy products

Brazil	Russia	India	China	South Africa
No data available.	Renova Group who were involved in developing renewable energy in India and South Africa	Lanco Energy, Moserbaer India, Kiran Energy, Tata Power Solar, Welspun Energy, ACME Solar, IL&FS Energy, Thermax India, Mahindra Partners, Sunbourne Energy, Waaree Energy, sRRB Ener-gy, Clique energy, Suzlon India, wind world India, Global wind Power, Gamesa Wind turbines, Green Infra, Inox wind, NEPC India, Sindicatum Sustainable Resources, Yashwant Energy, Organic Recycling System and Grow diesel Ventures	Renova Group who were involved in developing renewable energy in India and South Africa	SAREC The South African Renewable Energy Council was an umbrella body to co ordinate and align the activities of its stakeholders in the renewable sector. A need had been identified for manufacturing facilities to setup in South Africa for Solar PV's and Wind for local and exports

Source: www.brics.tpprf.ru/download.php?GET=6LPAY%2F81Bmw4jugd58EVrg%3D%3D

Technology transfer and high technology Parternerships in the energy and green economy industry with the other BRICS countries

Brazil

Brazil had 40 years of experience in developing the largest ethanol programme in the world to substitute fossil fuels.

Russia

a. Russia established a working group bringing together investors, international organizations and multilateral development banks and the OECD to develop a dialogue on actions needed to foster financing for green and low carbon intensive technologies in BRICS countries.
b. Russia had a number of solutions on solar energy project development for India and South Africa.
c. Technology transfer for the energy saving technologies

India

India had joint ventures /investment in Process Technology Parternerships in:

i. PV manufacturing and wind turbine supply
ii. Process knowledge sharing and transfer under technology transfer agreement for the renewable products.
iii. Import of passive infrastructure for solar power projects.
iv. Alliance with Brazil for bio-ethanol production, the fermentation technology for production of 2nd generation bio fuels could be adopted in India.

India had also developed globally competitive manufacturing partnership and business in export of Wind Turbines and its components.

South Africa

South Africa renewable energy companies wanted to pursue with other BRICS countries as well as South African government on the following projects

1. Expansion of Inga and Grand Inga on the river of hydropower station in DRC and associated transmission infrastrure.
2. Mphanda Nkuwa construction of a 1500 MW hydro power station in Mozambique and Zambezi Basin.
3. Lesotho highlands water project phase 2 –water transfer programme to supply to Gauteng province in South Africa to generate 1200 MW of through a pump storage scheme.
4. Batoka Gorge hydro power –hydro electric plant with capacity of 1600 MW in Zambia and Zambezi Basin.

Source: brics.tpprf.ru/download.php?GET=6LPAY%2F81Bm-w4jugd58EVrg%3D%3D

The following table 4 shows future plans of BRICS countries to curb carbon emissions and share of renewable power by 2030

Table 4: Future plans of BRICS countries to curb carbon emissions and share of renewable power by 2030

Sr no	BRIC country	Brazil	Russia	India	China	South Africa
01	Climate change target	43% emissions cut by 2030 relative to 2005	25 to 30% reduction by 2030 relative to 1990	30–35 % increase in carbon emissions by 2030	Reducing carbon emissions by 60 to 65% relative to 2005	Reducing carbon emissions to 398-614 Mtoe
02	CO2 emissions compared to 1990	+113%	-33%S	+238%	+332%	+144%
03	Annual CO2 emissions per capita	9.1 tons (2012)	15.75 tons (2012)	2.33 tons (2012)	7.91 tons (2012)	8.8 tons (2012)
04	Share of renewable power in 2014	75 %	16%	16%	22%	02%

Source: www.greenpeace.de

Key findings

1. China has set very ambitious target of reducing carbon emissions by 60 to 65% relative to 2005. Brazil is already into renewable energy and has a moderate target 43% emission cut by 2030 relative to 2005.Surprisingly Russia has set low target of reducing carbon emissions.
2. CO2 emissions compared to 1990 China has maximum CO2emissions compared to 1990(+332) followed by India (+238%).AS both are populist countries and amount to almost one-third of the world's population.
3. India has least CO2 emissions per capita whereas has Russia maximumCO2 emissions per capita. This may be due to about 65% of population live in villages and usage of vehicles is less due to poor infrastructure and affordability. Russia maximum CO2 emissions per capita as the country are mainly into nuclear plants and space applications.
4. Brazil has tapped natural resources and share of renewable power in 2014 is maximum whereas South Africa has last used the natural resources amounting least Share of renewable power in 2014

IV. Recommendations

1. Brazil must tap its renewable energy potential
2. In Brazil, deforestation needs to be curtailed in the Amazon and Cerrado regions.
3. Russia should international renewable projects with neighboring countries like China, Mongolia, and Kazakhstan.
4. Russia to reorient subsidies from new oil and gas extraction as well as from nuclear power projects in favor of renewable energy.
5. Russia to develop ambitious targets in renewable energy.
6. In India about 45 percent of consumers do not have access to electricity. Indian government to ensure effective implementation of power projects to stick to a pledge to provide 24/7 electricity to all
7. Forests should be off-limits for coal mining in India. India must impose a restriction on coal mining in forest areas.
8. Indian prime minister said that his ambition is on efforts to ensure universal access for India's poor people. The state electricity boards and power distribution companies to ensure that Indian prime minister's ambition s are fulfilled. The state government must support in long term goal of phase out fossil fuels and nuclear energy by 2050
9. India has many hot spots and being tropical country, sun rays abundant are available for fixing solar panels on roof top. Indian government to incentivize and make it mandatory for all future buildings to use solar panels only
10. China to take proper steps to reduce dependence on coal consumption.

11. China to make concentrated efforts in implementing renewable energy projects in future.
12. The South African government must revise the country's electricity plan which was published in 2011(IPR 2010).
13. The current expansion of the coal sector in South Africa must be stopped. No further coal fired power plants to be built after Medupi and Kusile power plants.
14. The recent plan in South Africa ignores the massive advantage of natural resources available in the country.
15. Opportunities need to be created for manufacture of renewable energy in South Africa.
16. BRICS countries have shown keen interest in making FDI in India by signing MOUs for renewable energy products. It is recommended that all states should cooperate and ease out on doing business.
17. To achieve sustainable growth, BRICS countries need to promote value-added trade amongst BRICS countries by focusing their attention to cooperative investments in energy projects in BRICS countries.[16]

V. Conclusion

The electricity generation varies from country to country among BRICKS countries. There is heavy reliance on coal in India, China and South Africa. Brazil has good natural resources and has developed mainly on hydro plants as a source electricity generation. A political will and efforts are required by BRICS countries (barring Brazil) in shifting to renewable energy by tapping all natural resources. Indian government has invited manufacturing and trade initiative between BRICS for renewable products through 'Make in India'. China had carried out maximum trades for renewable energy.

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Measurement of Concentration of Natural Uranium in Ground Waters of Bathinda District (S. Punjab) for the Assessment of Annual Effective Dose

By H.S. Virk
SGGS World University

Abstract- LED Fluorimeter has been used to measure the uranium content of the ground water samples of Bathinda District of South Punjab.16 locations have been selected for the present investigation. The aim behind this study is to see the variation in the uranium content of the ground water during 2012-2016 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 9.72 to 186.61 μgl^{-1} with an average value of 69.54 μgl^{-1}.This uranium content exceeds the safe limit of 60 ppb of uranium in groundwater proposed by AERB, India.

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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 range of uranium content in water in these areas is reported to vary from 0.2 μgl^{-1} to 74.98 μgl^{-1}.The objective of present investigations is health risk assessment due to natural uranium in drinking water in Bathinda district of South Punjab.

Author: Visiting Professor, SGGS World University, Fatehgarh Sahib 416 406, India . e-mail: hardevsingh.virk@gmail.com

II. The Study Area

a) Location

Bathinda district is situated in the southern part of Punjab State. It lies between 29°33´and 30°36´North latitude and 74°38´and 75°46´Eastlongitude.It covers an area of 3367 Sq. Km. The district is surrounded by Sirsa and Fatehabad districts of Haryana State in the south, Sangrur and Mansa districts in the East, Moga in the North-East and Faridkot and Muktsar districts in the North-West.

b) Geomorphology and Soil types

The district area is occupied by Indo-Gangetic alluvium. The soil in the district is mostly sandy. Being sandy, plain region is dotted with scattered sand dunes which have a tendency to shift towards eastern side. But with the development of latest technology and machinery the topography is under vast change with respect to various aspects connected with green revolution. The district has two types of soils, the arid brown soils and siezoram soils. The arid brown soils are calcareous in nature; these soils are imperfectly to moderately drained. Salinity and alkalinity are the principal problems of these soils. In siezoram soils, the

accumulation of calcium carbonate is in amorphous or concretionary form (*kankar*). Presence of high amount of calcium carbonate and poor fertility is the main problem of this soil. The arid brown soils are found in mostly eastern parts of the district and siezoram soils are found in the western part of the district [16].

III. Methodology

a) Pre-processing of the sampling bottles

Washed the container and cap with a dilute solution of detergent and tap water (kept overnight). Rinsed thoroughly with tap water and then rinsed with aqueous 10% nitric acid solution.Drained and completely filled with an aqueous 10% nitric acid solution. After that capped it and stored for at least 24 hours. Then empty the container rinsed with distilled water and kept the carboy in closed condition.

b) Sampling

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.

c) 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 photomultiplier 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.

d) 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.

e) 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.

f) Analytical Procedure

A water sample of quantity 6ml is used to find its uranium content. The water sample is takenin 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:

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

Concentration of uranium in water sample = CF x (Fluorescence from sample – 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.

IV. 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:

a) 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}), linked with 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].

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

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

b) 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 substanceingested per kg of body weight per day andis given by the following equation [19, 20].

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

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).

c) 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 $kg^{-1}day^{-1}$.

V. Results and Discussion

Groundwater samples were collected from villages around Talwandi Sabo area of Bathinda district of Punjab (India) and analysed for Uranium content using calibrated LED Flourimeter (Quantalase Make). Uranium content varies from 9.72 ppb (Canal water) to 186.61 ppb (Hand Pump). 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]. The proposed guideline of concentration of the uranium in water by EPA from radiochemical toxicity is 30 μgL^{-1}, which indicates that uranium content of natural water is usually not high enough to cause a health risk. In comparison with WHO, UNSCEAR and ICRP safe limits, the values obtained for U in groundwater are significantly higher than the safe limits suggested by these agencies? If the observed data of uranium content of water is compared with the guideline of AERB, 9 water samples exceed the proposed concentration level of 60 ppb.During our survey of March 2012, we reported high uranium content in the same area in the range 69.57 to 205.62 ppb using Laser Flourimetery. Table 1 reports a comparison of both surveys. As sample sites are not exactly the same in the two surveys, some large scale fluctuations in data are observed along with concordance in reported data for Jajjal, Bhagi Vandar and Jagga Ram Tirth.

a) Radiological risk

In the present investigation, uranium content of the ground water samples of the Bathinda district of 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 $0.28\times10^{-4} - 5.29\times10^{-4}$. The value of the excess cancer risk in the surveyed district is approximately higher 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 district comes out to be about 2 per 10,000 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 0.56 μg/kg/day –10.80 μg/kg/day and from 0.12 – 2.38, respectively.

The concentration of the uranium is found to be high in ground water samples collected from the hand pumps or other ground water sources of several villages of Bathinda district. The high uranium concentrations found in this investigation support the earlier reported measured values[13,15]. What is the source of high U content in groundwater? It is as yet an open question begging for answers. However, some authors have

offered plausible solutions as follows: (i) the presence of high uranium concentration in the ground water samples of the southwest Punjab has been attributed to the high uranium content in granitic rocks of Tosham hills in the neighbouring Haryana state [25]; (ii)the use of phosphate fertilizers in the fields of selected villages of Bathinda district is linked to the enhanced uranium concentration in the ground water [26]. The water samples containing the high carbonate or phosphate concentration enhances the dissolved uranium content of the water, as it has been established that uranium forms complexes with the carbonate and phosphate ions. Uranium concentration would be lower in the water samples having low carbonate or phosphate levels[27].

Our investigation reveals that the mean value of excess cancer risk in the surveyed district comes out to be about 2 per 10,000 people. The maximum value of excess cancer risk for residents of Kot Shamir is estimated to be 5 per 10,000 persons. However, this area is reported to be in grip of cancer disease at an alarming rate, especially villages falling in Talwandi Sabo block of Bathinda district. Our study shows that U in groundwater is not the sole cause of cancer induction; one has to look for other causes, e.g., use of pesticides and an overdose of fertilizers, by taking recourse to epidemiological investigations.

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Table 1: Total Uranium content in the water samples of Bathinda district and corresponding risk factors

S.No	Location	Water Source	Year 2012	Year 2016	Uranium Concentration (Bq l^{-1})	Excess Cancer risk * 10^{-4}	LADD ($\mu g\ kg^{-1}\ day^{-1}$)	Hazard Quotient
			Uranium Concentration (ppb)					
1	Jajjal	Hand Pump (HP)	76.37	61.62	1.56	1.75	3.57	0.79
2	Jajjal	Motor Driven Pump (MP)	96.10	24.98	0.63	0.71	1.45	0.32
3	Malkana	HP	109.07	35.85	0.91	1.02	2.07	0.46
4	Giana	HP	-	69.57	1.76	1.97	4.03	0.89
5	Giana	Canal Water	-	9.72	0.25	0.28	0.56	0.12
6	Giana	Tubewell	205.62	92.96	2.35	2.63	5.38	1.19
7	Takhatmal	HP	-	96.90	2.45	2.74	5.61	1.24
8	Sangat	HP	-	140.10	3.54	3.97	8.11	1.79
9	Kot Shamir	HP	86.27	186.61	4.72	5.29	10.80	2.38
10	Bhagi Vandar	HP	129.45	139.86	3.54	3.96	8.09	1.79
11	Talwandi Sabo	HP	117.82	24.24	0.61	0.69	1.40	0.31
12	Jagga Ram Tirth	HP	82.85	77.55	1.96	2.20	4.49	0.99
13	Jiwan Singh Wala	HP	120.07	67.18	1.70	1.90	3.89	0.86
14	Raman Village	Tubewell	-	55.64	1.41	1.58	3.22	0.71
15	Raman Village	MP	-	34.51	0.87	0.98	2.00	0.44
16	Akal University Talwandi Sabo	MP	-	44.09	1.11	1.25	2.55	0.56

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Coastal Zone of the Sochi Re-Gion of Russia – Problems and Perspectives

By Yuriy I. Dreizis
Sochi State University

Abstract- The modern state of the Sochi region of Russian Black seacoast is parsed in the article from the point of view of beaches stability, efficiency executed of the coastal protective measures, and quality of seawater in the coastal zone. The possible influencing on an environment of engineering measures, foreseen General schema of the coastal and landslide measures on coastal zone of Greater Sochi of 1990 is considered. The offers on organization of complex monitoring of the coastal zone are made.

Keywords: coast zone, integrated coastal zone management, beaches, general schema of coastal protection.

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Coastal Zone of the Sochi Region of Russia – Problems and Perspectives

Yuriy I. Dreizis

Abstract The modern state of the Sochi region of Russian Black seacoast is parsed in the article from the point of view of beaches stability, efficiency executed of the coastal protective measures, and quality of seawater in the coastal zone. The possible influencing on an environment of engineering measures, foreseen General schema of the coastal and landslide measures on coastal zone of Greater Sochi of 1990 is considered. The offers on organization of complex monitoring of the coastal zone are made.

Keywords: coast zone, integrated coastal zone management, beaches, general schema of coastal protection

I. Introduction

Due to the natural resources, the coastal zones all over the world always were and remain most intensively maintained sites. Half of population of the states having an exit to the sea lives at the coastal zones. The migration on coastal region from continental districts is prolonged. In outcome, there is an acute contravention between necessity in immediate consumption of natural resources of the coastal zones and necessity of maintenance of these resources safety on a long-lived outlook. In many inshore sites, including on the Black Sea coast of Caucasus, this contravention already has reached an extreme stage. The considerable proportion of the coastal zone is contaminated; its attractiveness for international tourism is reduced. The fish stocks exhaust. The problem on development of oil and gas fields on shelf, construction of cargo ports and oil terminals is permanently lifted. For stable progressing of the coastal zone, protection and recovering of an environment the acceptance of urgent effectual measures is necessary.

This problem in international scale is decided based on development and realization of the dodge of Integrated Management of the Coastal Zones (ICZM).

Per the last years, the concern to ICZM has acquired global nature. The realizations of principles and programs on ICZM participate in development both more than 50 countries of a world. In Russia the National report on ICZM, invoked also is prepared to pay attention the President, Government, Legislative power and authorities on places to problems of the coastal zones. Besides major significance for the coastal zones, there is an estimation of environmental impact (EEI) projects of different engineering activity.

All engineering measures on seashores of Russia (earlier USSR) are carried out within the framework of the so-called General Schema of seashores progressing. For coast zone of the Sochi region in the beginning 1990 years the last version of such General Schema of progressing is developed ([1-4], 1992-1995. The present article is prepared by the writers in addition to the indicated General Schema based on analysis of the existing state of coast.

Author: e-mail: yurid2006@yandex.ru

II. Materials and Methods

It was used materials published in the works of modern Russian and foreign research scientists in the management of coastal regions. Information was collected in scientific publications, as well as in open Internet resources. Analyzed reporting metrics provided in the published literature.

This article was used scientific methods, such as the principle of comparison, analysis and synthesis of the results. The article is also based on the principles of objectivity and systematic. This article was used scientific methods, such as the principle of comparison, analysis and synthesis of the results. The article is also based on the principles of objectivity and systematic.

III. State of the Coastal Zone of Greater Sochi

a) General information

The city of Sochi - representative large in-shore administrative center on the Black Sea coast, which is capturing territory 3,5 thousand km2, on which one lives about 400 thousand the person. The common expansion of a land border of the Sochi resort site constitutes more than 133 km with maximum expelling from beaches of the sea on 56 km, sea border - 105 km. The Sochi site is a health resort of Federal significance. There is a developed SPA-hotel infrastructure, plenty of SPA-hotels, boarding houses, of rest houses and etc. in city. Here is disposed about a quarter of all resort establishments of country for the adult population. Annually more than 1,5 millions tourists direct in this coastal region in summer. More than 900 thousand person simultaneously lived on the territory of a health resort Sochi per separate months of a resort season. At the same time, lump sum holding capacity of existing beaches on a site of the Black Sea coast from Tuapse to Psou is no more than 350 thousand the person (Yu.I. Dreizis, 2005; Goryachkin Yu.N., Kosyan R.D., Krylenko V.V., Nguyen Man Hang, Medvedovsky V.V., 2014).

Four administrative districts select in city. Historically economy of city developed around of seaport disposed in Central district; therefore, there are disproportions in progressing districts. The central district is also center of a SPA-hotels complex and industry is represented in the Fig. 1 (Dreizis, 2005, 2016). Current state of the main Primorskaya Embankment of Sochi is represented in the Fig. 2. (Serebryakov G.B., Grishin N.A., 2012).

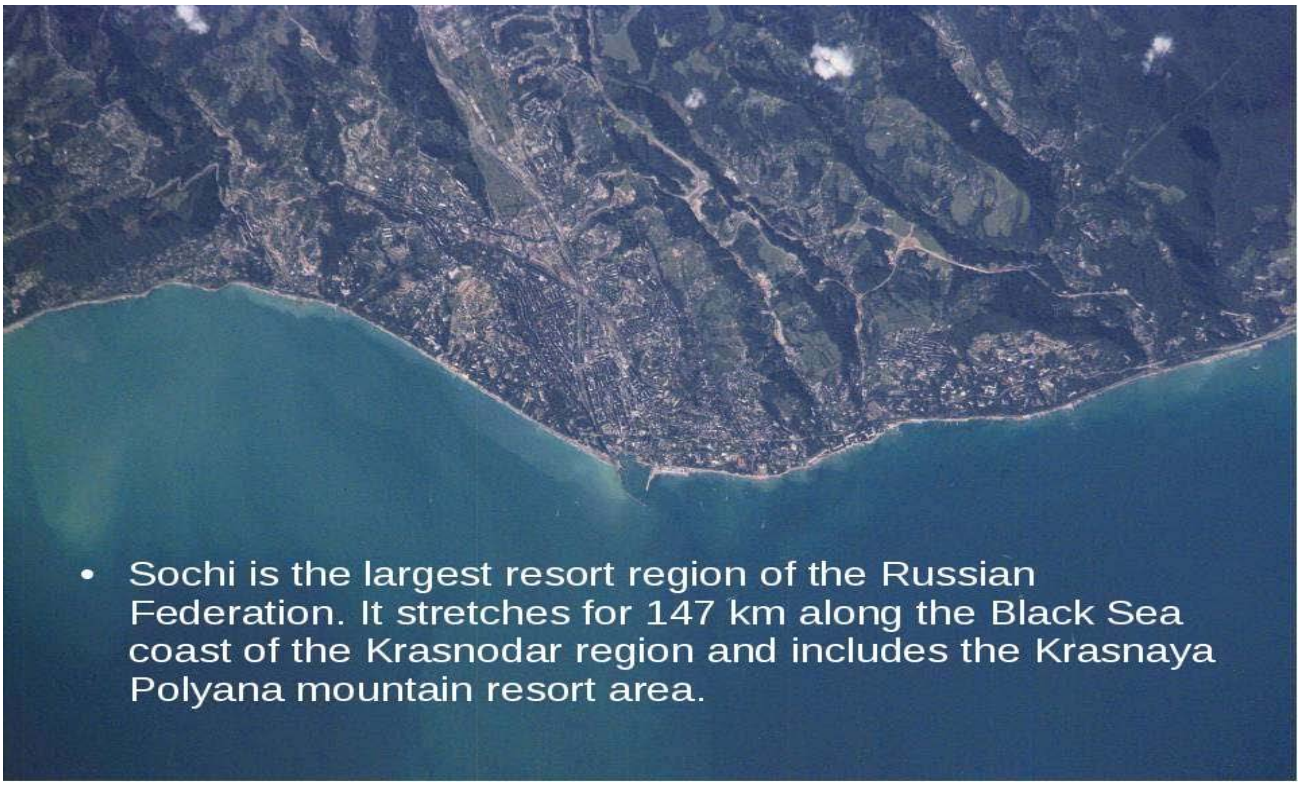

Fig. 1: Schema of Sochi region coast

Fig. 2: Current state of the main Primorskaya Embankment of Sochi

The hydrological conditions of the Black sea for coast of Russia are those, that the impurities hitting in the coastal zone, are not distributed in a central part of the sea. They concentrate alongshore. This is promoted by that circumstance that the fulcrum of the basic Black Sea current is apart about 4 nautical miles from

beaches, and the drift currents are directional alongshore, irrespective of a wind direction. Hitting in seawater at emergency downthrows the unrefined drains fast are distributed alongshore and in the direction of it owing to effect of nodular carrying. The absence of dodges of impurities carrying by currents can result in to formation of hold-up spots with a high pollutant concentration. The small intensity of water exchange in half-closed coastal dock spaces with the sea, plenty of impurities acting at a coastal zone, makes an inshore dock space by area of a high ecological load.

One of the basic recreational factors in Sochi region is a recreational and medical beach. Besides near to beaches is disposed and designed many objects of a cultural and sporting infrastructure: theatres, stadiums, yacht-centers, aqua parks etc.

Natural environments of the Sochi region are characterized by an average and low mountain contours, by lithologic complexes of cretaceous and paleogene, concerning high damp and daily average temperatures, which are stipulating the subtropical nature of vegetation. The seismicity of Sochi district is evaluated in 9 balls.

It is necessary to point out, that the features and originality of a geological feature of Sochi region (tectonic dissociation, progressing modern downing of beaches, high seismicity, lithologic heterogeneity) promote fissile progressing of sliding processes, destroying of beaches and native born beaches, water logging of the rivers ostium.

One of the basic transport mainlines on coast of Black sea coast is the North-Caucasian railway. In the Sochi region on a major extent (about 90 km) it is compelled drives near to the seacoast. Though there are projects of carrying of the railway deep into coasts, they are very problematic, since are interlinked to construction of tunnels, bridges and flyovers on a major extent (Fig. 3, Fig. 4).

Fig. 3 : The railway and highway driving alongshore with groin system for beaches protection

Fig. 4: The railway drives near to the seacoast

b) State of beaches in the Sochi region

The modern progressing of a coastal zone of the Sochi resort region has transgressed directivity that is stipulated by general upheaval of a sea level. It takes place within last century to an average speed 1,5-2,0 mm/years.

The beach should be considered as complex natural recreational resource, where his geologic-geo-morphological basis is indissolubly interlinked to a hydrological mode of the sea.

The beach promotes as progressing of alive organisms in the sea, and represents one of the basic recreational resources involving tourists in marine resort site.

The state of beaches (physical and ecological) defines the amount of visits in a health resort.

The common necessity in recreational beaches for all districts of the Russian Black Sea coast constitutes 410 ha. The Russian sanitary-hygienic norms define the following performances of a beach – 0,2 m lengths of shoreline of a beach at its width 25 m on 1 person. It ensures, in the long term till 2020 year, lump sum holding capacity of 820 thousand resting. Thus the common expansion of beaches should constitute about 160 km. Now total expansion of recreational beaches within the limits of the Black sea districts of Russia does not exceed 130 km, and their total floor space is about 354 ha.

This floor space powers up a back part of beaches, which one will defend from a water boundary of the sea more than on 25 m, foreseen sanitary-hygienic norms, and closed part, disposed on foreseen spacing interval till both parties from finding here engineering objects (tunnels, marine berths, buffer beaches, building polygons etc.). If to exclude from the common floor space of a beaches it is back and closed parts, the recreational floor space of existing beaches will make all about 259 ha.

The morphometrical performances of beaches in the Sochi resort region are listed in table 1 (Yu.I. Dreizis, 2005, 2016).

Table 1: The morphometrical characteristic of beaches in the Sochi region

Sites of beach	Expansion, km	Average width, m	Expansion of the beach with average width, m			
			5	5-15	15-25	25
River Tuapse – river Ashe	19,1	15,5	6,8	6,5	5,0	0,8
River Ashe – river Psezuapse	10,5	17,0	2,9	1,3	1,4	5,0
River Psezuapse – river Shahe	16,6	20,0	0,6	4,9	5,5	5,6
River Shahe – cape Uch-Dere	18,1	5	0,7	1,0	3,3	13,1
Cape Uch-Dere – river Mzymta	41,0	19,0	2,9	9,4	24,1	4,6
River Mzymta – river Psou	8,2	49,0	No	No	No	8,2
Total	113,5	20,9	13,9	23,1	39,2	37,3

As demonstrate introduced data's in the table 1, the expansion of offshore coastal strip in the Sochi region constitutes 113,5 km. About 40 km it is subject to landslide phenomena and up to 20 km is subject of the downfall phenomena (Fig. 5-7).

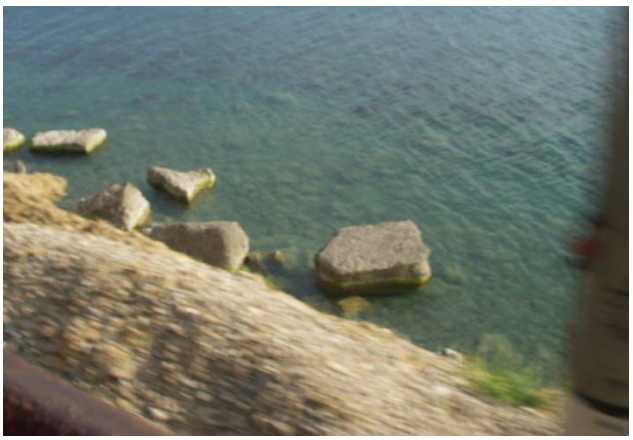

Fig. 5: The coastal site with landslide phenomena

In favorable conditions, there are beaches on overall length on miscellaneous sites of 40 km, where their width constitutes more than 25 m. On remaining 73 km width of a beach is less than 25 m and does not ensure clearing storm waves. It calls destroying beaches and strains of engineering structures finding in a zone of shock effect of sea waves. Photo of a typical sites of the Sochi region coastal zone are present in Fig. 8–28 (Yu.I. Dreizis, 2005; Serebryakov G.B., Grishin N.A., 2012; Goryachkin Yu.N., Kosyan R.D., Krylenko V.V., Nguyen Man Hang, Medvedovsky V.V., 2014).

Let's mark some features of distribution of beaches on the coast. The maximum sizes there is a beach for station Loo, where during 4 km its width constitutes 40-50 m (Fig. 8).

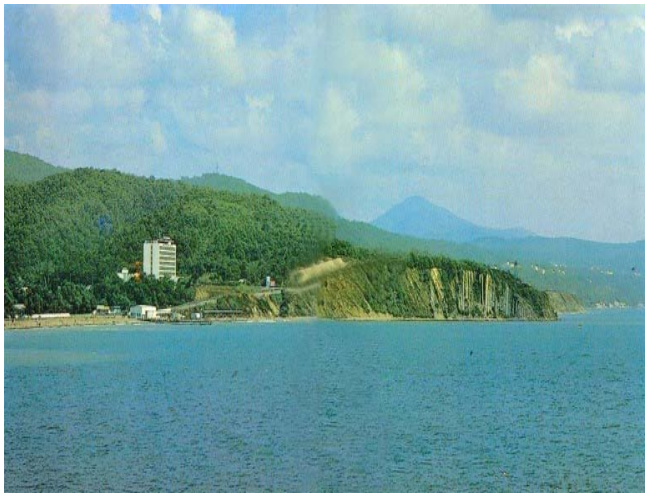

Fig. 6: The coastal site with a landslide and downfall phenomena

Fig. 7: The coastal site with a road, going along shoreline and a landslide and downfall phenomena

Fig. 8: Site of a coast with a free beach

From cape Uch-Dere up to an ostium of the river Dagomys the size of a beach band are constituted by 10-30 m. Further, on the south up to an ostium of the river Mamayka the beach practically misses. From the river Mamayka and up to an ostium of the river Mzymta width of beaches constitutes 10-30 m and only on separate short sites it constitutes less than 1 m. In district between of the rivers Mzymta and Psou the sizes of a beach band lay within the limits from 25 up to 60 m. It is interlinked to a deficit of a solid drain of the rivers. Per the last years, the intensive withdrawal of rubble from a channel practically of all rivers of locale is supervised.

The analysis of dynamics of a beach's width has shown that average width of a beach in 1914 year was peer 34 m to the south of town Tuapse. Till 1976 on this site the diffusion of a beach band (average width 6,1 м) was supervised. Now for the account addition on a beach average width of a beach constitutes 15,5 m, and disregarding zones of dumps average width of a beach on this site remains at a level 1964 year (about 12 м). Dynamics of beach has distinctive features on separate short sections of beach, especially in zones of beach protective structures and dumps of mined rock. Therefore, with 1956 on 1976 years on 2-3 km of a railway line of Tuapse to Adler was supplemented 116 thousand m3 of rubble that has allowed saving average width of a beach within the limits of 10-14 m.

The beach width was reduced on the average from 3 up to 17 m between of the rivers Ashe and Psezuapse for the last 70 years. The broad shingle beaches without variations were saved only to a north from an ostium of the river Ashe during 1 km and to the north of an ostium of the river Psezuapse. Also, they begun to expos to fluid wash per the last years have. Beaches are blurred completely on a considerable extent of beach for last 20 years.

The abatement of average width of a beach on a site the river Psezuapse - the river Shahe began with 1950 year and is prolonged till the present time. The beach became already on 12 m for this period. However, variations of a beach were irregular because of realization of beach protective measures: constructions of the beach protective structures and the addition of mined rock.

Average width of a beach from an ostium of the river Shahe up to cape Uch-Dere till 1955 was changed unsignificantly. The tendency of its reduction was scheduled per consequent years. It was diminished with 37 up to 29 m to 1985 year. The abatement was scored practically on all extent of this site, but with different intensity. Beaches from an ostium of the river Loo up to cape Uch-Dere there are stable and practically not changed for this time.

A beach band from Cape Uch-Dere up to an ostium of the river Mzymta underwent the greatest variations. Average width of a beach on a site was diminished with 30 m per 1914 year up to 19 m per 1955 year. The most intensive fluid wash was supervised in 1945-1963 years. Since 1964 year, due to intensive of a beach addition material, the further fluid wash managed to be stopped, and in consequent and synthetically to retrieve a beach. All sites are entirely built by beach protective structures. The least variations were undergone with a beach between the rivers Mamayka - Sochi. Here after construction of the Sochi port in 1936-1939 years the increase of a beach band till 1950 was scored at the expense of detention of an alongshore current of rubble. The size of beaches were stabilized in the next year. Per the last two decades its fluid wash, however while rather gentle was scheduled. Now practically on all extent of coastal zone from the Sochi port and up to an ostium of the river Mzymta beaches are saved under cover of beach protective structures.

The sizes of a beach band between ostium of the rivers Mzymta and Psou for the last decades were not changed almost. It is interlinked that the beach here is in state of nature. The shore on a site from an ostium of the river Mzymta up to cape Konstantinovskiy has receded on the average on 10-15 m for a period 1959-1979 years.

Even after accomplishment of measures on recovering natural beaches for the purposes of the wave breaking, their recreational floor space will be augmented all on 65 ha and will constitute about 63% from the indispensable floor space. For today, the total deficit of beaches approximately constitutes on an expansion - 31 km; on the floor space - 87 ha. The deficit of beaches in borders of Sochi region constitutes 8,8 km on an expansion and 31 ha on the recreational floor space.

Reduced above data on state of the art of offshore coastal strip testify that the existing beaches do not safeguard beach from shattering effect of surges on a considerable extent. The surplus of recreational beaches is tracked only on rather small sites of considered coast of a health resort within the limits of Sochi region.

The rough necessities of the recreational floor space of beaches on the Sochi site for the term of till 2014 are indicated below: on an expansion: recreational beaches - 88 km, closed - 12 km, sum - 100 km, expansion of beaches indispensable for recreation - 96 km, deficit of beaches - 8,8 km; on the recreational floor space of beaches: the existing floor space of a beach - 224 ha, floor space of a beach indispensable on wave breaking - 320 ha, floor space of a beach, indispensable for recreation, 250 ha, magnitude of a beach deficit - 31 ha (Yu.I. Dreizis, 2005).

Therefore, basic engineering decision of this problem is the creation or magnification of existing beaches up to the sizes providing complete wave cclearing at passing of the whole gales.

In the created situation, taking into account justified and all increasing draft of the tourists to the Black Sea coast, necessity:

1) keeping of the acting sanitary-hygienic norms of their accommodation,
2) preservation of unique coastal landscapes the demanded recreational progressing of the Sochi site can be provided only at native born variation of adding up practice of resort development of territories. It is necessary to create along a coast band shareware in width not less than 100 m (apart from beaches).

This band everywhere should be used for green plantings, quays, parkways and squares, automobile and foot entrances and approaches to this band. To it should flank all coastal protective and hydraulic engineering structures located in an inshore dock space of the sea.

In each concrete case of recreational usage of a maritime belt of the sea it is necessary to take into account a depth of water, geology of bottom, parameters of rocks, composing it, alongshore and cross-cut removal of beach detrital deposits existing or anticipated transshipment of a beach band by the tourists over the established specifications etc.

It is necessary to consider the extension and creation of beaches within the limits of the Caucasian coast of the Black sea, construction of hydraulic engineering recreational complexes as the basic nature protection measures. The possibility of fluid wash of beaches is eliminated with their help (Yu.I. Dreizis, 2005, 2015, 2016; Serebryakov G.B., Grishin N.A., 2012; A.Yu. Lein, I.I. Rusanov, G.A. Pavlova, A. Meluzov, Z.I. Verkhovskaya, L.R. Merklin, M.V. Ivanov, 2009; T.B. Filatova, 2009; Goryachkin Yu.N., Kosyan R.D., Krylenko V.V., Nguyen Man Hang, Medvedovsky V.V., 2014; Kanonnikova E.O., 2014).

c) Impurities of the Sochi resort region

The hydrological conditions of the Black sea for coast of Russia are those, that the impurities hitting in the coastal zone, are not distributed in a central part of the sea. They concentrate alongshore. The absence of dodges of impurities carrying by currents can result in to formation of hold-up spots with a high pollutant concentration. The small intensity of water exchange in half-closed coastal dock spaces with the sea, plenty of impurities acting at a coastal zone, makes an inshore dock space by area of a high ecological load.

The unfavorable ecological situation is supervised, basically, in narrow 3 km band from the seacoast.

Outbursts annually constitute truck - 52600 ton/years (dust -2200 ton, monoxide of carbon - 39200 ton, nitric oxides - 2100 ton, hydrocarbons - 8100 ton). The amount of ambulances was augmented from 23015 units in 1980 up to 130000 units in 2002. An amount of units of the transport on trunk mains of city - 2400-3000 automobiles/hour. The residential quarters flank to the basic mainlines.

Transport impurities give 75% from all impurities in locale.

Stationary sources - 10000 ton (sulphurous anhydride - 2200 ton, monoxide of Carboneum - 2700 ton, hydrocarbons - 600 ton). In 1993 volume consisted 7800 ton and in 1986 - 5500 ton. There are 31 enterprises in Sochi (food-processing industry - 13, domestic and mild industry - 4, build construction - 7 major concerns and tens smallsized, wood facilities -1, other - 6). The fuel and energy complex constitutes more 300 boiler, from them 60% work on Donetsk coal (high sulphurous - 3-4%), 27% on boiler oil, only 5% on gas. 8 industrial enterprises are disposed along the river of Sochi (transport enterprises, base building construction), resetting insufficiently furbished drains in the river and sea.

Agriculture - 30500 ton - nitrite nitrogen, 1460 ton - nitric nitrogen, 60 ton - ammonium azotes, 19,7 ton - copper, 75,8 ton - zinc, 100 ton - pesticides. The common floor space of grounds taken by the agricultural enterprises constitutes 31700 ha (8,9% from territory of Sochi region). Land there are basically in the coastal zone of city, not further 3-5 km from beaches in a north up to 15 km in the south of cities.

SPA-hotel complex. There are more 250 recreational establishments in Sochi region, more 120 year-round, remaining seasonal. Only 4% have own refining structures. 60% have own boiler-houses, 50% of boiler-houses is disposed near to recreational zones. The security resting by beaches constitutes - for 55% of the recreational enterprises a load on a beach less than 5 m2/person, for 45% more than 5 m2/person (request of World tourist organization - 5-25 m2/person).

Load on urban beaches are consist 1 m2/person.

Water resources. There are more than 30 rivers of length from 4 up to 90 km in Sochi region. The average modulus of a drain consist 60-70 l/sec with 1 km2. The level of contamination of the sea coastal zone

is interlinked to a level of contamination of the rivers and grounds of site. In Sochi is present 7 «so-called deep water water issue (depth 8-34 м), which one are in district of water use. This spacing interval constitutes less than 2 miles from beaches. The impurities concentrate near to beaches and are distributed alongshore and to it, do not leave on depth. The high bacterial impurity is permanently scored. The coastal waters in district of Sochi and river frequently do not correspond to international and Russian norms (Yu.I. Dreizis, 2005, 2015, 2016; A.Yu. Lein, I.I. Rusanov, G.A. Pavlova, A. Meluzov, Z.I. Verkhovskaya, L.R. Merklin, M.V. Ivanov, 2009; T.B. Filatova, 2009; Goryachkin Yu.N., Kosyan R.D., Krylenko V.V., Nguyen Man Hang, Medvedovsky V.V., 2014).

The data for the basic types of pollution are given in the table 2.

Table 2: The list of pollutants acting at an atmosphere, in water and in grounds on the average for one year on the Sochi resort region

Name	Data's 2008 year (ton/year)
Benzol	2,071
Benzopiren	The outbursts are minor
Diesel soot flakes - from boiler-house and truck 0,5 %	36,472
Formaldehyde	6,669
Stiren	0,004

d) Impurity of the Sochi region coastal zone

The basic polluters of waters of the given dock space are the household drains and sea trans-port.

The level of contaminations of petroleum hydrocarbons in district of ports of Tuapse and Sochi are close among themselves. The average long-term concentrations constitute accordingly 15 x -2 and 11 x -2 mg/l. The absolute maxims of concentrations, disregarding of emergency downthrows, on these districts reach 13,0 mg/l and 2,45 mg/l accordingly. For a period of supervising the average annual concentrations of petroleum hydrocarbons in district of Tuapse were changed in surface layer from 0,05 up to 0,31 mg/l, for bottom - from 0,05 up to 0,26 mg/l. The average annual concentrations of petroleum hydrocarbons in district of Sochi are changed from 0,05 up to 0,24 mg/l to a surface and from 0,05 up to 0,13 mg/l for bottom.

Interannual dynamics of petroleum hydro-carbons concentrations in both districts is characte-rized not monotonic. The average fluidized on volume concentration, both in district of Tuapse, and in district of Sochi, reaches 2,8 mc (marginal concentrations).

The seasonal variability of concentrations is expressed is gentle. The maximum concentrations of petroleum hydrocarbons were supervised in October - November, minimum - in May and August. In the course of the year, first of all, is infringed by appearance of high concentrations in July in both districts, both on a surface, and for bottom.

The time-space distribution of petroleum hydrocarbons concentrations in district of studies is characterized by variable nature.

The systematic and detailed supervising mirrors a substantial oil painting of impurity of a dock space of Sochi coastal region. The average long-term concentration of petroleum hydrocarbons constitutes in district of Sochi 0,14 and 0,09 mg/l accordingly for surface and for bottom of horizons.

The waters of Sochi coastal district during studies had also composite hydrochemical conditions. For consequent years of supervising of essential quantitative variations and demurs was not supervised. Two yardsticks should conduct the estimation of ecological state of marine resort locale: ecological - implying state of common impurity of different objects, and applied problem - performances of their suitability for a concrete kind of usage.

From the point of view of relevance of recr-eational resources for economy of marine resort, locale basic usage of a coastal zone of the sea is a beach.

For an estimation of quality of these resources, first of all from the point of view of ecological purity, the relevant parameter is water exchange in a coastal zone of the sea. For its estimation, it is necessary to know speeds of alongshore currents permitting to evaluate distribution of impurities in a coastal zone.

The ecological status of the Caucasus coast of the Russia can be estimated generally as quite satisfactory. It is essential for reasonable ecologically and economically further development in these coast of resort activities and tourism.

Significant increase in content of biogenous substances in a coastal zone is observed usually in places of a confluence of the rivers, at the cities and in areas of ports. The main critical zones of environmental risk in the Black Sea are formed in places of influence of a river drain.

To increase of recreational load of beaches and the coast there is an increase in content of biogenous substances in waters of sea coastal zones, cases of the adverse mode on dissolved oxygen are observed. It often is a consequence of the increased content in water of the easily oxidized organic chemistry.

Comparison of the obtained data with previous gives the grounds to consider that the tendency of stabilization of level of impurity of a coastal zone remains

e) Engineering coastal protective structure in the Sochi region

Wave damping wall there are on length of 81 km, beach protective groins - 40 km, wave breaking moles - 11 km and berm - 4,5 km. Thus in a complex these hydraulic engineering structures are executed on an extent only 56 km.

As it is visible from stated, the coast of the Sochi site by 1990 was rather saturated with coastal protective structures. It is explained by necessity of protection a resort infrastructure and railway.

However, system of coastal protective structures, adding up by 1990, did not ensure reliable fulfillment of coastal protective functions on a considerable extent of beaches. On data of the Sochi Geoecological center, average width of beaches in region was reduced since 1914 on 8-10 m.

The analysis of construction and operation of coastal protective structures allows marking their following negative consequences for the coastal zone:

- the submerged breakwaters do not ensure deduction of beaches without crosscut structures by the way groins. They conduct to deterioration of their stability and worsen conditions of water exchange in summer and reduction of capacity of self-wiping of waters of the coastal zone sharply;
- construction of the groin system practiced frequently without filling with an inert material of bays between groins. It results lined to interception of detrital deposits from an alongshore current by groins and to progressing of disastrous low fluid washes;
- blocking a dock space by groins also worsens a water exchange and self-cleaning of water in bays between groins;
- fulfillment of coastal protective measures in a contingency plan (the outburst on beach of building wastes, concrete blocks of the different sizes and bulk, cross ties etc.) gives void effect. But it also disastrously reduces aesthetic and recreational qualities of coast;

rigid regulation of beds of the rivers in an ostium part (the construction of concrete beds) conducts to sharp reduction of a solid drain;

the erection close set of wave breaking walls has reduced receipt of detrital deposits in an alongshore current at the expense of a coastal decline abrasion ;

the structure of wave breaking walls without beach retaining structures and artificial addition of detrital deposits speeds up fluid wash of a beach band (Yu.I. Dreizis, 2005, 2015, 2016; Serebryakov G.B., Grishin N.A., 2012; A.Yu. Lein, I.I. Rusanov, G.A. Pavlova, A. Meluzov, Z.I. Verkhovskaya, L.R. Merklin, M.V. Ivanov, 2009; T.B. Filatova, 2009; Goryachkin Yu.N., Kosyan R.D., Krylenko V.V., Nguyen Man Hang, Medvedovsky V.V., 2014).

The photographs of separate sites of a coastal zone of the Sochi region are indicated on photographs (Fig. 9-28). For creation and the protection of a beach were used various types of coastal protective structures. Efficiency of use of the chosen types of coastal protective designs is various.

All above mentioned, and also the development of new methods of the coastal protection, has reduced in comprehension of necessity of development of the new General schema of coastal protective and against a landslide measures (Yu.I. Dreizis, 2005, 2016; A.Yu. Lein, I.I. Rusanov, G.A. Pavlova, A. Meluzov, Z.I. Verkhovskaya, L.R. Merklin, M.V. Ivanov, 2009; T.B. Filatova, 2009; Serebryakov G.B., Grishin N.A., 2012; Goryachkin Yu.N., Kosyan R.D., Krylenko V.V., Nguyen Man Hang, Medvedovsky V.V., 2014).

Fig. 9: Destroying of the wave-breaking wall from the marine and coastal party for want of a wave

Fig. 10: The coast disfigured by groins and which lost the recreational quality

Fig. 11: Destroying of the wave-breaking wall from the marine and coastal party for want of a wave

Fig. 12: Example of destruction of a wave protective wall. The beach near the wall is small

Fig. 13: Example of destruction of a wave protective wall. The beach near the wall is small

Fig. 14: Creation and protection of a beach with use of a faltering breakwater

Fig. 15: Creation and protection of a beach with use of a faltering breakwater

Fig. 16: Protection of the shingle beach with using of the groin system and wave-breaking wall of the quay

Fig. 17 : Protection of the shingle beach with using of the groin system and wave-breaking wall of the quay

Fig. 18 : Protection of the shingle beach with using of the groin system

Fig. 19 : Protection of the shingle beach with using of the groin system

Fig. 20 : Protection of the artificial shingle beach with using of the groin system, wave-breaking wall of the quay and a long shore breakwater (beach of the 5*hotel "Black Sea")

Fig. 21 : Protection of the artificial shingle beach with using of the groin system, wave-breaking wall of the quay and a long shore breakwater (beach of the 5*hotel "Black Sea"

Fig. 22 : Protection of a landslide coast from the wave influence by installation of concrete blocks

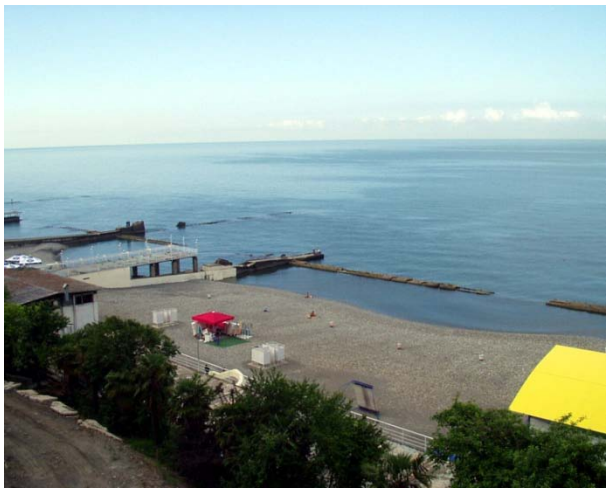

Fig. 23: Protection of the artificial shingle beach with using of the groin system and a long shore breakwater

Fig. 24: Protection of the artificial shingle beach with using of the groin system and a long shore breakwater

Fig. 25: Protection of the artificial shingle beach with using of the groin system and a long shore breakwater

Fig. 26: The classical architecture of the Sochi resort is not combined with a "classical" method of coastal protection

Fig. 27: Aqua-park, groin system in coastal and beach zones and moles of the port Sochi

Fig. 28: Aqua-park, groin system in coastal and beach zones and moles of the port Sochi

IV The Purposes of the General Coastal Protective Measures Schema Development and Availability of Reasonable Alternatives

The current state of coast of the Black Sea in general can be characterized as unsatisfactory. Now a considerable part (309 km) of coast of the Black Sea within Krasnodar Region of Russia are damaged to abrasion and landslide processes. The situation aggravates a problem of abrasion and washout of sea coast. The general exhaustion of beaches or their absence constrains resort construction. The listed complex of dangerous natural and anthropogenous processes demands acceptance of urgent measures for protection of coast of the Black Sea.

Thus, urgent need of development of the program of complex development of resorts of the Black Sea coast of Russia is obvious today. As a prototype of such program, the Concept of formation of a coastal zone of resort recreational system in borders of the resort town of Sochi can be considered.

The analysis of the existing condition of the coast of Greater Sochi showed that now on many sites of the coast of Greater Sochi beaches in the between groin compartments and for breakwater spaces have small width or in general are absent. Similar models of strengthening only spoil a coastal landscape and have no advantage. Meanwhile, now almost all coast of the central part of Sochi quite so looks.

Without beaches of Sochi cannot take the worthy place among modern resorts. At the first stage, beaches can be created on local sites of 2-3 km in combination with wave canceling constructions. Faltering breakwaters from sketches of a natural stone can yield good results, for example.

The central part of the Sochi coast needs radical reconstruction. Most likely, it is necessary to dismantle monofunctional reinforced concrete designs and to replace them with the constructions providing not only hydrotechnical, but also recreational functions. It is important to have a worthy facade from the sea and the modern wellplanned embankment for the city. It is obvious that without this Sochi, can hardly apply for the worthy post among resorts of the international class. As it was scored above, the coastal zone of Sochi is saturated with the enterprises of a SPA-hotel and transport infrastructure. Thus, the beaches in city boundaries are not only method of beach protection, but also major recreational objects involving in city a plenty of the tourists. So, on accounts of design institute of Hyprogor by 2010, the lump sum loading of beaches of Sochi region could constitute during the high season up to 500 thousand people. Thus, for maintenance of sanitary-hygienic norms the floor space of beaches as contrasted to existing should be enlarged with 180 up to 250 hectares. Thus the coastal protective measures executed according to the adjusted General Schema, were directional on reaching of the following basic purposes:

- stabilization of existing shoreline and landslides;
- protection of a cloth of the railway against destroying by hurricane wave;
- stabilization or extension of existing beaches and creation of new recreational beaches.

The indicated purposes according to the General Schema are reached by realization of particular engineering measures in a coastal zone of the sea.

Key alternative (not in a part of concrete design solutions) considered General Schema, as well as anyone to coastal protective measures, can be only total failure from interference in a course of coastal processes. Width of a dynamical part of a coastal zone (band of beach should be in this case determined, in which one the storm strains are possible) and the prognosis of its strains on a call-off quantity of years (for example, on settlement service life of those or diverse engineering structures, boarding houses, SPA-hotels, communications etc.) is made. After that the recommendations for accommodation of capital engineering structures outside of a dynamical part of a coastal zone are given. In the most dynamical part of a beach, the temporary objects can be located only.

However, such approach merits attention, as a rule, when the complex designing of large objects in a coastal zone from "zero point" is conducted. That is the object is designed on free, not built up and not run in inshore territory. Thus, the floor spaces on the part of beaches are not limited. For conditions of the Sochi region in view of extremely plenty of capital objects in a coastal zone such alternative is unacceptable. Thus, engineering activity, offered in General Schema, key reasonable alternatives are not present.

The main characteristics of the region are provided in table 3 and table 4 (Dreizis Yu.I., 2016).

Table 3 : Characterization of the region

Name	Phyisical charecte-ristics	Human charecte-ristics	Land / sea uses	Length of the coast	Landward boundaries for management issues	Seaward boundaries for mana-gement issues	Mana-gement issues	Scales to be taken into account
Sochi region	Region territory - 3500 км^2. It is divided into 4 administrative areas. The barrier from mountain ridges is one their features of environment. Mountains are covered by wood vegetation	The population – more than 430 thousand people. The population is occupied in tourist service, on transport, in trade, services, restaurant business, agriculture, fishery	Tourism restaurant business, trade, transport prevails	Extent of coastal line – 113 km. The area of beaches – about 220 ha. The width of shelf varies to 1 km	Tidal limit	Territorial waters (12 miles)	Erosion control, water quality. State of environment crisis. Anthropogenous pollution is considerable (dumps not enough pure sewage in pools of the rivers and in the sea)	Local Local/ regional Local/ regional /global

Table 4: Conflict matrix (The main using of coastal zone. Possible contradictions between branches of economy of region from the point of view of use of natural resources)

Activity	Port and harbor	Fishing	Shipping	Tourism	Industry	Transport	Sea Resort	Forestry	Agriculture	Global project «Olympic games 2014»
Port and harbour										
Fishing										
Shipping										
Tourism										
Industry										
Transport										
Sea Resort										
Forestry										
Agriculture										
Global project «Olympic games 2014»										

The legend: green – no conflict, yellow – slow conflict, red – strong conflict

The basic reasons resulting in to exhausting of an ecosystem of the sea are not removed:

- the industrial technologies do not answer modern requests in a part of a bionomics. The outlooks on their meliorating as soon as possible are not present;
- inefficiently work about half of complexes on clearing of sewages. Their reconstruction, introduction of elements of an after purification is required;
- a web of sewer headers in inshore cities and occupied points practically is not developed;
- the large part of deep water issues of sewages has damages and requires(demands) recovering with simultaneous magnification of their expansion;
- the shower waters from the floor spaces of urbane territories arrive in the sea without clearing.

The considerable influencing on state of a marine environment renders downthrows of pollutants in structure of sewages of the enterprises of a chemical and petrochemical industry, agricultural and municipal services.

Foregone halving of throughput of ports, bound with the geopolitical provision of Krasnodar region in scales of Russia, and the piling ecological situation in country uniquely will reduce in deterioration of a bionomics of the sea.

From total mass of bioorganic matters acting at a marine environment, the greatest share is necessary on municipal refining structures and on a surface drain from the floor spaces of downthrows. Last is the basic polluter of waters by pesticides.

The analysis of outcomes of overseeing by a natural marine environment in coastal areas of the Black sea and, in particular, in district of Sochi region (tab. 1), allows making following conclu-sions:

- for the last five years the quality of seawater was evaluated, basically, II (net), III (moderately contaminated), IV (contaminated) and V (dirty) classes of purity;
- the rather stable quality of seawaters valued by the III class of purity was scored in 1991 ;
- the tendency to magnification of the pollutions in the coastal zone was scheduled with 1992 on 1994;
- the quality of seawaters was improved, that, apparently, is explained by sharp reduction of number resting in 1995, on the contrary.

To basic technique effects on a coastal zone, influencing the railway unconditionally refers. Its activity near to beaches reduces their recreational qualities. Over quality of water exercise influence also navigation and industry of entertainments in a coastal zone.

Middle 80 years were a years of peak load on the Sochi health resort. These years the city accepted up to 3 million tourists for a season. It, on the one hand, allowed receiving the stable incomes, both urban budget, and ordinary to the citizens, but on the other hand result ined to stressful loads on beaches.

Coastal protective measures, reputed by the General Schema, in case of them technologically realizations by building organizations, will render by exact (according to the projects) following influencing on the parameters of the factors of an environment:

- on dynamics of a coastal zone and beach as its component element - positive;
- on hydrodynamics of an inshore dock space of the sea - positive;
- on quality of seawater in the coastal zone - negative;
- on progressing of coastal-marine biocenoses - requires padding study;
- on forming of coastal-marine landscapes - positive;
- on a quality of life and health of the people - positive.

V. Measures of Software to Prevention of Unacceptable Consequences Accomplishment of the Coastal Protection

The disorder of the Soviet Union has made the created earlier territorial associations on coastal protection unfit to execute by it functions of the customer, general contractor and operational organization in one face. It has reduced in unbalanced development of offshore coastal strip. The natural mode of coast was infringed; there were disastrous consequences as a result of natural problems. Simultaneously it has provoked losses of recreative valuable inshore territories, economically unjustifiable costs and fulfillment rather expensive compensatory of coastal protective measures.

There was a necessity to adapt philosophy of recreational progressing of the Russian Black Sea Coast for modern socio-economic realities, to define the pragmatic approach to development of inshore territories in reasonable combination scientific, ecology-economic, town-planning and engineering decisions.

a) Existing state of a coastal zone

The modern state of the coastal zone is unsystematic, frequently chaotic urbanizing of recreational zones of coast, destroying of existing engineering coastal protective structures and, thereof, degradation of offshore coastal strip as a whole with losses of a recreational potential.

Reasons of such state are:

- Uniform approach to coastal protective measure too absolutely miscellaneous natural mode sites of coastal zone in the Soviet time;
- Heritage of unreasonable solutions on minimization of the costs on alongshore transport mainlines (railway and automobile road);
- Functionally inexpedient usage of recreative valuable territories;

- Unwarranted construction and seizures of a coastal territory;
- The termination of budget and departmental financing of repair and reconstruction of existing hydraulic engineering structures.

Outcome of these operating are fluid wash of beaches, landslides, erosion of grounds, destroying non-repaired, non-optimum and of small effective hydraulic engineering structures and their influencing on the beaches.

The primal problem, which one faces to the Black Sea cities of Russia, can be formulated as follows: the transformation of an existing coastal zone in a modern recreational megalopolis with the purpose of maintenance is maximum of comfortable conditions for tourists at a high level of investment attractiveness of independent sites of coast.

As a result of systematization and analysis of source requests on territory protection, architectural appearance and engineering infrastructure, the following conceptual principles mortgaged in the new complex schema of coastal protection measures were determined (Dreizis Yu.I., 2005, 2016; Serebryakov G.B., Grishin N.A., 2012):

1. Principle of statehood. A coastal zone of the Black Sea coast of Russia - most valuable seaside recreational territory - "card" of marine health resorts of Russia.
2. Principle of a priority. Basic elements of seaside resort industry should become beach complexes and objects of an infrastructure of yachting. That the health resorts of Russia of steel marine, are necessary to the full are to involve by a huge recreational potential of the sea.
3. Principle of the landscape architecture. A synthetically framed landscape and architectural image should organically integrate in a historically adding up town-planning situation.
4. Principle by fissile coastal protection. Coastal protective structures should actively neutralize a wave action on defended territories and structures at their simultaneous stabilization.
5. Principle of reasonable urbanizing of territories. The objects of quay should grant tourists an indispensable level of comfort and spectrum of services, simultaneously not enabling transship-ment of valuable landscape-recreational territories.
6. Principle of a universality of structures. All engineering structures should be multifunction.
7. Principle of ergonomics. It is necessary to create maximum comfortable and secure environment for the tourists. It is impossible without transport service of objects. Therefore, it is required to divide foot and motor transportation streams with simultaneous magnification of there qualitatively - operation capability. It is necessary to bear from beaches technical zones of operation small ships and structure, tearing integrity of beach recreational complexes and tourists, endangering to health.
8. Principle of aesthetic environment. The engineering structures and architectural appearance of building are harmonic combined with a landscape and existing by style-definitive objects. For this purpose, it is necessary to transform engineering structures, tearing integrity of beach complexes and finding in an obvious dissonance with an enclosing contour and architecture.
9. Principle of indemnification of territories. Taking into account an existing deficit it is impossible to enable most popular and, accordingly, most visited recreational beaches, reduction of their floor space and expansions along a water boundary as a result of variation of a functionality.
10. Principle of ecology. Coastal protective structures and the engineering measures on development of declines and other territories should meliorate an ecological situation of an inshore dock space and contiguous territory.

b) Milestones of program - target development

The implementation of a program is expedient for realizing on the basis of regional potential at coordination by Administration of Krasnodar Region, having dissected it on following milestones:

1-st stage- Systematization, generalizing both estimation of efficiency and expediency of available operating time of a regional and federal level.

2-d stage - Wiring design of legal zoning of coast based on the acting nature protection acts.

3-rd stage - Development of the coastal zone circuit natural and urbanizing zoning for creation of its steady investment potential.

As a result of supervising and scientific studies on the Black Sea coast executed in 1960-1990 years by different organizations, the philosophy were produced, which one should be guided by at realization of coastal protective measures:

1. The angle diameter of fragments of a careering material used for creation of artificial beaches should be close to an angle diameter of fragments in a natural beach on the given site of beach.
2. Used for creation of the artificial beaches the careering material should contain no more than 35 % of fragments of factions (more finely 1-2 mms) and no more than 5% by large surges of large-sized including and to have a high scale of stability to an abrasive wear. The fulfillment of the given item will promote stability of a beach and will reduce up to the minimum a mechanical pollution of coastal waters.
3. At fulfillment building of coastal protective operations it is necessary to exclude clogging of beaches and of near located territories to them by

sub-standard grounds, building garbage, wastes of fuels and lubricants oils etc.

4. It is necessary to envision for their replenishment, clearing, exportation of garbage, and alignment etc. special technological roads at organization of beaches. They should be powered up together with beaches in the maiden zone of a sanitarian mode.
5. It is necessary to exclude a construction of submerged breakwaters on the coast, where the organization of recreational beaches is realized.
6. It is necessary in all cases to ensure filling again constructed and maintained of between groin bays with an inert material on an unformatted capacity. It should settle up in the concrete projects.
7. The second path of the North-Caucasian railway is necessary be for designing and for plotting only in the party of a land. It is necessary completely to exclude withdrawal of a beach band under the railway.
8. The regulation of beds of the rivers in wellhead sites should be organized on width, not less triple width of a channel, with the purpose of maintenance of the unconstrained passing of a solid drain.
9. It is necessary to be guided by the following rules from the point of view of architectural-landscape designing:

- the free beach is the best from all beach protective systems;
- it is necessary to prefer structures, not dangerous for bathing, the top which one is disposed below than sea level;
- it is necessary to prefer disposition structures in scheduled disposed alongshore and which are not shielding a view on the sea up to horizon;
- it is necessary to prefer structures engaging (borrowing) minimum percent(interest) of the floor space of defended offshore coastal strip;
- at designing cross-cut structures it is necessary to envision safety factor for construction on them of berths, aeratiums etc. with the purpose of provision is maximum of their useful usage;
- the constructions, acting above water, should be finished with the special carefulness and to attach them an aesthetic kind.

10. The artificial creation of beaches for the account addition, recommended as the basic method of coastal protection, demands longtime security by an inert material. The delivery of a material from careers is justified in the General Schema. Considering a deficit of an inert material on the Sochi coast and seller's price of its delivery to places of addition, it is expedient to consider a possibility of searches and exploration of an inert material on a underwater decline within the limits of marine depths, where its production is technically probable) and is economically effective.

The examples of planned engineering solutions of the Sochi region coastal zone (projects) are given in Fig. 29-31).

VI. Complex Monitoring of a Coastal Zone

Per the last decades the fissile attempts of creation of a different systems of automation of natural environment monitoring in all branches of engineering activity, bound with interplay of the person and nature are undertaken. To such systems it is possible to refer different types of the automized management systems (MIS), overall systems of forecasting and management of natural processes (SFMNP), automated design-engineering systems (CAD system) etc.

Under the direction of one of the writers the maiden sequential queue of the Automized System of Coastal Processes Monitoring (ASCM) is developed. The maiden sequential queue of the system was developed for the Kaliningrad coast of the Baltic Sea (Makarov K.N., Nikolenko A.A., 1992, 1994). The basic problem of development is the definition of an optimal complex of engineering measures on management of coastal processes by multivariate study of reputed administrative and design solutions. The speech goes about optimization of key solutions on the basis of forecasting change in length of coastal processes strokes. After acceptance of key solutions, their realization can be now projected by traditional methods or with applying of CAD system elements an already available in a design organization. The key solutions constitute a basis of the General Schema of coastal protection.

Within the framework of first-order development (ASCM) are decided both general-system problems, and problem of its preliminary adapting to concrete coast.

To general-system problems refer:

- development of pattern, structure and applicable software of the intellectual interfacing of the system;
- development of the complex automized system of forecasting and management of coastal processes (CS ICZM);
- development of pattern, structure and management system of the automized databank (ADB).

As a result of a solution of the indicated general-system problems, the pattern (ASCM) is created, which one basically can be adapted to coast of any tide less pool.

By information basis of all automized systems of monitoring, forecasting and the managements of natural processes, are the automized intelligence systems (AIS). Generally they execute following functions: the tax, processing, storage, map, adjusting and issue of the information. In frameworks AIS can be

in turn chosen (Makarov K.N., Nikolenko A.A., 1992, 1994; Yu.I. Dreizis, K.N. Makarov, I.G. Kantardgi, N.O. Sapova, 2003; Yu.I. Dreizis, I.V. Grigoriyn, O.E. Lobova, 2011):

- subsystem of data acquisition in field conditions (survey) and its primary processing;
- subsystem of input in a computer, transformation, editing, storage, map and issue of the information for consequent usage in CS ICZM or immediately by person.

It is accepted to call the second subsystem of the AIS as the Automized databank (ADB). Primal problems ADB of seashores are:

- maintenance by the indispensable information CS ICZM, and in the long term as well as CAD system of coastal protective measures;
- maintenance of user-friendly input, adjusting and information display;
- systematization of available dates on beaches and definition of defects ("holes") in their sets. It allows to organize targeted prospecting operations and by that to save the applicable material means.
- The indicated functions are ensured with two principal components ADB:
- database that is purely dates on beaches, coastal processes existing structures etc.;
- DBMS representing collection of particular software.

However, it is necessary to mark, that for final adapting of the designed system and its further information attending it is necessary to organize a complex of special fullscale supervising on sites of coasts, it adapts for which one.

It is offered to execute adapting AS ICZM to conditions of coast of the Sochi region that will allow organizing alongside with full-scale supervising, complex automized monitoring of beaches.

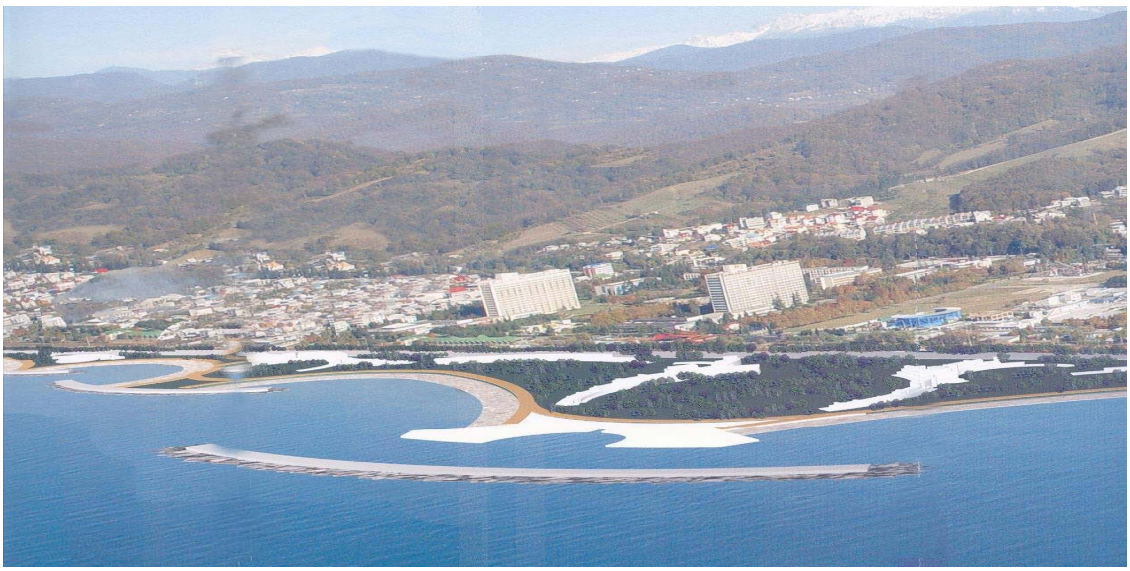

Fig. 29: System artificial bays with beaches, yachts - harbors and longitudinal breakwater

Fig. 30: System artificial bays with beaches

Fig. 31: The project on reconstruction of the main seaside embankment of Sochi with use of faltering underwater breakwaters of a macroporous design and the free pebble beach

VII. Conclusions

The international and domestic experience shows that there are many ways of effective protection of coast. Realization of this or that way depends not only on specifically current situation ashore, but also on the planned purposes of use of a coastal zone.

At assessment of impact of bank protection constructions on the environment it is necessary to consider consequences (negative and positive), both for nearby landscapes, and for all sea coast in general. When developing shore protection actions it is necessary to consider that the carriedout works did not cause damage to the environment, recreant, or it has to be minimum.

To estimate extent of influence of bank protection constructions, actions for strengthening of the coast on the environment, it is necessary to understand the nature of action of the considered means of a coastal protection in the beginning.

Creation of beaches in the form of bays is directed to improvement of natural conditions; this nature protection action. On coast with free beaches, free water exchange, which is complicated in the presence groins, is supported. Besides, the beach is not only a reliable engineering bank protection construction, but also an additional recreational facility. During creation of beaches, feed by its beach material is necessary.

Protection of coast against a wave erosion has to be carried out based on the regularities defining natural dynamics the of litodinamical systems. It is inadmissible to consider a problem of protection of coast as a problem of protection of certain sites of the coast, it has to be solved for all coast, or for several large sites (the litodinamical and coastal systems).

In addition, the most important – in the resort area only such design construction decisions that, along with ensuring protection of coast against destruction, will create at the same time the beaches that are actively used in the recreational purposes have to be applied.

As a result of an implementation of a program the following outcomes will be received:

a) Town Planning

- qualitative meliorating of functional usage of an inshore recreational zone of Russia Black Sea Coast;
- warning of unsystematic building of coast with exception of banal urbanizing territory;
- variation of architectural appearance of recreational and urbanizing complexes of a coastal zone by entering of principally new elements;
- creation of the district intensive yachting as element of the Mediterranean marine tourism.

b) Economic

- engaging of the off-budget investments;
- increase of substantial cost of the land lots of a coastal zone and of near coast territories;
- magnification of a commercial effectiveness of operation of objects;
- urging of progressing of new industries in locale; magnification of hotel capacitance of coast.

c) Social:

- creation of new jobs in different orbs;
- construction, household service, public catering etc.;
- progressing of peripheral districts of cities and districts;
- valuable using of coast recreational resources.

d) Ecological

- environmental sanitation of territory and of a near coastline dock space;
- positive influencing on litodynamic of coast and progressing of a biocenosis.

Accepted composition and the engineering solutions will allow creating ergonomic recreational environment of coast, without which one the organization of valuable and comfortable rest for the sea is represented rather doubtful.

The installment implementation of a program will reduce in forming a logical functional diagram that allows not only creating a modern seaside recreational megalopolis.

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Effects of Climate on Growth of Rice (*Oriza sativa*) in Greater Yola

By Ezra A, Umar A S, Joseph I & Kefas. A. H.
Modibbo Adama University of Technology

Abstract- This work was design when there is a need to investigate the effect of climate on growth of different varieties of rice in Greater Yola. The study was conducted in a research farm located in Sangere FUTY, Greater Yola, Adamawa State during the 2014 rainy season (3rd June – 7th October 2014). Experimental farm was designed base on Randomized Complete Block Designed (RCBD) system. Three selected varieties of rice; Nerica L20, Faro 44 and ITA 206 were planted and replicated three times and measurement was taken on them. Daily climatic data were collected from Modibbo Adama University of Technology Meteorological Station. Climatic pattern in the study area during the growing period indicated that, highest rainfall was recorded in the month of August and decreases toward October. Relative Humidity showed a direct relationship with rainfall, while the remaining climatic elements showed inverse relationship with Rainfall and Relative humidity. Variation in growth of rice revealed that, there is a variation in plant Height and Leave length at P= 0.05, but no variation in Culm diameter. Correlation result showed that, rainfall has a positive relationship with rice at all the developmental stages, it is positive at P= 0.05 in vegetative stage and at P= 0.01 in Reproductive and ripening stage.

Keywords: effect, climate, growth, rice and greater yola.

GJHSS-B Classification: FOR Code: 960399

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Effects of Climate on Growth of Rice (*Oriza Sativa*) in Greater Yola

Ezra A [α], Umar A S [σ], Joseph I [ρ] & Kefas. A. H. [ω]

Abstract- This work was design when there is a need to investigate the effect of climate on growth of different varieties of rice in Greater Yola. The study was conducted in a research farm located in Sangere FUTY, Greater Yola, Adamawa State during the 2014 rainy season (3rd June – 7th October 2014). Experimental farm was designed base on Randomized Complete Block Designed (RCBD) system. Three selected varieties of rice; Nerica L20, Faro 44 and ITA 206 were planted and replicated three times and measurement was taken on them. Daily climatic data were collected from Modibbo Adama University of Technology Meteorological Station. Climatic pattern in the study area during the growing period indicated that, highest rainfall was recorded in the month of August and decreases toward October. Relative Humidity showed a direct relationship with rainfall, while the remaining climatic elements showed inverse relationship with Rainfall and Relative humidity. Variation in growth of rice revealed that, there is a variation in plant Height and Leave length at P= 0.05, but no variation in Culm diameter. Correlation result showed that, rainfall has a positive relationship with rice at all the developmental stages, it is positive at P= 0.05 in vegetative stage and at P= 0.01 in Reproductive and ripening stage. Maximum and Minimum Temperature showed a negative relationship at emergence and vegetative stage but were positively correlated with rice at reproductive and ripening stage. Relative humidity showed a positive relationship at P= 0.01 in Reproductive stage but correlated negatively at emergence, vegetative and Ripening stage. Sunshine hours and Radiation were highly significant at vegetative, Reproductive and Ripening stage. In regard to this, awareness on some climatic parameters such as Onset, Cessation and Length of Rainy season should be pass to farmers, cultivation of Nerica L20 should be encouraged in the study area. In addition, more research work should be encouraged on other factors affecting rice growth in the study area, especially Genotype variation, Soil impact, among others.

Keywords: effect, climate, growth, rice and greater yola.

I. Introduction

Climate is a critical factor influencing production of crops and other human activities in any region. Generally, there are many physical factors influencing crop production because they are often human related factors and these include soil, relief, climate and diseases among others but climate is the most important (Adebayo, 2010). In relation to climate, rainfall is the dominant controlling variable in tropical agriculture since it supplies soil moisture for crops and grasses for animals. David and Mark (2007) reported that climate is fundamental to crop growth. They stated that, moisture and temperature stimulates seed to germinate and the time emergence and that, the rate of growth of roots stems and leaves depend on the rate of photosynthesis which in turn depends on Sun light, temperature, moisture and carbon dioxide (CO_2). They again stated that, temperature and day length determine when plant produce leaves, stems and flowers, and consequently the filling of grain or the expansion of fruits. The yield of grain crops depend on the grain number and grain weight at harvest which in turn depend on climatic factors. Climatic factors also influence farmer's behaviors, growth and yields of a crop, incidence of pests and diseases and water needs. Thus, there is no aspect of crop culture that is devoid of the effect of climate.

Rice (*Oryza sativa*) production is not spared from the effect of climatic factors, as climatic elements can also lead to change in its production. For example, Gumm (2010) noted that, Production of rice, will be thwarted as temperatures increase in rice-growing areas, He further stated that, unforeseen changes associated with temperature, relative humidity and rainfall are expected to affect rice production negatively leading to low yield of the crop. Ramirez (2010) stated that, increase in temperature, due to climate variability, adversely affects rice crop physiology and decreased crop yield and grain quality.

In Nigeria, rice is one of the major crops cultivated within the nation, which clearly showed that, change in its production as a result of climatic factors will affect its general production in the nation (Akinbile, 2010). Cultivation of rice is also being affected by the impact of climate in various locations in Nigeria. For example, Ogbuence (2010) stated that, climatic variability such as rainfall and temperatures are major threat to rice growth which leads to drop in quantity and quality of rice in Ebonyi State. He further stated that heavy rainfall and flood pose a serious impact on development of the early rice in the study area.

So far, from the research reports on rice production in the major rice producing area, there is an indication that climate has detrimental effects. This assertion therefore informs the need to carry out a study to examine the effect of climate on rice production in Yola, Adamawa State.

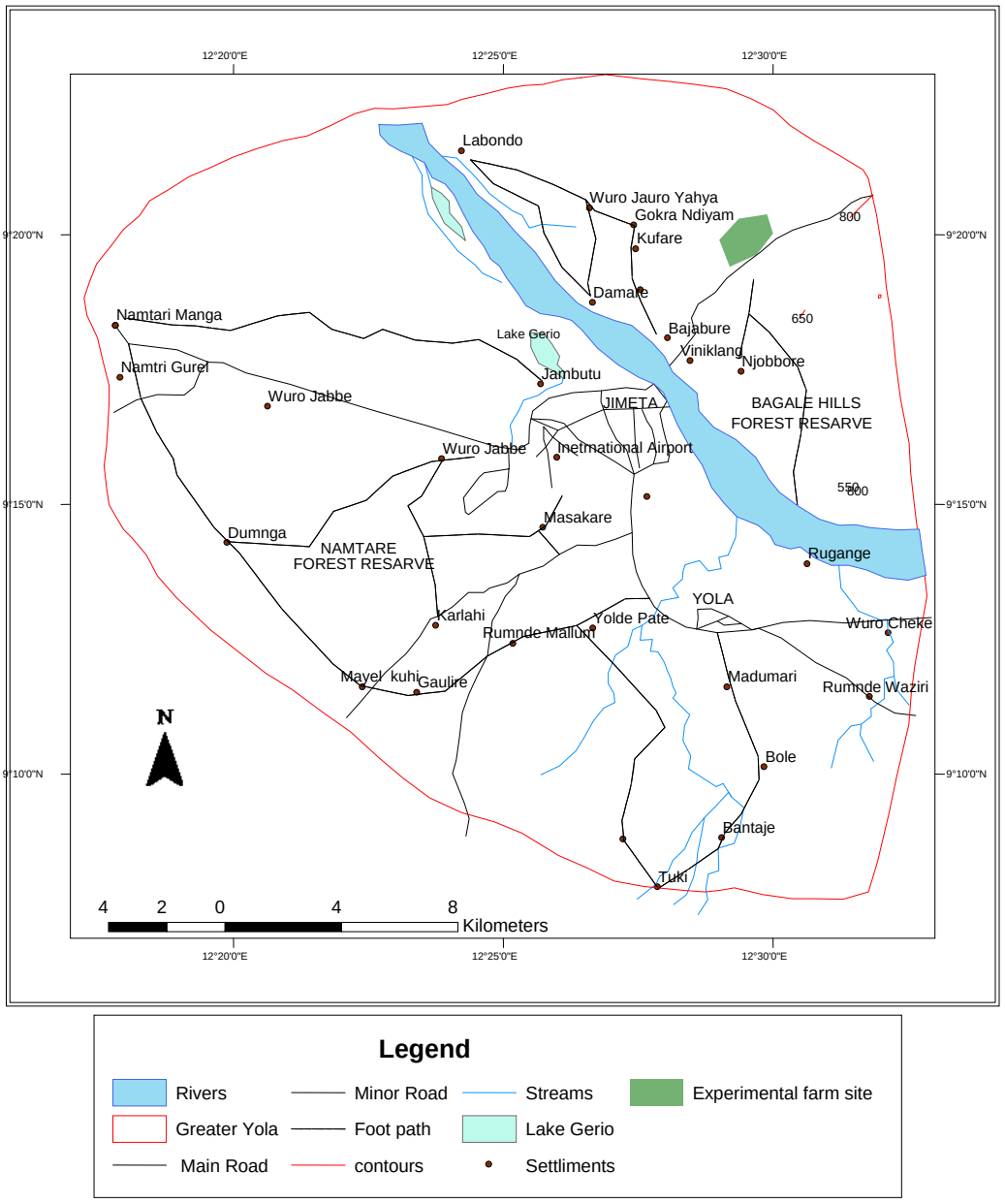
Author α: Department of Geography, Modibbo Adama University of Technology, Yola. e-mail: andrewezra12@yahoo.com

a) The Study Area

Greater Yola lies between latitudes 9^0 07^1 to 9^0 23^1 N and longitudes 12^0 17^1 to 12^0 33^1 E. (Gongola Urban Areas Designation Order 1985 and Yola Topographical Sheet 48/48A, 1974). Generally, greater Yola is bounded to the south and east by Fufore, West by Demsa and North by Song, Local Government Areas. Greater Yola covers the expanse of three Local Government area; Yola North, Yola South, and Girei LGA. The Experimental farm site is located in Sangere village, Girei LGA; it is located on Latitude 9^0 $11^{'}$ $15^{''}$ N and longitude 12^0 $20^{'}$ $29^{''}$E. The settlement is situated along the Yola-Maiduguri highway and share border with Modibbo Adama University of Technology (formerly Federal University of Technology Yola), to the East and is about 4km away from Girei town, the Girei Local Government headquarter.

The climate of greater Yola area exhibits typical tropical climate (Adebayo, 1999; Zemba, 2010). The study area has average sunshine hours of about 7-8 hours daily and the wind speed average of 76.1Km/hr. It has monthly mean sunshine hours of about 220 hours from January to April. This decrease to a mean value of 207 hours between May and September due to increases in cloud cover during the rainy season. The mean sunshine hours increase again to about 255 hours between October and December. The average sunshine hours for the year as a whole stand at about 2750 approximately (Adebayo, 1999). The air temperature in the state as a whole is a typical West African Savannah Climate. Temperature in this region is generally high throughout the year. Yola has a seasonal change in temperature, from January – April; the temperature increase is because of the clearer sky view which permits the reception of solar radiation. The maximum temperature is 43^0C which occur in April and the minimum temperature is 18^0C between December and January. There is a distinct drop in temperature at the onset of rains due to the effects of cloud cover. The temperature decreases at the beginning of the raining season to the end which is as a result of the cloud effect. The temperature again increases after the cessation of the season (October - November) before the arrival of harmattan which leads to drop in temperature (Adebayo, 1999).

Greater Yola has two distinct seasons- the rainy and dry season. The rainy season runs from the months of May through October, while the dry season commences in November and ends in April/May. The average annual rainfall is put at about 960mm with the highest occurrence in August and September. In fact, in the past few years, the highest occurrence of the rainfall has shifted to September, as opposed to August previously. The wind direction in the area is characterized by northeast and westerly winds. The northeast trade winds bring harmattan from the north during November to March through the influence of tropical continental air mass while the influence of tropical maritime air mass from the south brings about rains during the period of May to October. Evaporation is generally high in the area due to high insulation. The monthly distribution pattern is similar to that of sunshine and temperature, which shows significant decline during the rainy season. A record of evaporation in Yola shows that, the minimum value of about 2.5ml occurs in August while the highest value is in March (about15ml) (Adebayo,1999; Zemba,2010).



Source: Ministry of Land and Survey, Yola, 2001

Figure 1: Study Area Showing the Experimental farm site

II. Method of Data Collection

The Randomized Complete Block Design (RCBD) method was applied in plot design; the three selected varieties were planted and replicated three times on each plot at the onset of the season. The intra and inter spacing of the crop were equal in all the plots. The total size of the plot used was 10 x 10 meters which was divided into nine (9) separate plots with each variety replicated three times. The nine plots were spaced 0.5m apart (path way) from each other and were all sized 3x3 meters squared. The outside margin was spaced 1m away from the main plot and was planted with the corresponding variety of crop close to it so as to prevent the crop from animal interruption.

The method of rice farm management was uniformly applied to the farm throughout the growing season; the land was clear, thick bush were removed by hoe and cutlass while small debris and weed were left to be incorporated as manure. The land was plough by a tractor and then harrowed two weeks after ploughing to allow the weed to die; it was manually leveled for easy and uniform seed germination, growing and erosion control. Bund was constructed to accumulate water and to allow good drainage for plant growth. Three different varieties of rice were selected for the experiment, Nerica L20, FARO 44 and china as V_1, V_2, and V_3 respectively which were obtained from Adamawa State Agricultural Development Program (AADP) and Upper Benue River Basin Development Authority (UBRBDA) Gerio farm site.

The selection of the varieties was based on the fact that they were the common varieties of rice cultivated in the study area and the state in general, they also have maturity period that ranges from 90-130days (WARDA, 2005). Planting was done by dibbling of five seeds at a depth of 3cm for easy germination. Thinning was conducted at two stand of plant per hill after three weeks of planting, and spaced 20 x 20cm apart which gives a total plant density of 50 plants per m^2; this is to allow good weed control and adequate supply of solar radiation in between the plants. The first weeding was done two weeks after establishment followed by the first split of fertilizer (NPK 15:15:15) application. Second weeding was done four weeks after the first weeding followed by the second split of fertilizer (Urea) application for good yield.

Daily weather data were collected from Modibbo Adama University of Technology Yola, meteorological station throughout the growing season from June – October, 2014. Data on rice growth were collected from the selected rice varieties planted in the experimental farm site at seven (7) days interval throughout the growing season of the crop. Data on plant height, length of leaf, numbers of panicles, numbers of tillers, numbers of spikelet, yield per plot, weight of rice per plot, and total yield were measured to determine the growth and yield of the crop. All growth measurement was obtained from fifteen (15) randomly selected rice plants from each plot and was tagged for easy identification.

Both descriptive and inferential statistics were performed. The descriptive statistics involved the use of tables, percentage simple mean and graphs, while the inferential statistics are; Analysis of Variance (ANOVA), Correlation, Regression analysis (Stepwise regressions) and. Analysis of Variance (ANOVA) was used to test the variation in growth and yield of the three selected varieties of rice. The correlation analysis was used to test the relationship between climatic elements and Growth, and yield of rice at different developmental stages. To identify the climatic elements that influence rice yield, Stepwise regression analysis was employed; total yield of rice was expressed as dependent variable (Y) and climatic parameters as independent variables (X).

III. Results and Discussion

The climatic pattern as shown in Table 1 revealed that, during the growing season, rainfall increase as the month move toward August but letter drops in September and October. The high amount of rainfall was experience in the month of August; this is in line with the Nigerian rainfall distribution pattern in which rainfall has single maxima in the Northern part of the country. This result implies that, rice growth will have good productivity within that period. Maximum and Minimum temperature, sunshine hours and radiation shows an inverse relationship with rainfall, this is because all these parameters normally decrease as rainfall increases because of rain producing cloud during the rainy season which reflect much of the insulation from reaching the ground surface. Maximum and Minimum temperature decreases as the month moved toward August because of rainfall amount but letter increase as it move toward October. Sunshine hour and Solar Radiation also show a similar pattern of movement with Minimum and maximum temperature, their amount decreases as the month moved toward August and decreases after August, moving toward October. This also revealed the impact of rainfall on them in which they have inverse relationship. Relative humidity is the only climatic parameter that shows a direct relationship with rainfall in which as rainfall increase, Relative Humidity amount also increase.

Table 1: Mean Climatic Data for the Growing Period

	Rainfall	maximum temperature	minimum temperature	relative humidity	sunshine hours	Radiation
June	114.1	32.8	25.52	94.00	6.91	15.18
July	124.6	31.14	24.92	94.13	6.82	13.7
August	129.5	29.48	23.79	94.68	3.17	11.68
September	123.7	31.33	24.38	93.1	4.81	14.18
October	17.1	32.00	22.77	93.77	5.67	17.27

Source; Field Study, 2014.

IV. Variation in Rice Growth Parameter

In this aspect, variation in growth parameters of the selected varieties of rice was examined and presented in tables according to the parameters observed.

a) Variation in plant height

Table 2 shows the variation in plant height of the selected varieties at weekly basis after plant establishment. The result indicated that, plant height at Week 1, week 2, week 4 and week 5 varies significantly

within the three selected varieties of rice at P = 0.05 while week 3 and week 5 has no significant variation. In week 1 and week 2, V_2 and V_3 has no significant variation between them but varies significantly with V_1, while in week 4, V_2 and V_3 showed a significant variation between them where as V_1 shows no significant variation with V_2 and V_3. The mean result of variance in Table 2 shows that. V_1 and V_2 has the highest performance at week 1, week 2, and week 3 while, V_3 has the highest performance at week 4 and week 5. This result shows that V_1 and V_2 responded to climatic elements faster and positively than V_3 at the first three weeks but at week 4 and 5, V_3 reacted faster than the two varieties (V_1 and V_2), and the reason for this variation may be either genotype variation or respond to soil type .

b) Variation in plant leaves length

Variation in plant leave length as it responded to climatic variables is represented in Table 3 The result indicate that, all the selected varieties of rice varies significantly at P= 0.05 at week 1, week 2, week 4 and week 5 while week 3 shows no significant variation in leave length within the selected variety of rice. There is no significant variation between V_1 and V_3 but V_2 varies significant from V_1 and V_3 in both week 1 and week 2. V_2 and V_3 show no significant variation between them at week 4 and week 5 but vary significantly with V_1. The mean performance of the selected varieties as shown on Table 3 indicated that V_2 has the highest performance than V_1 and V_3 which clearly mean that V_2

c) Variation in culm diameter of rice

Variation in Culm diameter of the selected varieties of rice was displayed in Table 4. The result obtained showed that, there is no significant variation within and between the three selected varieties of rice in all the weeks of observation, this result indicated that, Culm diameter of the selected varieties of rice responded the same to the climatic variables in their development in the study area.

Table 2 : Mean Variation in Plant Height (cm) of three varieties of rice.

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5
Variety 1	24.233a	43.533a	49.933a	69.467ab	72.467a
Variety 2	19.933b	35.867b	52.167a	62.967b	67.100a
Variety 3	18.667b	33.633b	46.800a	73.033a	75.967a
Mean	20.944	37.677	49.633	64.488	71.844
Probability level	0.037*	0.038*	0.134ns	0.049*	0.208ns

Source: Field Study, 2014.

Note; Means with the same letters (a or b or c) are not significantly different
**Variation is significant at 0.05, **Variation is significant at 0.01*
Ns= Not Significant Variation.

Table 3: Mean Variation in Leave Length (cm) of three varieties of rice.

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5
Variety 1	8.067b	14.533b	21.100a	25.467b	27.100b
Variety 2	11.200a	20.167a	23.000a	32.033a	33.333a
Variety 3	7.867b	14.133b	19.733a	30.867a	32.100a
Mean	9.044	16.278	21.278	29.456	30.844
Probability level	0.036*	0.036*	0.114ns	0.037*	0.025*

Source: Field work, 2014.

Note; Means with the same letters (a or b or c) are not significantly different
**Variation is significant at 0.05, **Variation is significant at 0.01*
Ns= Not Significant Variation.

Table 4: Variation in Mean Performance on Culm Diameter (cm) of three varieties of rice.

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5
Variety 1	0.107a	0.193a	0.273a	0.330a	0.053a
Variety 2	0.117a	0.213a	0.247a	0.343a	0.036a
Variety 3	0.100a	0.180a	0.247a	0.387a	0.407a
Mean	0.108	0.196	0.256	0.353	0.373
Probability level	0.299ns	0.299ns	0.552ns	0.328ns	0.384ns

Source: Field work, 2014.

Note; Means with the same letters (a or b or c) are not significantly different
**Variation is significant at 0.05*
***Variation is significant at 0.01*
Ns= Not Significant Variation.

V. Relationships Between Climatic Factors and Growth and Yield of Rice

Correlation between climatic factors and rice at different developmental stages was observed to see the significant of the relationship.

a) Effect of climate at planting to emergence of rice

At planting to emergence, only Rainfall shows a positive relationship of 0.483, minimum temperature and sunshine hours showed a highly negative relationship at P=0.05 as well as relative humidity at P=0.01. The positive relationship of rainfall and rice at emergence means that, rainfall amount support germination and emergence of rice and any deficiency of rainfall at that stage will affect rice development negatively.

b) Effect of climate at vegetative stage of rice

Vegetative stage is another developmental stage of rice in which climatic contribution is very important because it is at this stage that a variety is to be determined whether it has, short, medium or long term growing circle. In Table 5 the result clearly showed that rainfall and sunshine hours have highly positive significant relationship at P=0.05 with rice. Radiation also showed a highly significant positive relationship at P=0.01 with rice, whereas maximum temperature, minimum temperature and relative humidity shows a negative relationship on rice at this stage. This implies that, rainfall, sunshine hours and radiation supply are vary sufficient for rice development at vegetative stage and that, any decrease in their supply will affect rice production negatively which may lead to low yield of the crop, but increase in their supply will favor development of rice at this stage. The negative relationship of maximum temperature, minimum temperature and relative humidity showed that their supply for rice development at this level is not favorable, and any increase in their supply will affect rice production negatively at vegetative stage. Plant at vegetative is displayed on plate III.

Table 5: Correlation between Climatic Elements and Rice at Different Developmental Stages

	Rainfall	maximum temperature	minimum temperature	relative humidity	sunshine hours	radiation
Planting to emergence	0.482	-0.572	-0.750*	-0.868**	-0.673*	-0.195
Vegetative	0.899**	-0.007	-0.112	-0.375	0.804**	0.680*
Reproductive	0.731*	0.670*	0.519	0.770*	0.634	0.628
Ripening	0.731*	0.333	0.497	-0.025	0.517	0.877**

Source: Field Study, 2014.

**correlation is significant at 0.05*
***correlation is significant at 0.01*

c) Effect of climate at reproductive stage of rice

Reproductive stage of rice is another climate sensitive phase that determined the total yield of rice. Result displayed on Table 5 showed that all the climatic parameters have a positive relationship with rice development. Rainfall, Maximum temperature and Relative humidity displayed a highly positive relationship with rice at P=0.05. Minimum temperature, sunshine hours and radiation also showed a positive correlation of 0.519, 0.634 and 0.628 respectively. The positive relationship of all the climatic parameters at this level indicated that, the entire climatic elements amount are sufficient for rice development at reproductive stage and it will positively affect heading and flowering of rice as indicated by (Yan et al 2010). Plate I showed the Vegetative, Reproductive and Maturity stages of rice in the study area.

Plate III: Vegetative, Reproductive and Maturity Stages of Rice.

Plate II: Taking record at maturity stage of rice

d) Effect of climate at ripening stage of rice

Ripping stage is the last or final stage of rice development and is not spared from the impact of climatic elements. The result in Table 5 clearly shows that Rainfall has a highly positive significant relationship with rice at P = 0.01 as well as radiation at P=0.05. Maximum temperature, Minimum temperature and solar radiation are other climatic parameter that shows positive relationship with rice development at this stage while relative humidity is the only climatic parameters that showed a negative relationship with rice development which means relative humidity amount at this level is not favorable to support rice development as increase in it supply will negatively affect rice production at maturity stage. Plate V showed the ripening/maturity stage of rice in the study area.

Generally, the result on Table 5 indicated that only rainfall showed a highly positive significant relationship with rice at each developmental stage which implies that Rainfall is the most vital in all the development stages of rice in the study area, it also signified that, any deficiency in it supply, will affect rice development negatively as also viewed by (Wetherald, 1991).

VI. Conclusion

High amount of rainfall in the study area during the growing period was experience in the month of August, Maximum temperature Minimum temperature, sunshine hours and radiation has an inverse relationship with rainfall. The three varieties of rice vary significantly in height within them but show no variation in Culm diameter. Rainfall is has a positive relationship in all the stages of rice. While minimum and maximum temperature and relative humidity showed a negative relationship at planting to emergence and vegetative stage. Sunshine hour and radiation are has a positive relationship with rice at reproductive and ripening stage.

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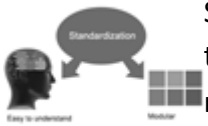

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The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

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

The Institute will be entitled to following benefits:

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

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

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

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

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

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

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

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

The following entitlements are applicable to individual Fellows:

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

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

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

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

Other:

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

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

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

Note :

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

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Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

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

(II) Choose corresponding Journal.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer, then Direct Submission through Homepage is also available.

(C) If these two are not conveninet , and then email the paper directly to dean@globaljournals.org.

Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

Preferred Author Guidelines

MANUSCRIPT STYLE INSTRUCTION (Must be strictly followed)

Page Size: 8.27" X 11'"

- Left Margin: 0.65
- Right Margin: 0.65
- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

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

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

Journals Inc. (US) are being abstracted and indexed (in process) by most of the reputed organizations. Topics of only narrow interest will not be accepted unless they have wider potential or consequences.

2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

Papers are accepted on strict understanding that the material in whole or in part has not been, nor is being, considered for publication elsewhere. If the paper once accepted by Global Journals Inc. (US) and Editorial Board, will become the copyright of the Global Journals Inc. (US).

Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals Inc. (US) follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

Appeal of Decision: The Editorial Board's decision on publication of the paper is final and cannot be appealed elsewhere.

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3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

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

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

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

4. MANUSCRIPT'S CATEGORY

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

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

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

Research articles: These are handled with small investigation and applications

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

5.STRUCTURE AND FORMAT OF MANUSCRIPT

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

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

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

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

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

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

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

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

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

(h) Brief Acknowledgements.

(i) References in the proper form.

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

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

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

Format

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

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

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

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

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

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Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

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

Key Words

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

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

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

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

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

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

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

Acknowledgements: Please make these as concise as possible.

References

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

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

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

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

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

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

Preparation of Electronic Figures for Publication

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

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

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6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

6.1 Proof Corrections

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

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

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

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

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

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

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

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

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

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

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Informal Guidelines of Research Paper Writing

Key points to remember:

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

Final Points:

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

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

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

General style:

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

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

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

In every sections of your document

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

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

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

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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

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

Title Page:

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

Abstract:

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

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

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

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

Approach:

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

Introduction:

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

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

Approach:

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

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

Procedures (Methods and Materials):

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

Materials:

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

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.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

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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