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Carbon Stock Dynamics

Climatological Review of Enugu

Highlights

Ground Energy Associated

Dynamics in Tropical Evergreen

Discovering Thoughts, Inventing Future

VOLUME 15 ISSUE 5 VERSION 1.0

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Climatological Review of Enugu Rainfall from 1916 - 2012 and its Implications

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Abstract- The study Climatological Review of Enugu Rainfall (RF) from 1916 – 2012 and Its Implications examines in detail the RF characteristics and pattern over Enugu during the study period. These include the annual, seasonal and parameters like onset, cessation, duration and seasonality of Enugu RF. Data for this work were extracted from the Nigerian Meteorological Agency (NIMET) Oshodi, Lagos archive for analysis. The result shows among other things that RF fluctuates both annually and seasonally between and outside the group study period over Enugu. In annual / trend analysis it was observed that RF occurrence decreased from 1916 – 1991 generally, but from 1991 – 2012 RF tend to increase. It was also observed that wet season accounted for 83.30% of the total RF over Enugu. The wet season months accounted for 83.30% of the total RF over Enugu.

Keywords: climate change and fluctuation, rainfall parameters, seasonality index of rainfall, wet and dry season, enugu.

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CLIMATOLOGICALREVIEWOFENUGURAINFALLFROM19162012ANDITSIMPLICATIONS

Strictly as per the compliance and regulations of :

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Keywords: climate change and fluctuation, rainfall parameters, seasonality index of rainfall, wet and dry season, enugu.

I. Introduction

The understanding of climate involves adequate knowledge of climatic variables or elements. These elements are temperature, precipitation, sunshine duration, wind, cloud cover, humidity and pressure. The fluctuation of these elements can affect the climate of an area for good or for bad.

The examination of these variables in a single paper or study is difficult; therefore researchers tend to study single or few variables, knowing that variation in one will also affect the others and indeed the climate.

In the tropics, it has been observed that the most unreliable variable is rainfall; besides the effect of rainfall (form of precipitation in the tropics) on the environment is multidimensional in nature. Note: rainfall is almost, if noteverything in the tropics.

Climate is a summary of mean weather conditions over a period of time, usually based on 25-30 years record. Climate are largely determined by location with respect to land and seamasses, to large scale patterns in the general circulation of the atmosphere, latitude, altitude, and to local geographical features (Alexander, 2012; Bradshaw and Weaver in 1995; Mayhew, 2004; Ajayi, 1998. and Iwena, 2008).

The study of climate is vital all over the globe. The importance of climate is summarized by Hardly (2004) he stated that almost every aspect of human life's are affected by weather and climate. Were we live, what we wear, eat and drink, and our work and leisure pursuit. It imposes cost on us but also bestows benefit. Storm and flood causes damage and sometimes loss of lives, but the day to day variations contributed to the rich variety of flora and fauna which add so much to the quality of life.

Rainfall is a form of atmospheric precipitation that is composed of large drops of liquid water it consist of water droplets ranging from 1 - 5mm in diameter (Alexander, 2012). The types of rain produce reflect the circumstances in which it is form (Mayhew, 2004).

Rainfall is one element that influences, the tropical ways of life, it dictates the agricultural calendar, impact on hydrologic circle, social life and even food distribution and transportation.

Most scholars within and outside Nigeria agrees that the climate is changing; there is now scientific consensus that the global climate is changing (Kandji, et al, 2006). Abaje, et al (2012) stated that observations show that as climate changes, changes are also occurring in the amount, intensity, frequency, and types of precipitation.

Ayoade,(2003) and Akinsanola and Ogunjobi, (2014) also pointed out that the global climate has change rapidly, with the global mean temperature

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increasing by 0.7 within the last century. However, the rate of change has significant different among region (IPCC, 2007).

Climate change is a product of natural factors or anthropogenic factors or both. It may result from factor such as change in orbital elements (eccentricity, obliquity of the ecliptic precession of equinoxes), natural internal processes of the climate such as the El Nino-Southern Oscillation (ENSO) or anthropogenic forcing (for example increasing atmospheric concentration of carbon dioxide and other greenhouse gases (GHGS), the effects of deforestation, urbanization and interference or limited infiltration due to tilling, pavement and inter logging of surface (Buba, 2004; Pobeni, 2004; Deneerdt, 2007; Agbola and ojeleye,2007; Odjugo,2010; Alexander, 2012, Bates et al, 2008; NOAA,2007).

Many factors are responsible for the changes in distribution and characteristics of rainfall in Nigeria, and indeed all over the globe. These include the aforementioned. However the general dispersions of climatic variables are just variations (being primary characteristics of natural system),but as a steadily and slow changes due to human inadvertent incursion into nature by ways of social-economic activities that result to developmental initiatives, population growth, agricultural activities as well as growth in science and technology.

The gaseous and material injections that the above activities inject into the atmosphere, the continuous clearing of green vegetal cover and other land use purposes practically inhabits transpiration and evaporation from land and vegetal surfaces. The stage is thus set for a change in the rainfall of such vicinity after decade or decades, centuries of such human intervention(Goldie,1980;Gribbinand Kelly, 1996; Sorte, 1999; Afangideh and Ekanem, 2005; Odjugo, 2007). This dynamic and natural variation occurs on seasonal, decadal, centennial and even longer time scales. Each “up and down” fluctuation can lead to conditions which are warmer or colder, wetter or drier, more stormy or quiescent (NOAA, 2007, Abaje et al, 2010).

Most of the available works are on trends for instance, Abaje et al, 2010; Ifabiyi and Ojoye, 2013; Abaje et al, 2012; Imo and Ekpenyong, 2011, all discussed trend. Rainfall trend gives pictureof rainfall pattern annually. It is important in the study of hydrologic cycle. However it is not very important for agriculture. It does not also explain the fact on drought and flooding. It is actually an illusion to true distribution of rainfall.

Other scholars such as(Srivastava, 1975 and Akinyemi et al, 2013) worked on seasonality of rainfall. Seasonal rainfall is vital in the field of agriculture and even monitoring of drought and flood incidences, however most of the works did not use results for predictions. It is also observed that seasonal rainfall on its own cannot explain much and therefore will be usefully limited. It is like a sort of fluctuation or monthly variations.

This work tends to review Rainfall (RF) characteristics over Enugu using annual records to study if climate was actually changing or not. Finally the work tends to investigate climate using the onset, cessation and duration of rainfall. Most of the previous works are limited to short period of time except when the element under investigation is temperature. This work will use a longer record 1916 – 2012.

Unfortunately many researchers around the world tend to portray climate change as evil. This work is in distance position or deviant. It tend to observe if there is such change in the first place, if there is, is it to human advantage or not. Such vision will help in further research on how to enhance climate change to human’s benefit.

II. Study Area

Enugu is an old city that came to prominence as a result of coal mining in and around it. The name Enugu means hilltop. However the city is on the foot of the hills. Presently Enugu is divided into three local government areas, Enugu East, Enugu North and Enugu South. Enugu is the headquarters of Enugu State, and former capital of old East Central State of Nigeria.

Enugu is located within the geographical coordinate of latitude 06° 26’ 0’’ N and longitude 07^{0}29’ 0’’E. the city of Enugu occupied 113km^2 area of land; with a population of 722,664 persons. It has an approximate population destiny of 6,400 persons per km^2(http//en.wikipedia.org/wiki/enugu, 7-8-2015; NPC, 2006.) Enugu is in between the northern edge of tropical rain forest and southern guinea savanna belt. In terms of climate Enugu enjoy the tropical wet climate. This implies that it has moderate rainfall of about 1500mm-2500mm (Iwena(36)2010).

Rainfall occurs within6-7 months followed with a dry period of about5-6 months. The southern part record more rainfall that the northern parts. Enugu has a double maxima pattern of rainfall. There is always a dry spell in between two peaks.

The temperature is moderate, a mean temperature of 27^{oc}, with a range of 5^{oc}–7^{oc}. The major soil type is the farraginous soil which falls within the interior zone of laterite soil. Major crops produce includes maize, cassava and palm fruit.

Mineral resources like Coal, Lead and Zinc are mined within and around Enugu.

Enugu is home to Enugu State University of Science and Technology, Enugu State Institute of Management studies and Akanu Ibiam International Airport (http://www.enugustate.gov.ng,7-8-15). Figure 1 shows the study area. The time zone is WAT (UTC+I). It is known in Nigeria as the coal city. She has one of the oldest football clubs in Nigeria, the Enugu Rangers.

Figure 1 : Map of Enugu, the study area

III. Methodology

Rainfall data of Enugu were retrieved from Nigeria Metrological Agency archive (NIMET)Oshidi, Lagos for a period of 1916-2012 (97 years). Five (5) of the years had no record, these include, 1922, 1966, 1967, 1968 and 1970. Records for these months were generated using the result of five years running mean. In isolated case, three years from before and two from after the year was taken or used in generating record for the missing months and years.

The data were grouped into 25 years(exclusive) and the last of the four has 22 years. Relationship between the four groups was sorted by observing first, the differences in the mean of the groups. Secondly, the groups were collapse into two to find the significance in relationship using Pearson Product Moment Correlation. Note student‘t’ test and coefficient of determination shall be used to test the result.

Pearson Product Moment Correlation(r) $= \Sigma xy - n\sigma\ e\ /n\sigma x\sigma y$-------------------------------- (1)

Each of the group mean ± the sample size depending on whether the GP σ > or < than the Gn σ. If GP σ >Gn σ minus sample size from the group mean. Then subtract the Gn σ from the result. If GP σ < Gn σ then adds sample size to GP σ and subtract Gn σ

Seasonality index of RF (SIR) which refers to the tendency for a place to have more RF in certain months than in others is also calculated. Markham’s vector method of calculation is used. The SIR is obtained in percentage (%) with values ranging from 0 – 100.

SIR = VR * 100/MAR .... (2)

Where SIR is the Seasonality Index of RF, VR is the Vector Resultant converted in term of the amount of RF. Note, vector lengths correspond to mean monthly rainfall. A circle proportionately divided into 12 sectors representing the twelve months of the year, the amount of RF is represented as a VR. MAR is the Mean Annual Rainfall. Srivastava (1975) and Markham (1970) used this method in their works.

Graphs of the group data where plotted using Microsoft Excel. The result shows the trend in rainfall distribution over the study period.

The seasonal, analysis will be carried out using graphs from the results of the four groups (1916-1940; 1941-1965; 1966-1990 and 1991-2012). The seasonal pattern will be achieved using Group σ /General σ * 100, which is the percentage of seasonal contributions.

Finally the onset, cessation and duration will be used to check for actual changes in climate, if there is any. Any trend develops tell the real rainfall pattern as it affects the climate and the economy.

Walter (1967) formula was adopted.

$$\text{Onset} = \text{NDM}\frac{(51-PAR)}{ARM} \text{---} \quad (3)$$

Where NDM is the number of days in the month, 51 is constant the amounts at which it was assumed that rainfall has started. Onset therefore is when the rainfall is = or > than 51mm.

ARM therefore is the actual rainfall as at the onset.

Same formula appose to cessation.

PAR, mean the previous accumulated rainfall before the 51 target was achieved. ARM is the amount of rainfall within the month that the target was achieved.

Duration of rainfall= Cessation – Onset -- (4)

IV. Results and Dicussion

a) Annual Rainfall

The highest rainfall (RF) occurred during 1991-2012, and the least was recorded during 1961-1990. Table 2 shows the mean, standard deviation, and coefficient of variation of Enugu RF during the study period.

Table 1 : Enugu RF statistical data over the study periods

PERIOD	1916-1940	1941-1965	1966-1990	1991-2012
TOTAL	45281.01	44156.55	42547.44	40091.3
MEAN	1811.241	1740.02	1701.9	1822.333
STD	302.691	272.0619	243.535	213.067
CV	16.71	15.636	16.72	11.69

Annual rainfall analysis shows that the four (4) Enugu rainfall groups has close mean over the study period. The fluctuation or changes in the mean is not directional, which implies that the difference in group mean rainfall is by chance.

The groups are 1916-1940, 1941-1965, 1966-1990, and 1991-2012. 1916-1940 has a mean rainfall distribution of 1811.24mm, 1941-1965 recorded 1740.02mm of rainfall, 1966-1990 had mean rainfall of 1701.9mm during the study period, and 1991-2012 had a mean rainfall occurrence of 1822.33mm for the 22 years of study.

Figure 2 shows the graph of the groups mean rainfall (RF) distribution during the study periods.

The coefficients of variation (CV) of the above groups are very close. It shows a slow shift from the normal RF of Enugu. The study shows that 1916-1940 has the lowest CV of 16.71%, 1941-1965 recorded 15.64%. The highest CV was recorded during 1966-1990 (16.72%) and 1966-010 had a CV of 11.69%. Note this explains the annual rainfall condition of Enugu and not the pattern or characteristics of Enugu RF. The highest CV was recorded during 1966-1990 with 16.72%, and the lowest CV was recorded during 1991-2012 with 15.64% this implies that the RF varies less with lower CV and more with higher CV.

Further analysis using the groups data, we apply the following rule, when the GP б >Gn б then, GP б – sample size –Gn б gives the require RF indicator. The result may be positive or negative or zero. If GP б ≤ Gn б then adds sample size to GP б and subtract Gn б , the result could also be positive or negative. Positive result is an indication that rainfall pattern (i.e. onset will delay, cessation will be earlier and duration will reduce) will reduce, if negative it shows wetter condition (i.e. onset earlier, cessation late and delayed duration) an indication of increase RF. A scale of –15 to 15 shows the level of climate shift from the normal.

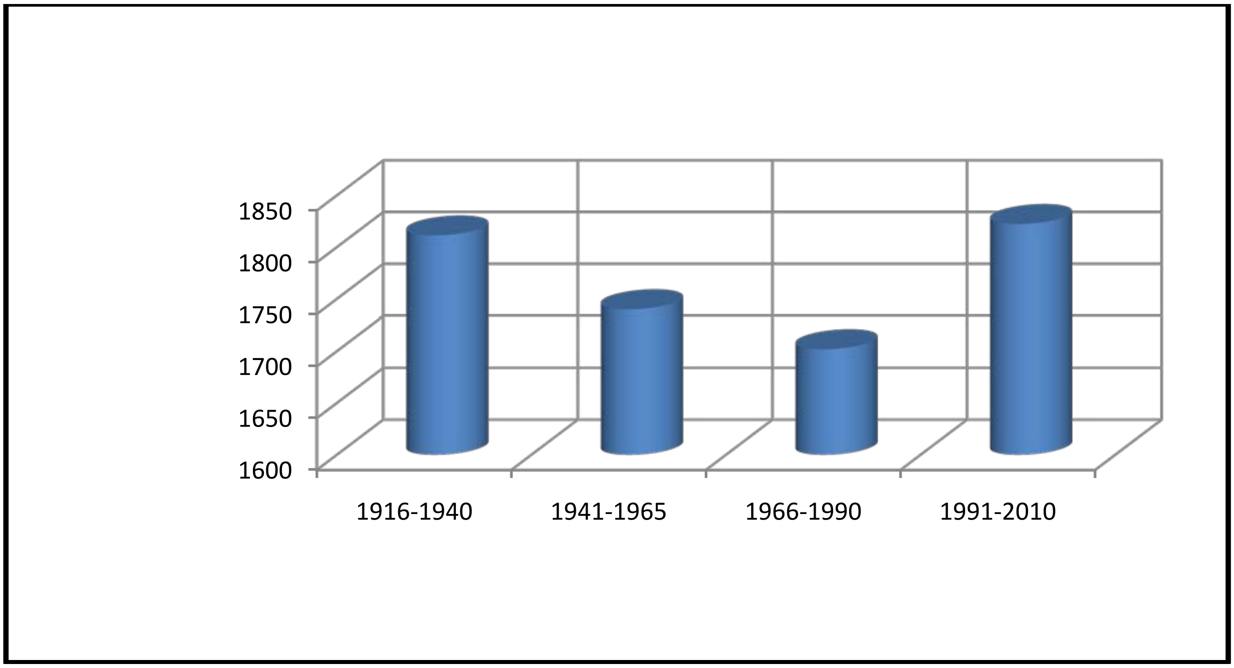

Figure 2 : Groups Mean RF Contribution during the study period

The group analysis shows a +0.01 result an indication of a very mild shift. Any increase in RF could be elusive, if the pattern continued for ¼ of a climate cycle (i.e. ¼*30yrs). The condition will trigger a reduction or drop in RF over Enugu and it's environ.

Statistical analysis using PPMC (Pearson Product Moment Correlation) shows a very negligible relationship between the climate groups during the study period. It was observed that r = -0.084, an indication of very mild reduction of RF distribution, this agrees with the trend line in figure 3. The coefficient of determination = 0.7%, this implies that the climate shift is explain by just 0.7% fluctuation in RF, this again in insignificant. The student's' test = 0.86 meaning that the result is not a product of chance.

The RF occurrence over the years is shown in figure 3. The highest RF was recorded in 1920 and the least in 1983.

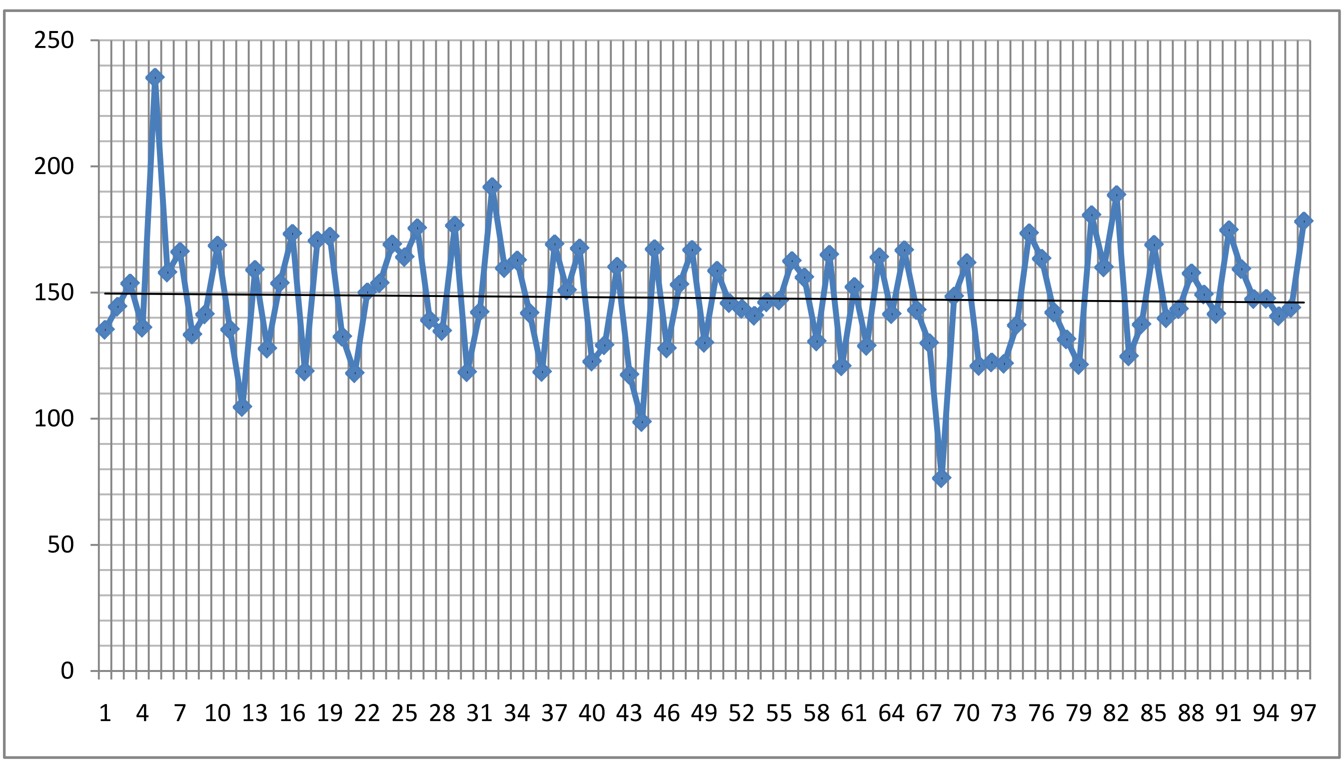

Figure 3 : Enugu Mean Rainfall Distribution (1916-2012)

To establish further trend in the study over the 96 years period under consideration, 5 years running mean was used. The result is shown in figure 4 as RF trend over Enugu.

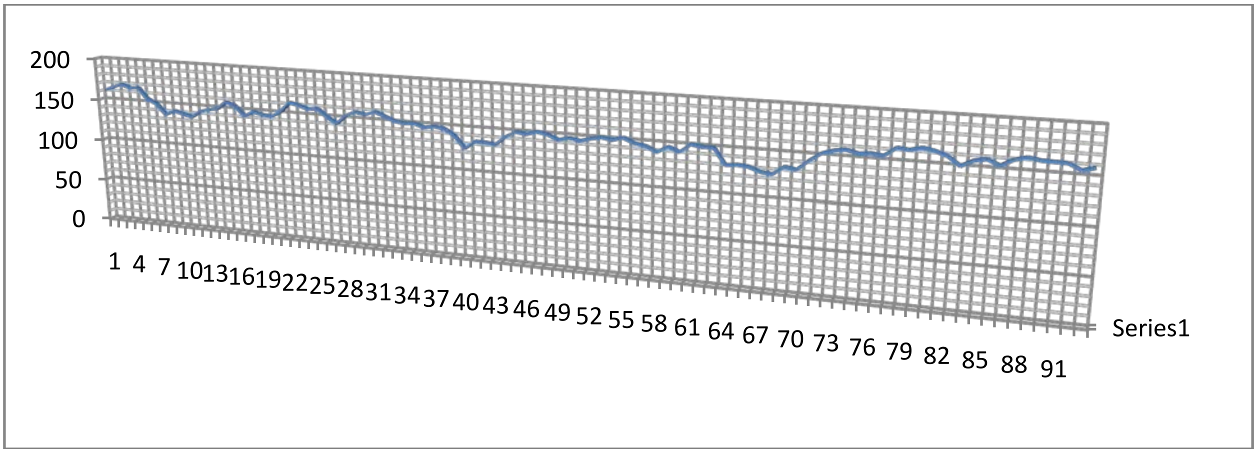

Figure 4 : Rainfall Trend over Enugu (1916 – 2012)

b) Seasonal Rainfall

The month of January and December had the lowest RF in the 97 years of study, while the highest RF was recorded in June and September. From figure 4 it was discovered that Enugu has double maxima type of RF pattern. In general sense of it, the break (dry spell) is longer than in the coastal areas of Nigeria.

The rainy (wet) season months of April through October accounted for 83.3% of RF during the study period (1916-2012), while the dry season months of November through March contributed just 16.7% (28841.95) of the total RF during the study period. This implies an average of 297.34mm of RF very year.

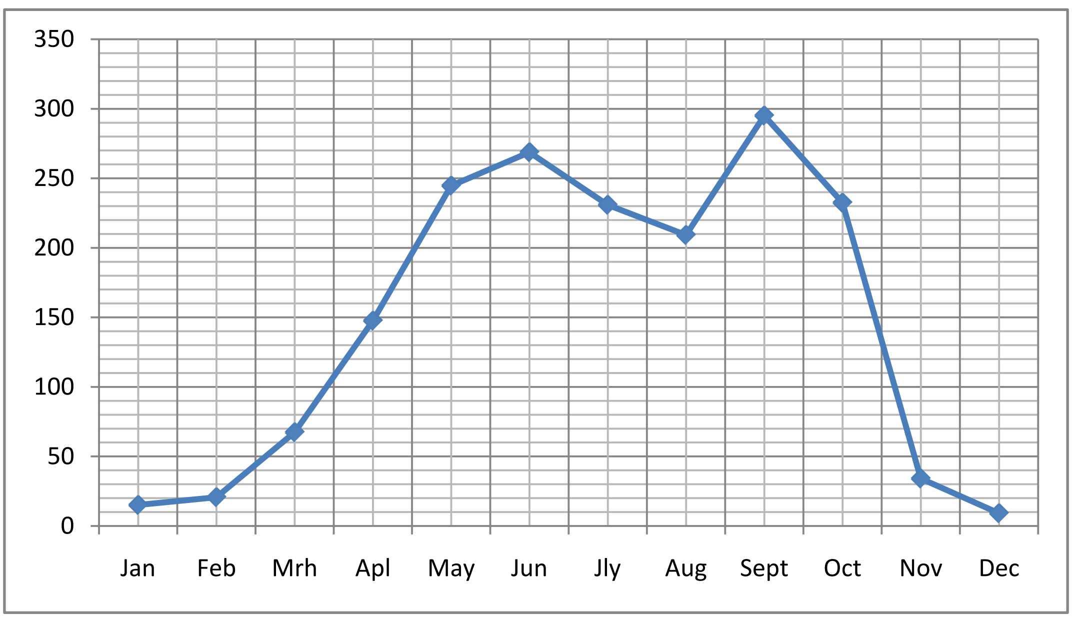

Figure 5 : Enugu mean seasonal RF distribution RF (1916-2012)

Table 2 shows the total, mean, standard deviation (σ), and coefficient of variation (CV) of the various periods of study of Enugu RF.

Table 2(a-d)

Month	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
Σ	647.17	591.59	1859.6	3978.98	6060.57	6167.36	5425.51	4511.6	6743.64	6610.9	1229.69	329.94
б	25.887	23.664	74.384	159.159	242.423	246.694	217.020	180.464	269.746	264.436	49.188	13.198
σ	31.934	27.798	56.110	71.564	68.453	77.919	88.366	101.633	86.370	120.465	42.869	23.403
cv	123.359	117.470	75.433	44.963	28.237	31.585	40.718	56.318	32.019	45.555	87.153	177.322

Table 2a (1916-1940).

The drier months has the highest CV, this implies that RF are very much unreliable during the dry season and more reliable during wet seasons.

Table 2b (1941- 1965)

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Σ	358.4	673.66	1942.89	3571.4	6524.963	7268.31	4660.79	4666.26	7858.15	6112.4	1291.03	352.76
б	14.336	26.946	77.716	142.856	260.999	290.732	186.432	186.650	314.326	244.496	51.641	14.110
σ	24.178	24.626	45.412	72.396	98.367	98.501	78.294	126.958	92.132	82.358	39.206	17.258
CV	168.62	91.39	58.43	50.68	37.69	33.88	41.99	68.02	29.31	33.69	75.93	122.32

Table 2c (1966-1990)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Σ	257.02	470.56	1753.38	3194.74	5421.35	6572.37	6006.61	5819.78	7550.16	4941.65	413.33	146.49
б	10.2808	18.8224	70.1352	127.79	216.854	262.895	240.264	232.791	302.006	197.666	16.5332	5.8596
σ	15.3537	25.7165	48.5039	56.0727	60.2441	88.7839	83.3844	103.081	86.3484	75.5455	21.9448	12.0235
C.V	168.65	91.39	58.43	50.68	37.69	33.89	41.99	68.02	29.31	33.68	76.26	122.3

Table 2d (1991-2012)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TOTAL	221.4	296	1045.5	3535.2	5687.9	6043.5	6158.2	5213	6474.2	4913.3	423.4	79.7
MEAN	10.064	13.455	47.523	160.691	258.541	274.705	279.918	236.955	294.282	223.331	19.246	3.623
STD	16.876	16.217	37.287	54.420	71.830	63.75	70.515	87.700	75.773	76.429	25.663	9.222
CV	167.793	120.505	78.472	33.867	27.783	23.207	25.191	37.011	25.748	34.222	157.965	254.540

The study shows that RF varies within months, years and seasons, the variation or fluctuation is natural, however, it was observed that dry months total RF is decreasing over the years. This is an indication that RF duration is reducing, therefore more of RF in and around Enugu may occur within very short period. This could be inimical to agriculture, water resources, soil conservation and transport industries. Short duration of heavy RF triggers flash flood, soil erosion and water logging which accentuates crop rotten and witting.

Enugu RF shows close resemblance in climate pattern during the 97 years period of study. For instance the CV of the various time scale of study falls within certain % for both annual and seasonal distribution. The annual CV is lower than the seasonal CV. This implies that the annual RF is more reliable and predictable than the seasonal RF in Enugu. The annual (climatic) CV for the various study periods shows that, 1916-1940 recorded 16.71%, 1941 – 1965had 15.64%, 1961-1990 had 16.72% and 1991-2012 recorded 11.69%. The seasonal CV for 1916 – 1940 was 83.42%, 1941 – 1965 had 80.49%, 1966 – 1990 recorded 85.67%, and 1991 – 2012 accounted for 84.76%. Note the seasonal variation is higher than the annual variation because the differences between the wet season and dry season are compared in seasonal CV, while the differences between years are considered in annual CV calculation. The Seasonality Index of RF (SIR) summarized by each group mean record shows a slight variation. The period 1916 – 1940 had a SIR of 19.89% (approximately 0.2), 1941 – 1965 had a SIR of 20.38% (~ 0.2), 1966 - 1990 SIR is 21.15% (~ 0.21), and 1991 – 2012 had SIR of 19.77 (approximately 0 .2). The mean SIR for Enugu over the different time or climatic period was 20.30% (~ 0.2). This implies that the seasonality index of rainfall varies very slightly.

c) Onset, Cessation, and Duration of Rainfall

Using the onset of RF for analysis, it was observe that the mean (б) RF onset for 1916 – 1940 is 12th March (71) day of the year. From 1941 – 1964 the б onset is 18th March (77) day of the year. The result for

1961 – 1990 б onset is 18th March (77) day of the year, and finally the б onset of RF from 1991 – 2012 is 27th March (86) day of the year. The result shows a gradual but consistent shift in onset of RF in Enugu. The Onset of RF in Enugu over the study period shows a delay of about two weeks. This gradual shift can hardly be noticed by local people and farmers and thus may affect agricultural yield. The б Onset of RF during the study period is the 19th day of March (78) day of the year. The best onset period target would be 78± a week. The implication is that RF could start a week to or after the 78th day of the year.

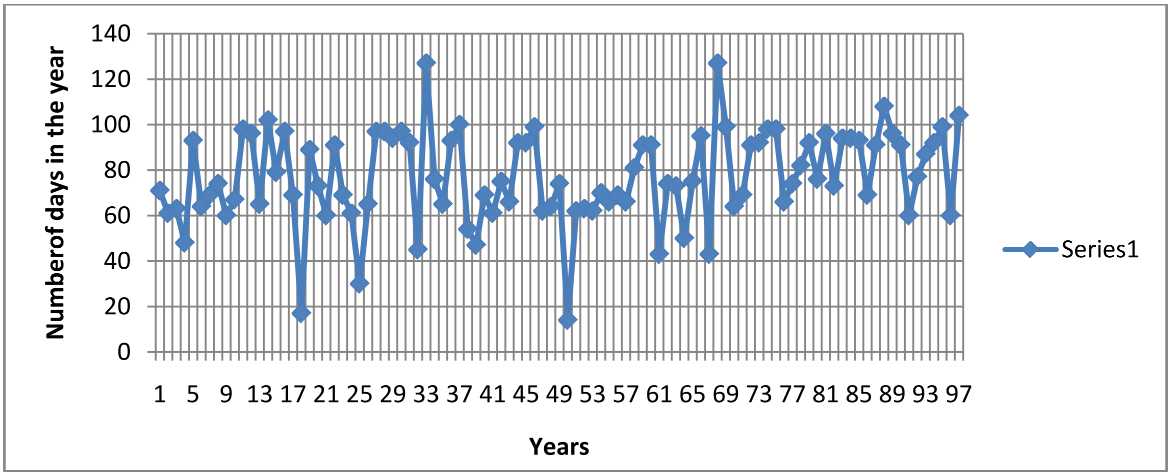

Figure 6a : Onset of RF over Enugu

Cessation or End of RF is analyzed, and it is discovered that the period 1916-1940 had a б RF cessation date of 21st October (294) day of the year. The period 1941 – 1965 recorded a б cessation date of 26th October (299) day of the year. Similarly the period from 1961- 1990 had a cessation б date of 12th October (285) day of the year. Finally, the periods between, 1991 – 2012 was analyzed and it was observed that the б cessation date was 10th of October (283) day of the year. The б cessation date for the study area during the study period is the 17th day of October (290) day of the year. The analysis shows a decrease in or an early cessation from 1941 to 2012. This implies that RF will cease earlier than expected, an indication or warning that late for late planting. There is need for water to be conserve which can be used after RF cessation.

The two analyses gave a clear picture of RF condition or situation as it affects agriculture in Enugu. The annual RF distributions above show an increase in amount of RF over the study periods. This increase could be as a result of flash storm for few days, weeks or a month.

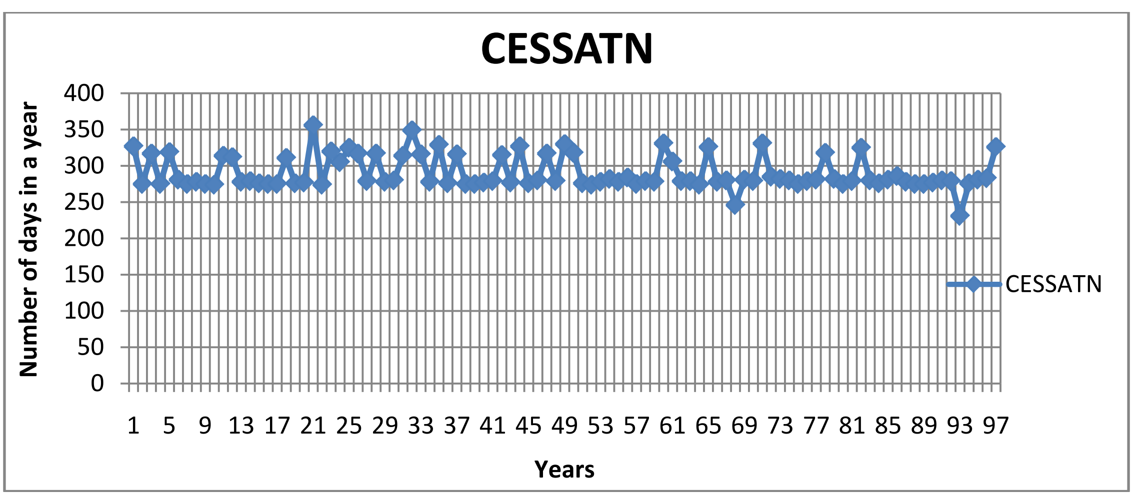

Figure 6b : Cessation of RF over Enugu

Finally Duration of RF was analyzed using the group data. It was discovered that from1916 – 1940, the б duration of RF was 223 days. Note, there is 365 days in a year, therefore 223 of 365 represents 61.10%. 1941-1965 has б RF duration of 222 days, representing about 61.07% of the year. The periods 1966 – 1990 recorded a

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б RF duration of 208days representing 57% of the total years of study. Finally, 1991 – 2012 had б RF duration of 198 days, representing 54.3% of the years under consideration. These show a gradual but steady decrease in duration of RF over the study period. Note, the drop in RF duration from about 61% to about 54% is a clear indication that RF characteristics over Enugu is changing. The б RF duration from 1916 – 2012 is about 213 days which represents about 58.36% of the years under review. The seven (7) rainy months of Enugu represents also about 58.33% of the months of the year.

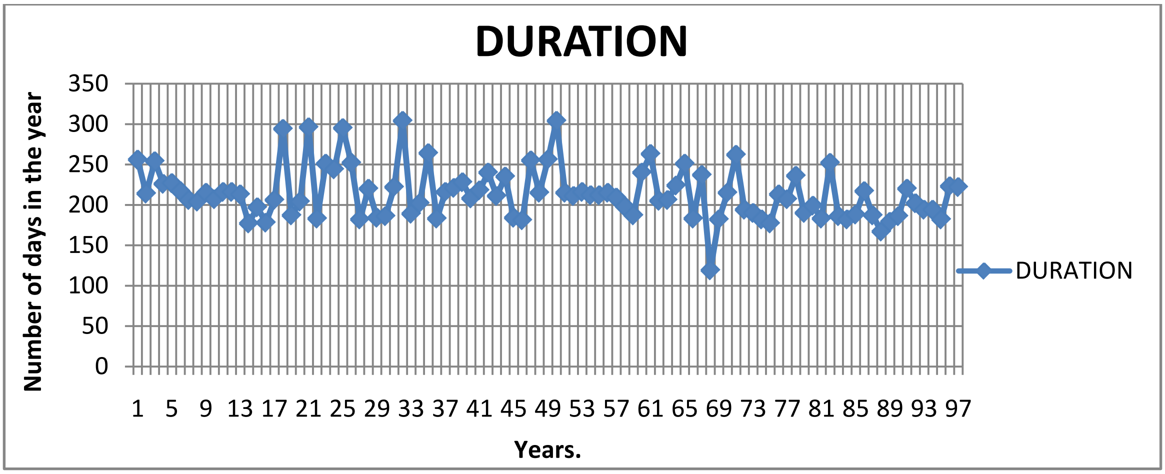

Figure 6c : Duration of RF over Enugu.

The analyses so far shows that Onset of RF is late, the cessation or end is early, these are responsible for the reduction in RF duration over the study area and period. The climate of Enugu is gradually shifting, because alteration of existing RF pattern will also affect other climatic variables. This is a sign for more food, because the climate is shifting to that of the zone known as food basket of Nigeria. The climate has about five months of dry season or relative low RF, new crops like beans; soya bean can now be cultivated in and around Enugu.

The RF condition of Enugu shows that policy makers, farmers, and developers need to consider the Onset of RF and End in their plan. For instance, in road construction especially the local roads, work should start about a week after End of RF.

V. Recommendations and Conclusion

The study observed a steady but gradual shift in RF characteristics/pattern over Enugu during the study periods, which suggest a likely change in climate in the future. Therefore adjustments should be made to accommodate changes observed.

The work shows that annual RF cannot actually explain the RF condition of an area, not even the drought incidence especially agricultural drought. Because a heavy RF outside the target period will give a high annual RF which in actual sense cannot stop agricultural or climatological drought. Similarly, flood can occur even when there is low annual RF or drought within the same year. So, this study suggests that data on RF pattern be consulted before outdoor plans are carried out, especially on agriculture which is the mainstay of the people. Furthermore we call on policy makers; Agriculture and Environment Ministry, and Water resources managers to dully consult related RF and take into account the benefits and otherwise associated with decrease in duration of RF and increase amount of annual RF over Enugu.

A fluctuation in annual RF occurrence is not characteristics of a climate change, besides climate change is not a threat to life and life style of the people of Enugu. Climate change (CC) portends threat or otherwise depending on the location and the environment. For people in the southern Guinea Savanna and Forest Vegetation of Nigeria CC will mean more time to work out door.

This work will not relay on available literature in making speculation, because most of it discusses annual and seasonal RF, and fluctuation and trends in RF distribution over Northern part of Nigeria. However, food productions in Enugu have not been under threaten in anyway or has its food production diminished as a resulted of climate change with regard to RF.

Enugu Ministry of Agriculture and Environment, should introduce crops that required less water and shorter period of maturity.

VI. Acknowledgement

I appreciate and dedicate this work to my late wife and friend Mrs. Justice Dornu Alexander who actually encouraged me to write and publish for the benefit of students and scholars, which she loved so dearly. It is unfortunate and regrettable that you did not live to see our dream and aspiration come true. I shall always remember youStice.

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References Références Referencias

1. Abaje, I, B., S.I. Ishaya and S.U. Usman(2010) An Analysis of Rainfall Trends in Kafanchan, Kaduna State, Nigeria. Research jour. Of Environt., and Earth Sci., 2(2):89 – 96.
2. Abaje, I.B., O.F. Ati and E.O. Iguisi (2012) Recent Trends and Fluctuations of Annual Rainfall in the Sudano-Sahelian Ecological Zone of Nigeria: Risk and opportunities. Jour. Of Sustainable Society. 1(2):44 – 51,
3. Afangideh, A.I., A.I. Ekanem (2005) The changing Annual Rainfall and Temperature Average in the Humid Tropical City of Uyo, Nigeria. Sub- theme: Climate Change. Nigeria Association of Geographers. University of Port Harcourt, 2005.
4. Agbola, T and D. Oyeleye (2007) Climate Change and Food crop production in Ibadan, Nigeria. African Crop Science Confer. Proceedings. 3(21): 1423 – 1433.
5. Ajayi, P.O.S (2003) *Comprehensive Geography for Senior Secondary School.* A. Johnson Publishers Limited, Lagos, Nigeria.
6. Akinsanola, A.A and K.O. Ogunjobi (2014) Analysis of Rainfall and Temperature Variability Over Nigeria. Global J. Hum. Soc. Sci.: B. 14(3): 1 – 5.
7. Akinyemi, O., O.A. Ayeni, O. Faweyeand A.G. Ibraheem (2012) Statistical study of Annual and Monthly Rainfall Pattern in Ekiti State, Nigeria. Int. J. Pure Appl. Sci. Technol., 15(2): 1-7.
8. Alexander, B.C (2012) Climate Change – A case study of Port Harcourt city Rainfall Pattern. Jour. Soc. Sci. Develop., 1(3): 54 – 60.
9. Ayoade, J.O (2003) *Introduction to Climatology for the Tropics.* Revised Edition. Spectrum Publishers, Ibadan, Nigeria.
10. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutik of (2008) Climate Change and Water. Technical paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva. Pp, 210.
11. Bradshaw, M and R. Weaver (1995) *Foundations of Physical Geography.* Wm. C. Brown Publishers.
12. Buba, A.D (2004) Climate Change and Water Problems in Chad Republic. Jour. Arid Env't., 3(2): 42 – 50.
13. DeWeerdt, S. (2007) Climate Change coming home: Global warming effect on production. World Watch. 2(3): 6 – 13.
14. Goudie, A. (1980) *The Human Impact: Man's Role in Environmental Change.* Methuen Publishers, London.
15. Gribbin, J and M. Kelly (1990) Wind of change, living in the Global Green House, Head way. Holder and Stoughton Publishers, Toronto.
16. Hardy, I.H. (2004) *Climatology.* The Royal Academy Press, London.
17. http://www.enugustate.gov.ng. Retrieved on 7th August, 2015.
18. http://enwikipedia.org/wiki/Enugu. Retrieved on 7th August, 2015.
19. Ifabiyi, I.P. and S. Ogoye (2013) Rainfall Trends in Sudano-Saheian Ecological Zone of Nigeria. Earth Sci. Resc., 2(2): 186 – 194. Doi:10.5539/esr.v2n2p 194. URl.http://dx.doi.org/10.5539/esr.v2n2p194.
20. Imo, E.J and N. Ekpenyong (2011) Extreme Climate variability in North – Western Nigeria: An Analysis of Rainfall Trends and Patterns. Jour. Geogr. Gly.,3(1): 40 – 51. Doi.10.5539/ jgg.vn1p51.
21. IPCC (2007) "Climate Change 2007: Syntesis report summary for policy makers". Available at http://www.ipcc-wg1-ucar.edu/wg1/wg1-report.html. Retrieved on 7th August, 2015.
22. Iwena, O.A. (2010) *Essential Geography*. Tonad Publishers Limited. Lagos, Nigeria.
23. Kandji, S.T., L. Verchot and J. Mackensen (2006) Climate Change and variability in the Sahel Region: Impact and Adaptation Strategies in Agricultural Sector. World Agroforestry Centre (ICRAF)/ United Nations Environmental Programme(UNEP). Available at http://www.unep.org/Themes/Freshwater/Documents/pdf/climatechangssahelcombine.pdf. Retrieved on 7th August, 2015.
24. Mayhew, C. (2004) *Dictionary of Geography.* University of Oxford Press, London.
25. NOAA (2007) Observing climate variability and changes. Available at http://www.oar.noaa.gov/climate/tobserving.html. Retrieved on 8th August, 2015.
26. NPC (2010) Nigerian Population Commission 2010 Projection.
27. Odjugo, P.A.O. (2005) "An Analysis of Rainfall pattern in Nigeria". Global J. Env't. Sci., 4(2): 139 – 145.
28. Porbeni, C.V. (2004) The Impact of Global Warming on high Latitude and Altitude. Jour. Arid Env't., 3(2) 75 – 85.
29. Sorte, W. (1999) Global Warming and World Food Production. Env't. Perspect., 12(4):78- 88.
30. Srivastava, M.K. (1975) "Regional Varistion in the Seasonality of Precipitation in Bangladesh". 42(A) 1. Available in http://www.new.dii.ernet.in/data1/upload/insa/INSA-1/20005bea-68.pdf.
31. Walter, M. (1967)" The length of the Rainy Season in Nigeria". Nigeria Geog. J., 10: 123-128.

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Biomass and Carbon Stock Dynamics in Tropical Evergreen and Deciduous Forests of Uttara Kannada District, Western Ghats, India

By Indu K. Murthy, Savithri Bhat, Vani Sathyanarayan, Sridhar Patgar, M. Beerappa, P. R. Bhat, D. M. Bhat, N. H. Ravindranath, M. A. Khalid, M. Prashant, Sudha Iyer, Daniel M. Bebber & Raghuvansh Saxena

Indian Institute of Science and Pondicherry University, India

Abstract- Western Ghats is one of the biodiversity 'hotspots' of the world and currently, there is limited evidence on the status and dynamics of tropical forests in the context of human disturbance and climate change. This study presents the findings of the study conducted under a citizen science programme. The biomass and carbon stocks in the evergreen and deciduous forests of the study area are comparable to the standing biomass of other tropical forests and range from 344-417 tC. There are no major differences between carbon stocks in less and more disturbed forests, which is of significance, given the large dependence of communities on the more disturbed forests. Periodic and long-term monitoring of forests is necessary in the context of potential increased human pressure and climate change to plan and manage forests for mitigation as well as adaptation in a synergistic manner.

Keywords: *carbon stock dynamics, evergreen, deciduous, tropical forests, uttara kannada, western ghats, human disturbance.*

GJSFR-H Classification : *FOR Code: 050299*

Strictly as per the compliance and regulations of :

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Biomass and Carbon Stock Dynamics in Forests of Western Ghats

Indu K. Murthy [α], Savithri Bhat [σ], Vani Sathyanarayan [ρ], Sridhar Patgar [Ѡ], M. Beerappa [¥], P. R. Bhat [§], D. M. Bhat [χ], N. H. Ravindranath [v], M. A. Khalid [ϴ], M. Prashant [ζ], Sudha Iyer [£], Daniel M. Bebber [€] & Raghuvansh Saxena [₣]

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I. Introduction

Tropical forests play an important role in the global carbon cycle. The future role of tropical forests in the global carbon cycle and the climate system is a function of future deforestation rates and the degree to which remaining forests will be sustainable or even increase their carbon stock (Grace, 2004). Tropical biome conversion is estimated to be a source of 1.3 GtC/year to the atmosphere during the period 1990-2005, whereas the intact tropical biomes are estimated to be a net carbon sink of 1.1 GtC/year, with a net source of 0.2 GtC/year for the same period (Malhi, 2010).

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However, the carbon balance of the world's terrestrial ecosystems is uncertain, especially that of tropical forests.

Carbon is stored in forests predominantly in live biomass and in soils, with smaller amounts in coarse woody debris (Malhi et al., 2009). In tropical forests world wide, about 50% of the total carbon is stored in above ground biomass and 50% is stored in the top 1 m of the soil (Dixon et al., 1994). In this context, secondary forests are of particular significance with the proportion of tropical secondary forests projected to increase due to increasing anthropogenic pressure and movement of populations towards urban centers (Wright, 2005). It is thus important to assess carbon stocks and uptake in secondary forests.

Western Ghats is one of the biodiversity 'hotspots' of the world. Forests in the Western Ghats like elsewhere in India are on the one hand protected under the Forest Conservation Act of 1980, from conversion, and on the other hand subjected to human use and disturbance. Studies by Ravindranath et al., 2006 and Chaturvedi et al., 2011 have shown that forests are likely to be adversely impacted by climate change in the coming decades. Further, studies by Rosenzweig, 1995 and Jandl et al., 2007 have shown that disturbed, fragmented and monoculture forests are likely to be more vulnerable to projected climate change compared to undisturbed forests. Currently, there is limited evidence on the status and dynamics of tropical forests in the context of human disturbance and climate change. Understanding of the forest dynamics is essential in order to arrive at precise rates of carbon fixation by a community and then applying it on a regional and global level for estimating the change of CO_2 in the atmosphere (Bhat et al., 2003). This study presents the findings of the study conducted under a long-term programme involving Indian Institute of Science, Earthwatch Institute and volunteer investigators from HSBC (Hongkong and Shanghai Banking Corporation Limited).

II. Materials and Methods

a) *Study area*

The Western Ghats in south-India is identified as one of the 34 biodiversity hot spots (Myers, 1990) and are important for providing multiple ecosystem services. In recent years, the Western Ghats have been subjected to intensive human disturbances apart from natural calamities leading to erosion of species richness, disruption of closed canopy, spread of invasive species, changes in structure and function. There are descriptive studies dealing with the qualitative aspects of the forests of the Western Ghats (Champion and Seth 1968, Rai and Proctor 1986, Pascal and Pellisier 1996), but very few studies that have attempted quantitative assessment and dynamics of this region (Bhat et al., 2000a, Pomeroy et al., 2003 and Bhat et al., 2000b).

Uttara Kannada district lies between 13° 55' to 15° 31' N lat., 74° 9' to 75° 10' E long (Figure 1). A detailed description of the physical environment of Uttara Kannada district is available in Bhat et al (2000a). This district is richly endowed with forests and about 75% of the total land area (10,291 km^2) is forested. The vegetation of the district is of evergreen/semi-evergreen type along the slopes and towards the east of the ridge, it is moist deciduous (Pascal 1982, 1984, 1986).

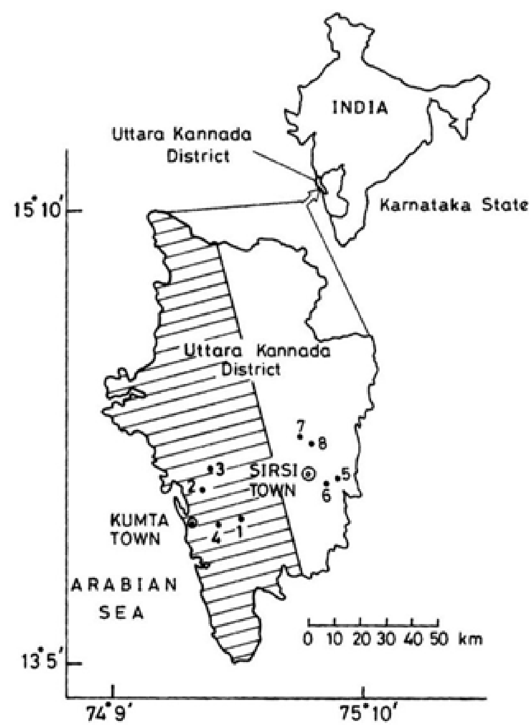

Fig. 1 : Uttara Kannada district showing broad vegetation

b) *Permanent plots*

Forest structure, species composition, and growth data was from 12 permanent plots established in representative areas in two forest categories namely, the evergreen and deciduous in Uttara Kannada district. In each forest category, plots measuring 100 m x 100 m (1-ha) were demarcated and in all, six 1-ha forest plots in three locations, representative of evergreen forest zone (Ekkambi, Tattikai and Hosur) and another six 1-ha plots (in three locations namely, Malgi, Hudelkoppa and Togralli), representative of deciduous forest zone were studied. At each location, two 1-ha plots were laid representing:

a) Less disturbed system – farther from settlements or human habitation
b) More disturbed system – in proximity to human habitation

In the plots, woody plants, including tree saplings, lianas, and climbers >10 cm in Girth at Breast Height (GBH) were mapped and identified to the species level following Cooke (1967), and in case of uncertainty identified up to genera or family level. When there were branches, the branches with a GBH >10 cm were noted as stems and marked respectively as A, B, C etc., and GBH measured and recorded. A red strip was painted on each tree and stem at the breast height. Each tree was numbered with an embossed metal tag. GBH was measured at 1.3 m, except for trees with buttresses, where diameter was measured 10 cm above the buttresses to minimize errors in biomass estimates

(Murali et al., 2005). Girth measurements in the study plots were conducted during 2009-10 and 2011-2012.

Basal area was calculated for the 12 one-ha forest plots located in evergreen and deciduous zones in Uttara Kannada district. Above ground standing biomass was estimated from basal area data following Murali et al. (2005). The carbon stock at each forest site was estimated assuming that it forms 45% of the biomass. Belowground biomass was estimated using the IPCC default factor of 0.26. Changes in biomass and carbon stock in the forest plots were computed by deducting the benchmark year values from the final year values. This included the contribution from recruits.

III. Results

a) Basal area

Basal area is an indicator of growing stock and biomass production. Here we discuss the basal area across different forest types and disturbance regimes.

Evergreen forest type: The basal area recorded across the 6 evergreen plots range from a high of 43.53 m^2/ha in less disturbed Hosur plot to 34.68 m^2/ha in Tattikai less disturbed plot for the base year-2009. However during 2011, highest basal area is recorded in less disturbed plot of Ekkambi. Across all the plots in evergreen forest type, higher basal area is recorded in the less disturbed plots as compared to more disturbed plots during 2009 as well as 2011, except in Tattikai where slightly higher basal area has been recorded in the more disturbed plot, only during 2009 (Figure 2).

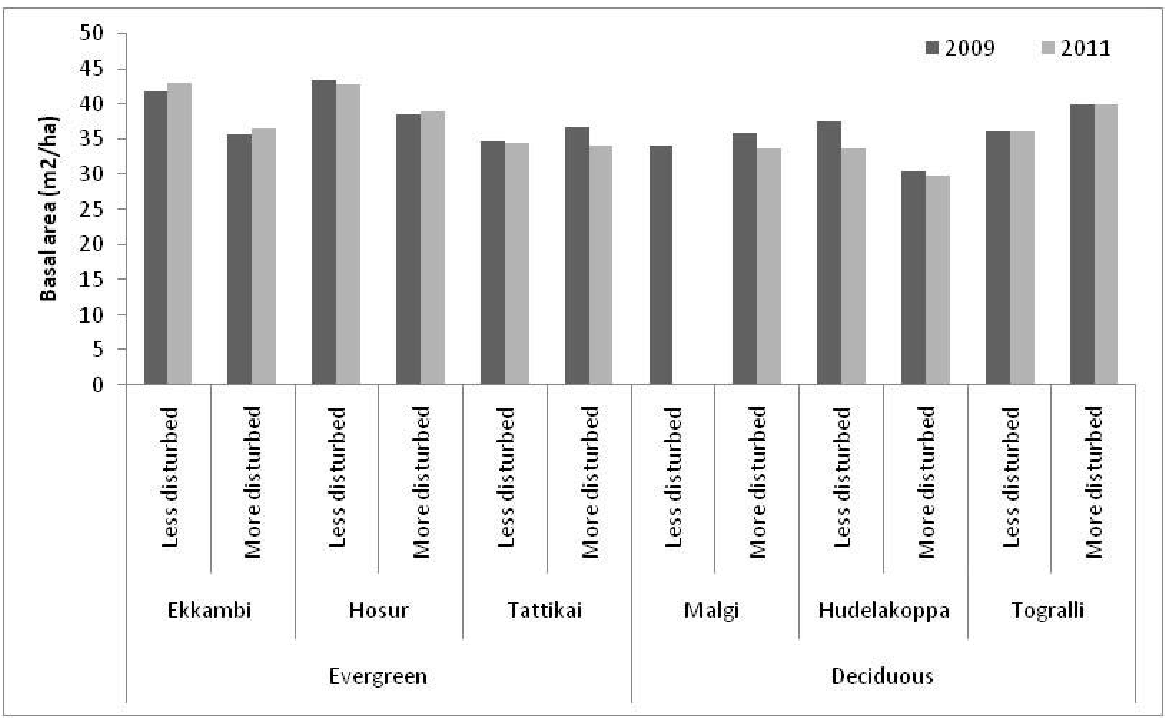

Fig. 2 : Basal area recorded in evergreen and deciduous plots during 2-enumeration periods

Deciduous forest type: Among the deciduous plots, 2-time enumeration has been carried out in all the plots, except Malgi less disturbed plot. In these plots, there is no clear pattern in that the basal area is higher in less or more disturbed plots during both the enumeration years. Highest basal area has been recorded in the more disturbed plot of Togralli during 2009, (Figure 2) while during 2011 Hudelakoppa less disturbed plot has the highest basal area. This is lesser than the maximum basal area recorded in Togralli during 2009.

A comparison of basal area recorded during the two enumeration periods indicates increase in 4 of the 11 locations while in others there is a very small to medium decrement in basal area, except Tattikai more disturbed plot among evergreen plots, wherein a 2.6 m^2 decrease in basal area is recorded and among the deciduous plots, this decrease is about 2 m^2 in Malgi and Togralli more disturbed plots. Thus in all, increase in basal area is recorded in about one-third of the locations while in others there is a decrease, indicating mortality or loss of trees due to natural causes or removal by communities.

Differences in basal area are mainly related to both the frequency of individuals and their size. In both the forest types across the 12 plots, trees >30 cm account for about 20% to 43% in evergreen plots, while in the deciduous plots, it is 18% to 49%. A comparison of change in basal area between less and more disturbed plots indicates the following:

i. *Evergreen plots*

- *Less disturbed:* There is an increase in basal area in only one of the 3 less disturbed plots, no change in another and a slight decrement in Hosur. This possibly could be attributed to increase in access to the location where the plot was laid, as a result of a road laid.
- *More disturbed:* There is an increase in basal area in 2 of the 3 locations and as mentioned above, there is a large decrement in Tattikai. The increase in basal area in 2 of the more disturbed plots could be attributed to disturbance-mediated accelerated succession (Dale et al., 2011, Bhat et al., 2011 and Marc and Michael, 1989). The decrease in basal area in Tattikai could be attributed to greater access of the plot by the communities, which supports several commercially important NTFP species such as *Garcinia cambogea, Syzigium cuminii and Ziziphus rugosa*.

ii. *Deciduous plots*

- *Less disturbed:* Of the 2 plots re-enumerated, an increase in basal area is recorded in one while in the other there is a decrease.
- *More disturbed:* A decrease in basal area in all the 3 plots have been recorded indicating mortality and loss due to natural as well as anthropogenic reasons.

Lower basal area results from indiscriminate logging, lower amount of precipitation, species composition, age of the trees, disturbance, succession stage of the stand and sample size (Sundarapandian and Swamy, 2000 and Swamy et al., 2010). According to Brown and Lugo (1990), recovering forests after previous disturbance accumulate more biomass and carbon. In this study, there is evidence to indicate both, probably due to difference in the intensity of pressure.

b) *Biomass*

Biomass is calculated using the Murali et al. (2005) equation based on basal area.

$$Biomass = 50.66 + 6.52 \times (Basalarea)$$

The biomass so calculated is the aboveground biomass. Using an IPCC default factor of 0.26 (IPCC, 2006), the belowground biomass was estimated and the total living biomass calculated.

i. *Evergreen plots*

The biomass estimates for the evergreen plots ranges between 349 tonnes in Tattikai less disturbed plot to 408 tonnes per ha in Ekkambi less disturbed plot during the baseline enumeration year of 2009. However during 2011, least biomass is recorded in Tattikai more disturbed plot and the highest is in both Ekkambi and Hosur less disturbed plot (Figure 3).

A comparison of biomass during the two enumeration periods indicates increase in biomass over a 2-year period by about 0.7 (Hosur more disturbed) to 2.3% (Ekkambi less disturbed) in 3 of the 6 plots while in the remaining three a decrement in biomass by a negligible 0.1% (Tattikai less disturbed) to as high as 6% (Tattikai more disturbed) is recorded.

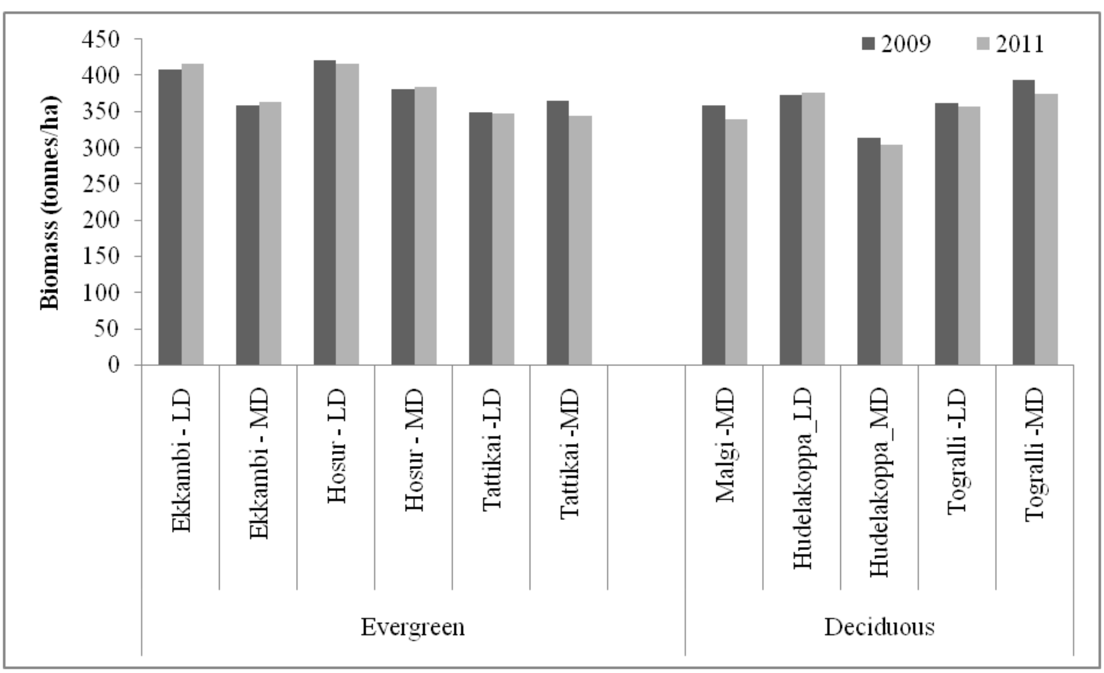

Fig. 3 : Biomass estimates of evergreen and deciduous forest plots

The average biomass stocks across the less disturbed evergreen plots during 2009 is 393 tonnes/ha and the same is slightly higher at 394 tonnes/ha during 2011. Conversely in the more disturbed evergreen plots, as one would expect the average biomass is lower than that of less disturbed plots (368 tonnes/ha) and the same decreases to 364 tonnes/ha by 2011. Overall the biomass stocks in the evergreen plots was 381±28.8 tonnes/ha during 2009 while in 2011 it is 379±32.6 tonnes/ha.

ii. *Deciduous plots*

Among the deciduous plots, the highest estimated biomass is in more disturbed Togralli plot (393 tonnes/ha) and the least is in Hudelakoppa more disturbed plot (314 tonnes/ha) during 2009. The same trend continues even in 2011 (Figure 3).

Among the less disturbed deciduous plots, the average biomass is about 367 tonnes/ha and the same shows a very slight decrease over the 2-year period of 2009 to 2011. However in the more disturbed deciduous plots, the average biomass recorded in 2009 is 355 tonnes/ha and the same decreases to 339 tonnes/ha in 2011. Overall, the average biomass recorded in the deciduous plots is 360±29.0 tonnes per ha during 2009 and the same decreases to 350±29.7 tonnes per ha during 2011.

c) *Carbon*

Forests provide several goods and services that are crucial to human survival. They are one of the world's major carbon stores, containing about 80% of above-ground terrestrial biospheric carbon and 40% of terrestrial below-ground carbon (Kirschbaum et al., 1996). Forests play an important role in the global carbon cycle. Forests, like other ecosystems, are affected by climate change and are either negatively or positively impacted. Forests in turn influence the climate and climate change process. Quantifying the role of forests as carbon stores, as sources of carbon emissions and as carbon sinks has become one of the keys to understanding and influencing the global carbon cycle.

In the forest plots of Uttara Kannada, carbon stocks are estimated from the biomass values calculated using the biomass equation, following Murali et al. (2005). Carbon is calculated using the IPCC default factor of 0.45.

As can be seen from Table 1, the biomass carbon in the evergreen forest plots ranges from 157 tC/ha in Tattikai less degraded plot to 183 tC/ha in Ekkambi less disturbed plot during 2009. During 2011, the carbon stocks in the same plots range from 155 tC/ha (Tattikai more disturbed plot) to 188 tC/ha in both Ekkambi as well as Hosur less disturbed plots. It is to be noted that in Tattikai more disturbed plot, the carbon stocks have remained stable at 157 tC/ha, indicating no additional loss that could not be compensated by recruits.

Table 1 : Carbon stocks in aboveground and belowground biomass during 2009 and 2011 in evergreen and deciduous forest plots

Location	Stem density		Aboveground biomass carbon		Belowground biomass carbon		Total biomass carbon	
	2009	2011	2009	2011	2009	2011	2009	2011
Evergreen forest plots								
Ekkambi - LD	1131	1087	146	149	38	39	183	188
Ekkambi - MD	1692	1656	128	130	33	34	161	164
Hosur - LD	1457	1409	151	149	39	39	190	188
Hosur - MD	2146	2089	136	137	35	36	172	173
Tattikai -LD	2184	2131	125	124	32	32	157	157
Tattikai -MD	3219	2920	130	123	34	32	164	155
Deciduous forest plots								
Malgi -MD	451	468	128	121	33	32	161	153
Hudelakoppa_LD	1288	1382	133	134	35	35	168	169
Hudelakoppa_MD	1573	1489	112	109	29	28	141	137
Togralli -LD	1566	1647	129	127	34	33	163	160
Togralli -MD	1388	1515	140	134	37	35	177	168

Similarly in the deciduous forest plots, the carbon stocks range from 141 tC/ha (Hudelakoppa more disturbed) to 177 tC/ha in Togralli more disturbed plot during first enumeration in 2009. During the second enumeration in 2011-12, the stocks in Hudelakoppa more disturbed plot have further reduced to 137 tC/ha, indicating disturbance, that led to loss of biomass and this loss has not been compensated by the recruits as in the case of evergreen plots. In Togralli more disturbed plot that recorded highest biomass during the year 2009 also, there is a decrease in the carbon stocks (loss of 9 tC/ha over a 2-year period). Highest stocks are estimated to be in the Hudelakoppa less disturbed plot.

Interestingly, the average carbon stocks in the less disturbed evergreen as well as deciduous plots are stable over the 2 enumeration periods. It is 177 tC/ha in evergreen and 165 tC/ha in deciduous plots during 2009 as well as 2011. However there are differences in the carbon stocks in more disturbed forest plots of both evergreen as well as deciduous; a decrease in stocks is recorded. Overall, the stocks in the evergreen plots (both less and more disturbed plots together) have remained stable at 171 tC/ha while in the deciduous plots, there is a loss of about 4 tC/ha over the 2-year period, with the loss being highest in Togralli more disturbed plot.

IV. Discussion and Conclusion

Tropical forests are one of the richest and complex terrestrial ecosystems supporting a variety of life forms and have a tremendous intrinsic ability for self-maintenance. However, many of these forests are losing this ability due to excessive biotic interferences such as anthropogenic perturbations and uncontrolled grazing. Consequently, these forests are disappearing at an estimated rate of 15–17 Mha/year (FAO, 1995). Furthermore, this comes at a time when our knowledge of their structure and functional dynamics is woefully inadequate (Hubbel et al., 1992 and Sundarapandian and Swamy, 2000). The conservation of biological diversity has become a major concern for the human society. Generation of structural status and functional dynamics of forests is essential for biodiversity conservation and sustainable management of fragile ecosystems. This study is a step towards generation of such information needed for planning, management and conservation of forests.

The biomass and carbon stocks estimated in the evergreen and deciduous forests show that tropical secondary forests are indeed storehouses of carbon. The biomass estimates of the evergreen forests in the present study (344-417 t/ha) are comparable to the standing biomass of other tropical forests such as that reported by Proctor et al. (1983) for tropical rainforests of Sarawak in Malaysia and tropical wet evergreen forests of the Western Ghats (439-587 t/ha) by Swamy et al. (2010). These estimates are all also within the range of values reported for other primary neotropical forests (Brown et al., 1995, Gerwing and Farias, 2000, Chave et al., 2001 and Keller et al., 2001).

Interestingly, the stocks in the less and more disturbed forests are not very different despite the greater dependence of communities on the more disturbed forests. This is a very important finding in the context of the region which is reported to have about 50% of households to be dependent on forests for a range of forest products (Murthy et al., 2005 and Murthy et al., 2014). This is an indication that communities are not over or unsustainably extracting forest produce. Periodic and long-term monitoring of the status and dynamics of the forests is however necessary in the context of potential increased human pressure and climate change in order to plan and manage the forests for mitigation as well as adaptation in a synergistic manner.

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References

1. Abrams Marc D. and Scott Michael L. 1989. Disturbance-mediated accelerated succession in two Michigan forest types. *Forest Science* **35**(1):42-49.
2. Bhat D. M., K. S. Murali and N. H. Ravindranath. 2003. Carbon stock dynamics in the tropical rain forests of the Uttara Kannada district, Western Ghats, India. *International Journal of Environment and Pollution* **19** (2):139-149.
3. Bhat, D.M., Hegde, G.T., Shetti, D.M., Patgar, S.G., Hegde, G.N., Furtado, R.M., Shastri, C.M., Bhat, P.R. & Ravindranath, N.H. 2011. Impact of disturbance on composition, structure, and floristics of tropical moist forests in Uttara Kannada District, Western Ghats, India. *Ecotropica* **17**(2):1-14.
4. Bhat, D.M., M.B. Naik, S.G. Patgar, G.T. Hegde, Y.G. Kanade, G.N. Hegde, C.M. Shastri, D.M. Shetti & R.M. Furtado. 2000a. Forest dynamics in tropical rain forests of Uttara Kannada district in Western Ghats, India. *Current Science* **79**: 975-985.
5. Bhat, P.R. Rao, J. Murthy, I.K. Murali, K.S. & Ravindranath N.H. 2000b. *Joint Forest Planning and Management in Uttara Kannada: A Micro and Macro Level Assessment*. In: NH Ravindranath, K.S. Murali and K.C. Malhotra. Joint Forest Management and Community Forestry in India: An Ecological and Institutional Assessment. Oxford and IBH, New Delhi, 59-98
6. Brown, S and A. E. Lugo. 1990. Tropical secondary forests. *Journal of Tropical Ecology* **6**:1-32.
7. Brown. IF, Martinelli LA, Wayt Thomas W, Moreira MZ, Cid Ferreira CA, Victoria RL. 1995. Uncertainty in the biomass of Amazonian forest: an example

from Rondônia, Brasil. *Forest Ecology and Management* **75**:175-189.
8. Champion, H.G & Seth S.K. 1968. A revised survey of the forest types of India, Government of India Press, Nasik, India.
9. Chaturvedi, R,K., Gopalakrishnan, R., Sukumar, R., Ravindranath, N.H. 2010. Carbon management in Indian forests: a policy analysis to assess mitigation potential. *Carbon Management* **1**(1):109-117.
10. Chave, J., Rie´ ra, B. & Dubois, M. 2001. Estimation of biomass in a Neotropical Forest of French Guiana: spatial and temporal variability. *Journal of Tropical Ecology* **17**:79–96.
11. Cooke, T. 1967. The flora of presidency of Bombay, Botanical survey of India, Calcutta.
12. Dale Virginia H. 2011. *The role of disturbance in seasonally dry tropical forest landscapes. In: The Ecology and Conservation of Seasonally Dry Forests in Asia*, Eds: William J McShea, Stuart J. Davis and Naris Bhumpkphan, Smithsonian Institution Scholarly Press, Washington DC, 2011.
13. Dixon, R.K., Solomon, A.M., Brown, S., Houghton, R.A., Trexler, M.C. & Wisniewski, J. 1994. Carbon pools and flux of global forest ecosystems. *Science* **263**:185–190.
14. FAO, 1995. Climate Change, Forest and Forest Management – An overview, Technical report 126.
15. Gerwing, J. J. & D. L. Farias. 2000. Integrating liana abundance and forest stature into an estimate of total aboveground biomass for an eastern Amazonian forest. *Journal of Tropical Ecology* **16**:327–335.
16. Grace, J. 2004. Understanding and managing the global carbon cycle, *Journal of Ecology* **92**:189–202.
17. Hubbell Condit, R.S.P. and R.B. Foster. 1992. Short-term dynamics of a Neotropical forest: change within limits, *Bioscience* **42**:822-828.
18. Indu K. Murthy., Savithri Bhat., Vani Sathyanarayan., Sridhar Patgar., Beerappa M., P R Bhat., D M Bhat., Ranjith Gopalakrishnan., Mathangi Jayaraman., Madhushree Munsi., Ravindranath N H., Khalid M.A., Prashant M., Sudha Iyer & Raghuvansh Saxena. 2014. Implications of Impacts of Climate Change on Forest Product Flows and Dependent Communities in the Western Ghats, India, *The Journal of Forest Science* **30**(2)-189-200.
19. IPCC, 2006. *IPCC guidelines for national greenhouse gas inventories*. In: Eggleston, S., Buendia, L., Miwa, K., Ngara, T., Tanabe, K. (Eds.), Vol. 4: Agriculture, Forestry and Other Land Use. IGES, Japan.
20. Jandl, R., L. Vesterdal, M. Olsson, O. Bens, F. Badeck & J. Rock. 2007. Carbon sequestration and forest management. CAB Reviews *Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* **2**: 01.
21. Keller, M., M. Palace& G. Hurtt. 2001. Biomass estimation in the Tapajós National Forest, Brazil. Examination of sampling and allometric uncertainties. *Forest Ecology and Management* **154**: 371–382.
22. Kirschbaum, M., A. Fischlin, M.G.R. Cannell, R.V.O. Cruz, W. Galinski & W.P. Cramer, 1996. *Climate change impacts on forests, 1996*. In: Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific- Technical Analyses, Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), R.T. Watson, M.C. Zinyowera, R.H. Moss and D.J. Dokken, (eds.), Cambridge University Press, Cambridge, UK, 95-129.
23. Malhi, Y. 2010. The carbon balance of tropical forest regions, 1990-2005. *Current Opinion in Sustainability Science* **24**:237-244.
24. Malhi, Y., Aragão, L.E.O.C., Metcalfe, D.B., Paiva, R., Quesada, C.A., Almeida, S., Anderson, L., Brando, P., Chambers, J.Q., da Costa, A. C. L., Hutyra, LR., Oliveira, P., Patino, S., Pyle, E.H., Robertson, A.L. & Teixeira, L.M. 2009. Comprehensive assessment of carbon productivity, allocation and storage in three Amazonian forests. *Global Change Biology* **15**:1255-1274.
25. Murali, K.S., D.M. Bhat & N.H. Ravindranath. 2005. Biomass estimation equation for tropical deciduous and evergreen forests. *International Journal of Agriculture Resource Governance Ecology* **4**: 81-92.
26. Murthy, I.K., Bhat, P.R., Ravindranath, N.H. & Sukumar R. 2005. Financial valuation of non-timber forest product flows in Uttara Kannada district, Western Ghats, Karnataka. *Current Science* **88**:1573-1579.
27. Myers, N. 1990. The biodiversity challenge: expanded hot spots analysis. *The Environmentalist* **10**: 243-256.
28. Pascal JP and Pelissier R. Structure and floristic composition of a tropical evergreen forest in South-West India. *Journal of Tropical Ecology* **12**:191-214.
29. Pascal, J.P. 1982. *Vegetation maps of South India*. Karnataka Forest Department and French Institute, Pondicherry, India.
30. Pascal, J.P. 1984. *Vegetation maps of South India*. Karnataka Forest Department and French Institute, Pondicherry, India.
31. Pascal, J.P. 1986. *Explanatory booklet on the forest maps of South India*. French Institute, Pondicherry, India.
32. Pomeroy, C., R. Primack & S.N. Rai. 2003. Changes in four rain forest plots of the Western Ghats, India, 1939- 93. *Conservation and Society* **1**:113-135.
33. Proctor, J., J.M. Anderson, S.C.L. Fogden & H.W. Vallack. 1983. Ecological studies in four contrasting low land rain forests in Gunung Mulu National Park.

Sarawak. II. Litterfall. Litter standing crop and preliminary observations on herbivory. *Journal of Ecology* **71**: 261-283.

34. Rai, S.N. & J. Proctor. 1986. Ecological studies on four rain forests in Karnataka, India I. Environment, structure, floristics and biomass. *Journal of Ecology* **74**: 439-454.
35. Rai, S.N. 1983. Basal area and volume increment in tropical rainforests of India. *Indian Forester* **109**: 198-211.
36. Ravindranath, N.H., N.V. Joshi, R. Sukumar & A. Saxena. 2006. Impact of climate change on forest in India. *Current Science* **90**:354–361.
37. Rosenzweig, M.L. 1995. Species Diversity in Space and Time. Cambridge University Press.
38. Sundarapandian, S.M. & P.S. Swamy. 2000. Forest ecosystem structure and composition along an altitudinal gradient in the Western Ghats, South India. *Journal of Tropical Forest Science* **12**: 104-123.
39. Swamy, S.L., C.B.S. Dutt, M.S.R. Murthy, Alka Mishra & S.S. Bargali. 2010. Floristics and dry matter dynamics of tropical wet evergreen forests of Western Ghats, India. *Current Science* **99**:353-364.
40. Wright, S.J. 2005. Tropical forests in a changing environment, *Trends in Ecology & Evolution* **20**:553–560.

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Night Time Pulses of Ground Energy Associated with a Celestial Source; A Comparison of Observations from Locations in Italy and Canada

By John F. Caddy & Robert W. Elner

Abstract- A phenomenon emanating from surface and ground water before dawn was investigated in Italy and Canada. During this phenomenon, rooms adjacent to water sources were filled with pulsed clouds of green particles which were identified as ground energy by persons sensitive to qi phenomena. Individual pulses lasted approximately 30 minutes and were repeated several times nightly. Their relative timing appeared to be part of a 24-hr cycle of sky and ground energies which was consistent between nights, and particularly strong in spring and early summer. We hypothesize that sky energy impacts Earth as radiation from the centre of the Milky Way, and is either converted into ground energy, or displaces ground energy from sub-surface geoflora above the surface of the ground. One strong nightly pulse of tinnitus was provisionally identified with a cosmic source, due to its occurrence 4 minutes earlier on successive nights.

GJSFR-H Classification : FOR Code: 050299

NIGHTTIMEPULSESOFGROUNDENERGYASSOCIATEDWITHACELESTIALSOURCEACOMPARISONOFOBSERVATIONSFROMLOCATIONSINITALYANDCANADA

Strictly as per the compliance and regulations of :

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John F. Caddy [α] & Robert W. Elner [σ]

Abstract- A phenomenon emanating from surface and ground water before dawn was investigated in Italy and Canada. During this phenomenon, rooms adjacent to water sources were filled with pulsed clouds of green particles which were identified as ground energy by persons sensitive to qi phenomena. Individual pulses lasted approximately 30 minutes and were repeated several times nightly. Their relative timing appeared to be part of a 24-hr cycle of sky and ground energies which was consistent between nights, and particularly strong in spring and early summer. We hypothesize that sky energy impacts Earth as radiation from the centre of the Milky Way, and is either converted into ground energy, or displaces ground energy from sub-surface geoflora above the surface of the ground. One strong nightly pulse of tinnitus was provisionally identified with a cosmic source, due to its occurrence 4 minutes earlier on successive nights.

I. Introduction

Many powerful taboos circumscribe where scientists can legitimately direct their attention. The difficulty of publishing on new issues with subjective elements is why progress in 'paranormal' studies has been slow. Although the following study does not meet the criteria of 'objective science', we propose hypotheses to describe real phenomena. We believe that in the past these phenomena were important for practical and religious reasons, and formed a component of traditional knowledge over millenia, that should not be ignored by Science. Because of their cultural significance, we encourage further testing by those capable of doing so.

Carl Woese (Anon 2013a) summarized our point of view as follows: "In my opinion, there exists a prima facie case that many of the phenomena associated with that special energy the Chinese call Qi are real. They are deeply interesting and, therefore, they invite, indeed require, investigation by Western science". We concur with this, and are convinced that some traditional beliefs of 'primitive' peoples reflect realities that only those sensitive to qi phenomena can experience. Excluding reports on such investigations, even when the role of working hypotheses is emphasized, is not in the long term interest of Science. Our study suggests that there is a direct influence of the Black Hole at the centre of our galaxy, the Milky Way, on us and our world. This intensive source of various kinds of radiation has been confirmed by Astronomers, but reports on human sensitivity to cosmic qi, prana or orgone (commonly-used names for this phenomenon) with minimal equipment, are given here. We describe first (and most importantly) a phenomenon that both authors encountered, namely, upsurges of ground energy in two different parts of the world, and investigated the timing of these upsurges. We suggest a novel mechanism that concurs with some astronomical observations, and with several traditional views of cosmic energy.

a) *The Events*

Both authors have particular sensibilities. The first author developed these by 15 years of attention to acquiring non-ordinary perceptions of qi or prana phenomena (see Caddy 2006). The second author's sensibilities are particularly acute after expeditions into the Amazon rainforest over the last 20 years. Some of his early experiences correspond to traditional beliefs of indigenous peoples, and could assist in interpreting the phenomena shared by both authors in this essay.

The main phenomenon encountered in April 2012 on different continents occurred just before dawn in each respective time zone. Both of their bedrooms were filled with a cloud of green particles emerging from the floor or a green mist coating the furniture, identified in both cases, as manifestations of ground energy. These incursions each lasted about half an hour before slowly subsiding. The first author confirmed that this was not a mental aberration by placing his Egely wheel (Egely 1994) on a table where it registered a low-moderate level of qi energy at the time of the inflows.

The first author described how on occasions in April 2012, specific imagery was seen among the turbulent flow of particles emerging from the tiled floor. This suggested a biological and/or mineral connection, as illustrated later in Fig 9. This was accompanied by a

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prickling sensation on the face, and a rise in the tinnitus pitch when encountering high levels of qi. The observations of the second author at a similar local time mirrored those of the first, although, as noted, the green cloud was seen as a green mist covering surfaces in the bedroom.

The first author's bedroom is on the ground floor of a house south of Rome, Italy, in a narrow valley outside Ardea in Latina. It sits near the bottom of a steep decline ending in a shallow stream, before the land rises steeply to another hill (Fig 1). The local water table is 30-40 meters below the house. The second Italian location is approximately 100 km distant, outside Tolfa, again in a ground floor bedroom on a hillside, 500m above sea level. Here there is a slow slumping of material due to downhill water runoff in the winter months. The second author's bedroom is on the first floor of a house in Vancouver, British Columbia, Canada, with a large pond system in the garden. Interestingly, the observations and their timing relative to the local 24hr cycle were consistent between locations, suggesting a phenomenon of global occurrence below the earth's surface.

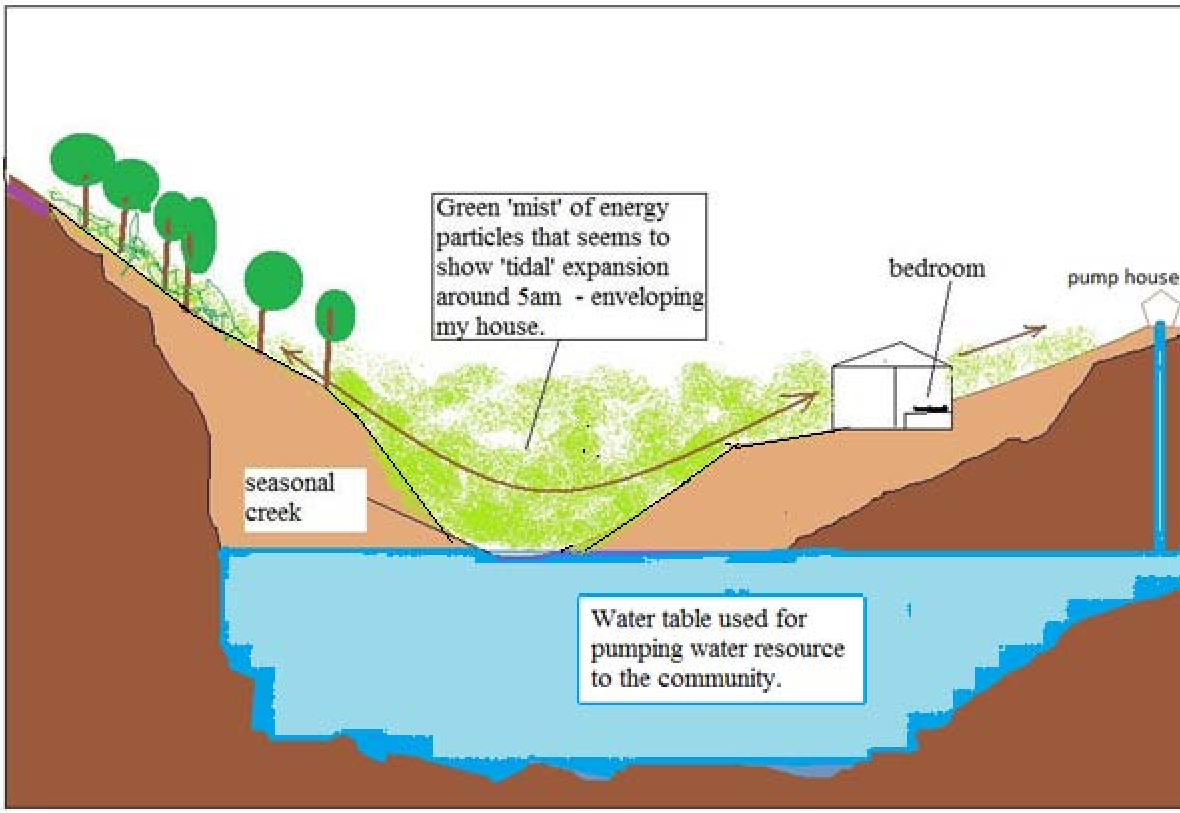

Fig 1 : Position of the first author's house near Ardea, Italy, and an impression of the stratigraphy underlying the April 2012 observations of 'green clouds'

II. Methods

The first author learned a technique of dowsing vital energy from a master dowser, Mauro Aresu, (Aresu 1995) in Sardinia, and found this useful for estimating the qi energy of a variety of phenomena (described in Caddy 2011). The dowsing fork is rotated between the hands after asking the subconscious to provide a score for the phenomenon in question. The number of rotations achieved before the wand is blocked by the subconscious, represents the intensity of the phenomenon investigated. While standing in the same position in the open, the questions asked were: 'What intensity of sky energy is falling here? – and after this reading was taken, asking: 'What intensity of ground energy is emerging here?' While doing so, he was aware of a faint vertical striation of the air which is described on p. 174 of 'A Return to Subjectivity': "As night fell, swirling banks of energy rose from the forest floor and dispersed at 2-3 metres off the ground, fed by upward spurts of sparks from the damp mossy soil".

a) *A time series of readings of chi energy*

Readings were taken at different times in a 24-hr cycle over the period 11-29 April 2012 outside the first author's house in Ardea. The readings taken at different times of day on different days were assembled later on a 24-hr time scale, since it would have been physiologically stressful to record data every hour over a single 24-hr cycle. The resulting data points are given in thousands of Bovis Units (BU), the standard dowsing scale (Bovis scale 2013), where 7-8 rotations (7-8000

BU's) of the wand imply a normal (unemotional) level of energy, while readings above or below 7-8000 BU's imply, respectively, an exciting or depressing impact.

Figures 2 + 3 show that average-high ground energy scores are associated with low sky energy during the hours of darkness, while scores of sky energy peak rapidly at dawn and decline slowly through the afternoon and early evening (dusk), with a smaller peak in the afternoon. Although the trend line did not vary radically from 7,000-8,000 Bovis Units, low scores of sky energy were recorded at night, and very low scores in predawn hours. The 04.30-05.00 am pre-dawn peak of ground energy coincided with one of the 'events' described earlier, the emergence of ground energy from the floor of the author's bedroom. At dawn the sky energy level shot rapidly upwards as ground energy levels collapsed. (It is worth noting that the high sky energy readings at dawn confirm that it is not 'light' being measured; this peaks at mid-day.) An auditory 'champagne bubble' effect was typical of high sky energies, while the very high level of ground energy observed (40 BU) was registered by a less pleasant lower tinnitus sound.

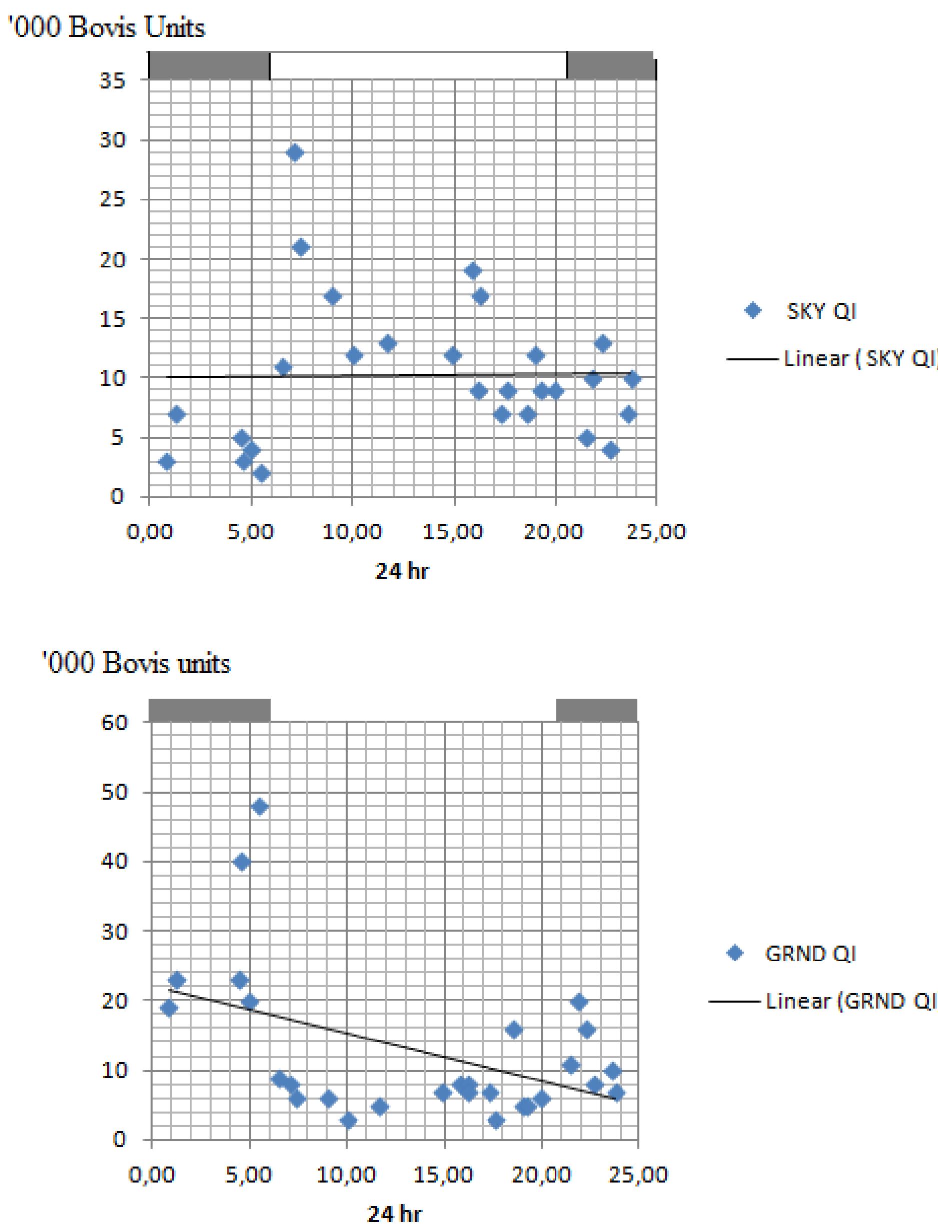

Fig 2.: A) and B) Scores of ground (above) and sky energy (below) – in thousands of Bovis Units outside the house in Ardea, Latina of the first author in April 2012 (darkness hours shaded)

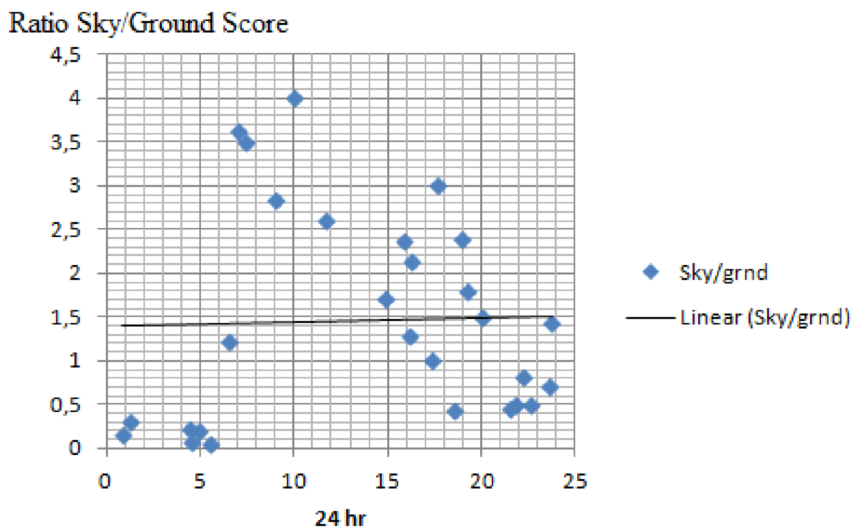

Fig 3 : Ratio of scores of sky/ground energy readings over a 24-hour cycle at Ardea during April 2012

b) Timing the arrival of energy pulses

Other events might lead to pulses of ground energy. Subsurface soil bacteria and the root systems of plants are sensitive to ground vibrations, such as those caused by a series of earthquakes described near Modena, Italy in April-May (CSEM/EMSC 2013). Such seismic events might have been responsible for initiating the pulses of ground energy experienced. The data available are first discussed in light of this hypothesis.

The arrival of a ground energy pulse while the first author was sleeping, was detected by a strong tinnitus ringing in his ears that awakened him. He then became visually aware of a ground energy outflow from below the floor of the dimly lit bedroom and noted down the time. Several pulses lasting 20 min to half an hour before weakening slowly, were detected nightly. Although no specific note was made of the duration of each pulse, these seemed stronger and more frequent in April-May when vegetative growth was underway, than in June-July when high temperatures and an absence of rainfall prevailed, and weakest in hot, dry August. The number of pulses detected during the post-midnight hours (after he went to bed) varied from 1 to 5 (Fig 4), but there may have been pulses before midnight and after 7 am that were not investigated. The earlier pulses recorded are judged less reliable, since they depend on the variable time the author remained awake. Other evidence obtained by dowsing (Fig 2), suggests that ground energy mainly rises above ground in the hours of darkness.

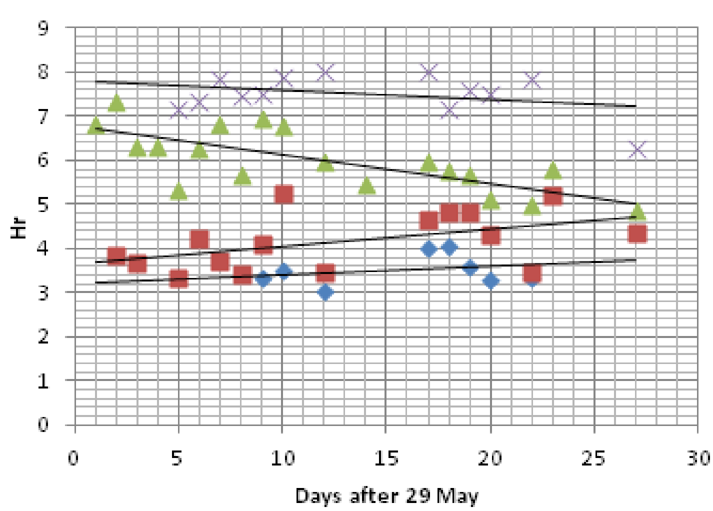

Fig 4. : Times of occurrence of tinnitus episodes (hours after midnight) in the bedroom of the first author in Ardea, Italy May-June 2012. The four regression lines suggest that the causative agent is closely scheduled, and repeats nightly at approximately the same times. However, the slopes of the upper two linear regressions average close to -0.04, a criterion suggesting a causative connection with some cosmic phenomenon

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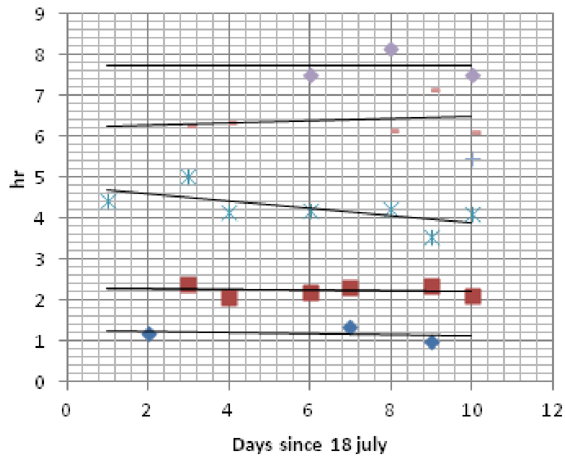

Fig 5. : Times of occurrence of personal tinnitus episodes in the bedroom of the first author in Tolfa, Italy, over the 10 day period from 18 July. From the bottom up, the lines represent distinct episodes occurring at close to constant times throughout the night from midnight (0 hr) onwards. (The third line from the top, as for the upper 2 lines in Fig 4, is a 'cosmic' series with a slope of -5.25 min/day, not far from the criterion of -0.04 mentioned in the caption of Fig 4)

One hypothesis is that the sequence of successive observations during the night shown by each regression line in Figs 4-5, represents a separate 'event', scheduled separately in time. The timing of each series is largely constant on successive nights, making data from individual pulses readily identifiable. As noted, the first hypothesis considered was that the pulses reflect underground movements of tectonic plates in Northern Italy where extensive earthquakes occurred in April 2012. The phased timing might reflect the travel times of signals from distant quakes through different ground strata. However, examining the timing of quakes in the official record showed no dominant hour of occurrence. Also, there was no obvious correlation between the hours when quakes were experienced near Emilia (effectively these occurred throughout 24 hrs), and the time of occurrence of ground energy pulses, even allowing for travel time from Emilia (Fig 6).

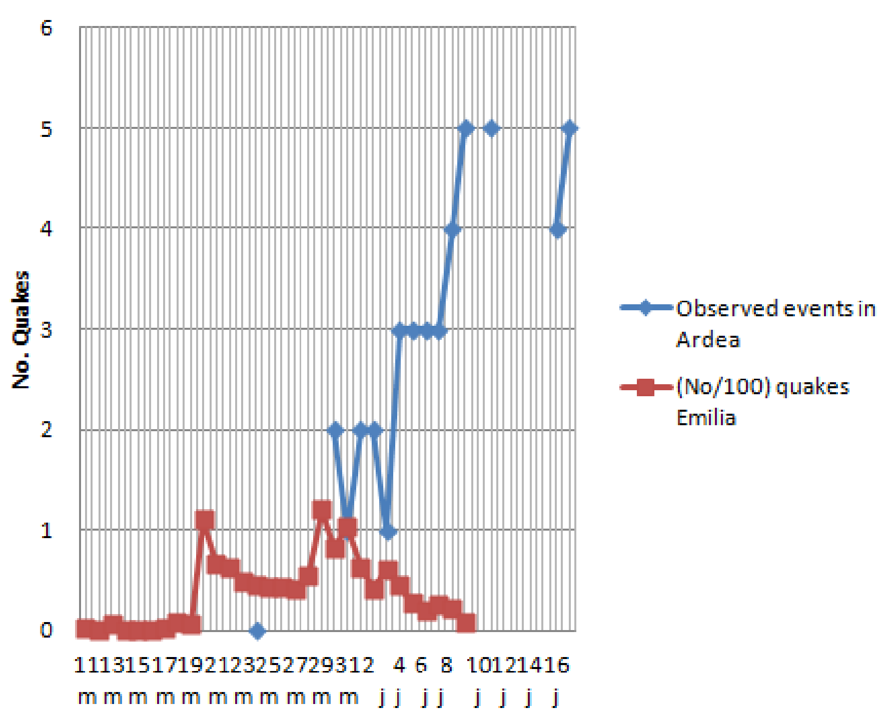

Fig 6. : Number and dates of quakes registered in Northern Italy (CSEM/EMSC 2013) and numbers of personal observations per night of ground energy pulses in Ardea, Italy

A graph of the number of quakes registered by experts in Emilia (up to 100+/day-) suggested that my observations were not caused by tectonic movements. Although a sensitivity to earth movements in ground energy production is not excluded, the quakes (mostly less than 4 on the Richter scale) are unlikely to be detectable given the hundreds of kilometers of our observation point from Emilia. Shown below, is an estimate of possible travel times between Emilia and Ardea, using statistics for velocity of seismic waves given in Wikepedia. These suggest rejecting this hypothesis.

Table 1 : Published velocities of seismic waves (from Wikipedia), and their presumed travel time between Emilia and Ardea

Documented speeds m/sec	Km/hr	Elapsed time (hr)
2	7,2	53,9
8	28,8	13,5

The distance of the main quake center in N. Italy from Ardea is approximately 390 km. At a travel speed of 2-8 m/sec, (quoted from Wikepedia for underground shock waves), this would make the total travel time of the order of 13-54 hrs – i.e., up to 2 days. The peak in number of shocks identified by Italian authorities (a maximum of 120 shocks occurred on the 29 May), occurred approximately 2 weeks before the peak number of ground energy pulses were registered as tinnitus episodes in Ardea, rather than just 1-2 days. This estimated travel time seems too slow for these seismic events to be the source. (In fact, the repetition of night time tinnitus episodes in 2014 in the absence of strong seismic events confirms the validity of this rejection).

It seems important to establish why individual sequences of pulses arrived at more or less the same time on successive days (Fig 7). Why the time of arrival of 'secondary pulses' increased at a seemingly constant rate for some sequences of observations, and decreased for the main pulse of energy we began to call 'cosmic', remains in part a mystery.

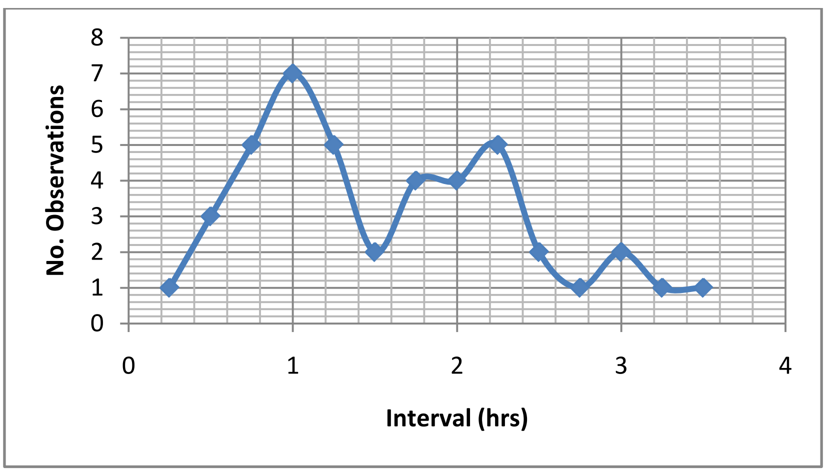

Fig 7. : Histogram of time intervals between sequential series of energy pulses

c) A cosmic or a terrestrial source?

The upper series of observations shown in Figs 4 and 5 were the most powerful pulses, and were continuously delayed over time. Their slopes were equivalent to a critical event occurring approximately 4 minutes earlier/day (Fig. 4) at Ardea, and fairly close to this in Fig 5 for observations at Tolfa, Latina. The other lines showed either a slight progressive delay in timing, or a constant timing of onset of the tinnitus episodes.

Relevant here is recent evidence supporting the view that there is a biomass of bacteria below the earth's surface down to 2 km that is at least equal to the biomass of plants and animals on the Earth's surface (Anon 2013b). Fierer et al. (2009) contend that: '50% of animal biomass is also found below ground'. The three locations where observations were made have ground or surface water present, supporting an abundance of microfauna and flora and the roots of macroflora. One reasonable assumption could be that subterranean bacteria use qi for distant messages, since relying on chemical messengers alone may not be ineffective if bacteria are dispersed through a rocky medium. A quote from Anon (2011) is that: "There is a greater concentration of prana just above the ground than in the air. The density of prana just above the ground is about four or five times greater than the prana contained in the air". Heavy ground energy, which is what we provisionally identify the signals to consist of, is presumed to be associated with living organisms, possibly living below ground (e.g., Fierer et al. 2009). One hypothesis we considered was that the sudden compression caused by earthquakes would affect organisms such as geobacteria, plant roots or microfauna adversely, suggesting that they may have been induced to send out a pulse of qi. On the other hand, the hypothesis of a transmission of qi energy over hundreds of kilometers from Emilia from mainly weak earthquakes, picked up locally by below-ground organisms which in turn exude qi energy, seems improbable. This led us to discount seismic phenomena as the cause for individual qi pulses. Further evidence that seismic events were not immediately responsible for the pulses was the fact that they persisted months and years after seismic activity in Emilia had effectively concluded.

d) An astronomical coincidence?

Qi energy has been observed by 'sensitives' to be associated with both life forms and certain mineral strata. On this occasion the observation of qi emerging from the Earth's surface suggested that if an astronomical effect is occurring, the observed phenomenon must be secondary to a primary source of radiation. This is hypothesized to be sky energy falling on the dark side of the planet from the galactic centre (Fig 8).

Referring to ground energy, a phenomenon registered by 2 independent observers at different global locations, at roughly the same local time of day, invokes the possibility of a diurnal or astronomical causality. A biological consequence of an astronomical phenomenon was hypothesized as a possible causal function for the timing of the 'cosmic' energy pulse.

e) Galactic radiation

Cosmic rays and gamma radiation from the galactic centre are understood as a potential threat to life on Earth but we are protected by the magnetosphere. The centre of the Milky Way is the key source of this high-energy radiation. What other radiation may accompany this electromagnetic and particle bombardment is a more open question. Considering that some of the billions of planets in the galaxy must contain life forms, it is not improbable that a radiation of subtle sky energy or prana is also arriving on our planet. That this comes from space is an ancient Tibetan and Incan belief, and the Mayan civilization considered the Milky Way as a centre for the life force. Considering the Milky Way as a possible source of this radiation, we learned of a discovery by Spottiswoode (1997) that cosmic sources of radiation affect human Extra-Sensory Perception (ESP). Together with the similar cosmic timing of a source of global radio interference discovered earlier, this effect is repeated every 23 hours and 56 minutes, and the time scale is now referred to as LST (Local Sidereal Time): the time kept by celestial bodies. The LST cycle was used to explain Spottiswoode's analysis of when Extra-Sensory Perception (ESP) practitioners are "more" or "less" accurate in their ESP ability. Peak ESP efficiency occurred when the centre of the Milky Way was on the horizon, rather than directly overhead. This suggests that a form of radiation interfering with paranormal mental processes originates at the Galactic centre, hence is strongest when the centre of the galaxy is overhead. It is our hypothesis that sky energy from the galaxy induces the pulses of ground energy we have been sensing. The time of emergence of ground energy on our nighttime surface of the planet peaked before dawn on April 11-25th 2012, and we assumed that a peak in sky qi energy from the Milky Way impinging on the nighttime side of the planet was responsible.

In consequence, we hypothesize that light sky energy impacting the Earth has either been converted to heavy qi energy below the earth's surface, or has displaced below-ground heavy energy to above the planetary surface. According to this hypothesis, a night-time 'tail' of heavy energy is extruded on the night side of the planet either as a consequence of radiation from the Milky Way or other cosmic sources (Fig 8).

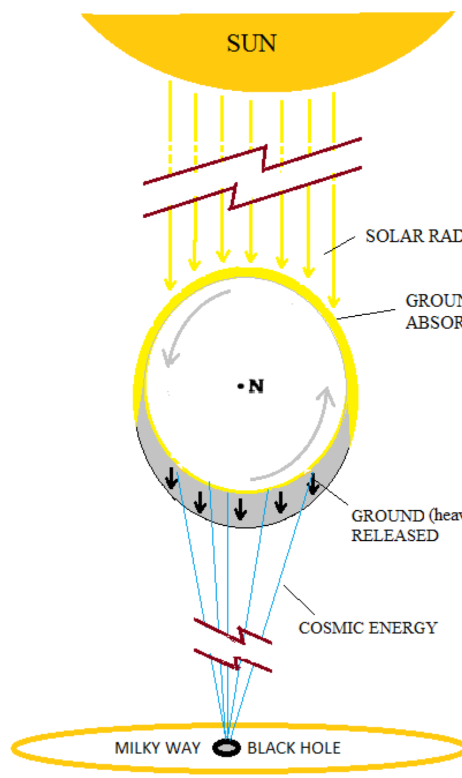

Fig 8. : A polar view of the Earth, hypothesizing successive sky and ground energy domination at any point on the planetary surface caused by an external radiant source of sky energy; the centre of the Milky Way. This is postulated to impact the rotating planet, and make dynamic changes to the distribution of sky and ground energy. (Zig-zag lines indicate solar and galactic distances)

f) Some tentative conclusions

'Real life' experiences leading up to this text demanded answers and explanations which were not found in the scientific literature. However incomplete the

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data sources, we used them together with original hypotheses in arriving at a tentative explanation for our nighttime 'green energy' experiences. These we concluded result from the incidence of sky energy originating from the centre of the Milky Way: though what form this energy comes in is left unresolved. On one occasion, in April, a vision of the clouds of qi energy emerging from the ground was mixed with what appeared to be images of crystals, small arthropods, and tufted mosses (see first illustration in Fig. 9), and there were even olfactory hallucinations experienced by the second author at the time of energy emergence. On other occasions, the energy emerged from the tiled floor in columns, consisting of what seemed to be 'bubbles' of particles (2nd of Fig. 9). On the night of April 13, a particularly powerful energy inflow continued longer than previously, and the last image in Fig. 9 was recorded. The previous three days had been humid, and the impression at the time was that the vegetation in the garden was experiencing a rapid growth spurt.

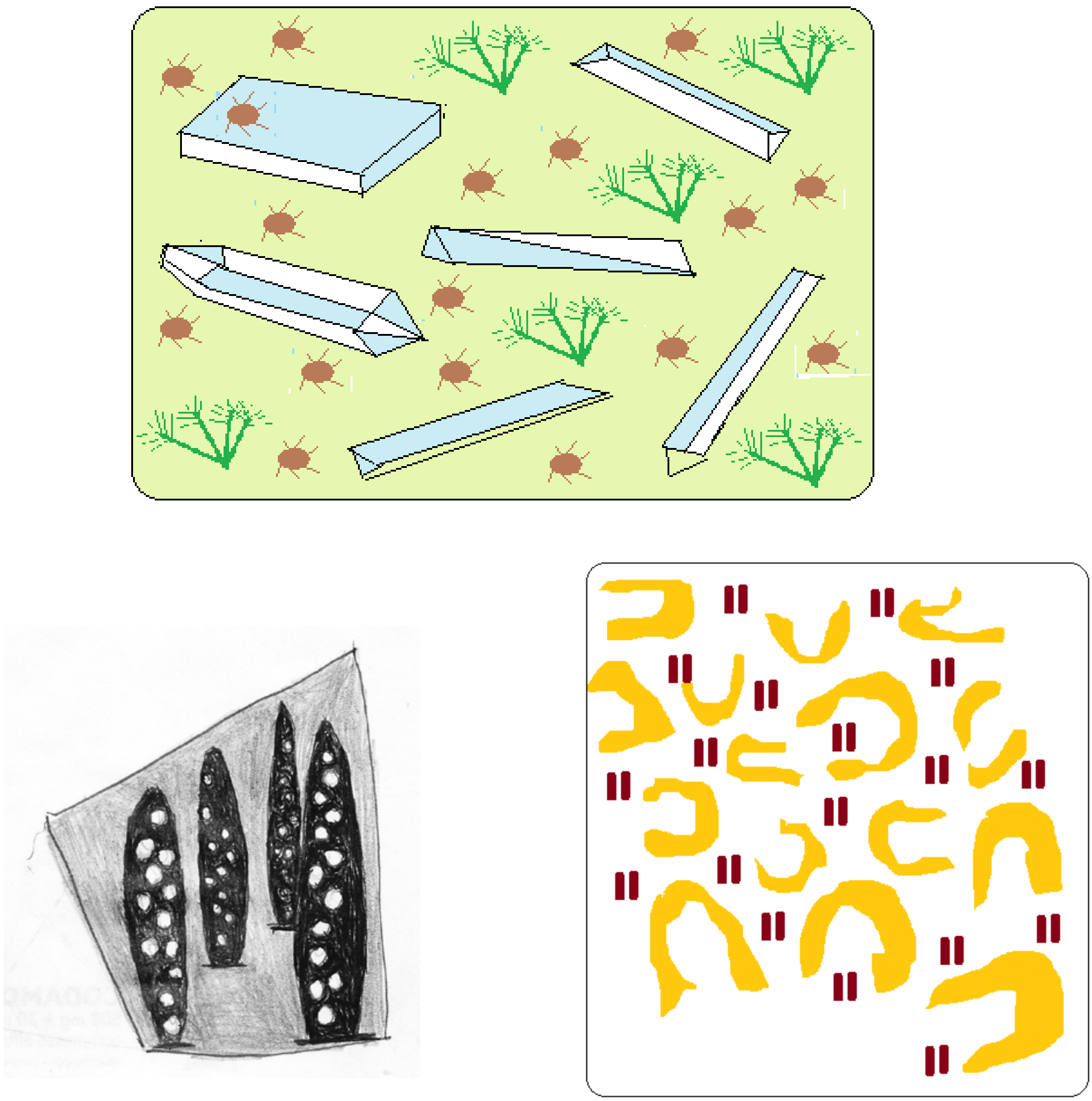

Fig. 9. : Three personalized images sketched by the senior author, as experienced during the 'green cloud' phenomenon described in the text

III. Discussion

Some ancient belief systems appear relevant to an interpretation of our findings. According to ancient Chinese beliefs, qi is the energy or natural force that fills the Universe, and occurs in three forms and places; heaven, earth and humans. This opinion, especially when expressed by wise persons in the pre-scientific era was undoubtedly influenced by their greater capacity to sense vital energy, uninhibited by the materialism that now underlies western 'objective' observations. Hence, the method and the phenomena detected, as described in this paper, are believed to recreate procedures used by our ancestors much earlier in time. They raise important questions about physical and spiritual reality which appear to be supported by traditional beliefs, and opinions of modern persons with psi sensibilities. These range from the 'sky qi' of ancient Chinese, Incan and Indian sages, to the dark energy and dark matter of current astronomical theory, with at least the possibility that the ancient and modern conceptions refer to the same thing. In fact, an analogy was proposed by Das (2013) between the 'primordial' energy (e.g. Prana, chi or qi) visualized by many ancient cultures, and the 'dark energy' considered the solution to the 'missing mass' problem of the Universe, which according to astronomers, accounts for more than 90% of the mass present.

In relation to our observations, we outline here some ancient beliefs on the two categories of pranic energy we mention, for example, that 'light' or sky energy emanates from the sky and is considered spiritually uplifting. Ground energy is sky energy which has been modified by contact with biological or emotional phenomena. It is associated with the earth's surface and subsurface, and the plants and animals encountered there, and in some traditions is also a product of strong emotions. For our species, qi energy is encountered where subsurface strata are interrupted (e.g. from wells), at ceremonial locations, or in human habitations, ancient and modern. Implicit in all this, and factual in our opinion, is the associated sensation that there is an 'aura' of vital energy lying around and under the earth's surface that some associate with the Earth Goddess Gaia.

Numerous ideas based on traditional beliefs in earlier societies support the suppositions presented here. In the Incan tradition, light energy (or 'sumi') is a refined form of qi that rains down from outer space…heavy energy (or Incan 'huchi') is 'sticky', and held close to the ground by a force analogous to gravity. This suggests an analogy between 'heavy' or ground qi, which is associated with physical objects or persons, while light or sky qi is presumed to be of galactic origin. After contact with the earth's surface, light energy may be converted to heavy or ground energy: a phenomenon known to Tibetan and Incan sages. (See Chakana 2011 for a discussion of the energy traditions of mountainous regions). 'Heavy energy' is accumulated on and below the surface of the earth, and also stores emotional events and conceptual structures which become embedded in the qi field of Gaia. The identity and interchangeability of the two forms of qi is asserted by Incan shamans, who suggested that touching 'magic stones' (meteorites) discharges the heavy pranic energy from the human body accumulated through stressful experiences. We are convinced that traditional beliefs also reflect the reality that only those sensitive to qi such as Qi Gong practitioners (e.g. Yan Xin 1999), can consciously experience subtle energy phenomena.

The dichotomy of after-life destinations some religious mythologies including modern religions, have postulated, seems at first sight to reflect beliefs as to the structure of the energy sheath of our planet. We now know this is dominated by a diurnal dynamism of sky and ground qi. Did our ancestors view literally this spiritual analogy with the physical world? We suspect they did. For example, ground energy is generally high above open wells, which may explain why the ancients considered them sacred. More observations need to be made on this aspect of vital energy in light of the importance now shown to the Gaian hypothesis (Lovelock 1979). As noted in Anon (2011): "When I have encountered earth prana, in a ravine or large excavation where the land has been broken and opened up severing an earth nadi….this form of prana feeds plants, trees and the soil". This may explain the images shown in Fig 9. The nightly extrusion of heavy qi energy from the earth's surface has almost certainly affected how our species, and other species with diurnal activity cycles, organize their lives. As noted, heavy energy outflow from the earth appears very pronounced in spring, and could be tied to the growth spurt then shown by vegetation. More observations on the factor leading to this outflow need to be made in light of the importance now shown to the Gaian hypothesis (Lovelock 1979), and the possibility that this outflow is induced or enhanced, by radiation from the centre of the Milky Way.

Further developments on the theme of ground energy incursions above ground level are that it suggests why spirits are mostly encountered at night – they are heavy energy phenomena! In this connection, a relevant example follows from the second author's personal experiences in Amazonia. While camping in a remote area of primary rain forest next to a tributary of the Amazon, there was a violent windstorm during the night. Swaying in his hammock, the second author became acutely aware that there were long-limbed spirit-beings moving past him through the forest. After a few minutes of experiencing these spirits the wind storm abruptly stopped. In the profound sudden silence, the second author received an oral message from an entity, repeated twice. Next morning, when he related these experiences, his native guide was completely unsurprised, and indicated that this phenomenon is commonplace. He explained that these were the spirits that resided in the mud of the river bottom and routinely came out to wander the forest at night. Here, the traditional belief that 'spirits' emerge from the rich microbial ecosystems below tropical rivers at night, seems compatible both with the behavior of ground energy, phantoms, and ancient beliefs in our below-ground residence following life on earth. Such beliefs in societies sensitive to qi energy, were that after death of the physical body, the energy body risks being captured by the nexus of vital ground energy emerging at night from low-lying humid areas. To what extent such an entity with an energy body clothed in microbial qi may retain a human mental configuration or awareness, is not clear. Recent studies (e.g., Radford 2002) on colonial bacteria suggest that they are capable of cooperative and symbiotic actions such as this would require.

We have made deductions based on a new hypothesis and information now available, in an attempt to explain the peak in ground energy, and the trough in sky qi values that occurs prior to dawn. A partial confirmation of this pre-dawn phenomenon is found in 'Energy Healing –Wikipedia' (Wikipedia 2013): "You can consciously absorb prana or ki from the air and the ground. It has been clairvoyantly observed that there is more prana during daytime than at night. Prana reaches a very low level at about three or four in the morning". (Prana is identified here with light 'sky energy'). It seems that this energy, once incorporated into the Gaian aura, plays a vital role in the growth spurt of vegetation in spring, and perhaps provides a 'template' of information to encourage correct implementation of growth forms. We are convinced that the images drawn from memory in Fig. 9 are also recorded in Gaia, and serve as reminders to earth biota of the structures and functions of their predecessors. (This idea is similar to the Morphic Resonance theory of Rupert Sheldrake 1988).

Given the originality of our hypotheses, we leave it to readers to explore further if the mechanisms proposed are feasible, and ask those with the appropriate sensibilities to repeat these observations.

References Références Referencias

1. ANON; Universal Life Force Energy - Chi/Prana /Ki(arizonaenergy.org/Ki/ Universal% 20Life %20Force%20Energy%20-%20Chi%20%20Prana% 20%20Ki%20etc..htm.); 2013a.
2. ANON; Help stop soil erosion. (urbanext.illinois.edu/soil/sb_mesg/sb_mesg.htm); 2013b.
3. ANON; Utilizing Ground Prana In Healing. (www.youtube.com/*watchv=Wh0yXsgQOAQ29/* ago/2011).
4. ARESU, Mauro; Uomoterra: testimonianza di energia ritrovata; Ago e Filo, Palau, Sardinia; 1995.
5. BASSLER, B.; (quoted in: Bacteria make sense'; a Flatrock publication. Source: corante.com). 2 March 2004.
6. BOVIS SCALE. (http://www.psiram.com/en/index.php/Bovis_scale); 2013.
7. CADDY, John; A Return to Subjectivity; Trafford Press, Victoria, BC; 2006.
8. CADDY, John; Hidden by the Words; Authorhouse Publishers; 2011.
9. CHAKANA (www.chakana-creations.com); 2011.
10. CSEM/EMSC; European-Mediterranean Seismological Centre (www.emsc-csem.org/#2); 2013.
11. DAS, Tapan; Dark Energy and Primordial Energy - The Mindshift Institute (www.mindshiftinstitute.org/articles/darkenergy.htm); 2012.
12. EGELY, George; The Egely Wheel; (www.egely.hu); 1994.
13. FIERER et al.; Global patterns in below ground communities; Ecology Letters; Volume 12; 1-12, 2009.
14. HOLLOWAY, M.; Talking bacteria; Scientific American; 2004.
15. LOVELOCK , J.E.; Gaia: a new look at life on Earth; Oxford University Press; 1979.
16. MADIS SENNER; The Circulation of Prana (chi). How Mother Earth's Subtle Body Works. (www.jubileeinitiative.org/pranaflow.html); 2013.
17. WIKIPEDIA (en.wikipedia.org/wiki/Milky_Way); 2013.
18. RADFORD, T.; Bacteria 'send message' to ailing colonies. The Guardian, (www.anapsid.org/cnd/drugs/abxresistance.html); 04/29/2002.
19. SHELDRAKE, R.A.; The Presence of the Past: Morphic resonance and the habits of nature. New York, NY: Times Books; 1988.
20. SPOTTISWOODE, J.; Journal of Scientific Exploration, Volume II, No.2; 1997.
21. YAN XIN; On Scientific Qigong Research. (http://homepages.ihug.co.nz /~sai/DrYan_qi.htm); 1999.

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Well Screens and Gravel Packs

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Abstract- The purpose of well screens and gravel packs is to maintain open access within the aquifer ensuring that thorough development of the well is not impeded by sand. Where a well draws on unconsolidated sands and gravels, or other friable materials. The production section is characterized by mainly medium to coarse grained sandstone, the uniformity coefficient efficient ranging from 1.44 to 2.14, and the installation of a screen and pack is essential.

The use of correctly designed equipment is important and this paper represents a review of the diverse types available, but does not set out to make any recommendations.

These type of screen, commonly known as wire–wrap is usually manufactured from type 304 stainless steel, galvanized steel and coated screens have been introduced seeking to inhibit corrosion resistant alloy. The surface area of opening of this type of screen used with aperture sized 0.75 mm necessary to control fine sands from thick aquifer. The screen entrance velocity it was calculated 0.030 m/s.

Keywords: *well screen, slot size, grain size, disi aquifer, water level, pumping test, well specific efficiency.*

GJSFR-H Classification : *FOR Code: 099999*

WELLSCREENSANDGRAVELPACKS

Strictly as per the compliance and regulations of :

Well Screens and Gravel Packs

Mehaysen A. Mahasneh

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The gravel pack should ensure that the completed well operates free of sand; thus the particle size of the pack depends upon the particle size of the aquifer. Gravel pack design should be guided by standard sieve analysis. The initial static water level was established and recorded at126.98 m.

Keywords: well screen, slot size, grain size, disi aquifer, water level, pumping test, well specific efficiency.

I. Introduction

The purpose of a well screen and gravel pack is to maintain open access within the aquifer whilst ensuring that a well operates free of sand after development work has been completed. A screen and gravel pack are an absolute necessity if the well draws on unconsolidated sands and gravels–even under composed rock becomes friable and may gradually cave in. The screen and gravel pack should first prevent the collapse of the well due to the abstraction of large quantities of sand and secondly, damage to the pumps due to sand particles in the water (1).

The gravel pack surrounding the well screen may be provided in two ways (E.E.Johnson, 1955) (2). A naturally developed filter pack is produced by removing the fine sand and silt from the aquifer material, bringing these fines through the well screen openings by surging and bailing.

For the naturally developed filter pack, the choosing of the correct size of screen openings permits development of the pack from the aquifer material at some distance outside the face of the screen (E.E.Johnson,1959)(3).

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II. Basic Requirements of Well Screen

The general basic requirements are that a well screen should:

1. Prevent movement of sand into the well.
2. Have effective non clogging opening.
3. Have maximum possible open area.
4. Have uniform distribution of inlet openings.
5. Combine adequate strength to prevent collapse.
6. Have minimum resistance to flow in well.
7. Have low inlet resistance.
8. Be resistant to corrosion.
9. Be resistant to encrustation.
10. Be economic.

The well screen should not retain the entire aquifer of gravel pack contents, should be designed to allow the fine and medium particles to wash out into the well during development.

III. Well Screen Design (Design Criteria For Screened Wells)

Screened wells typically are classified as either natural–packed or artificially–packed wells. In the natural–pack type, a screen–slot size is selected which will allow a definite proportion of the finer part of the aquifer adjacent to the screen to pass into the well for removal during development. The remaining envelope of coarser aquifer material around the screen serves as a retainer for surrounding fine–grained deposits. In the artificial–pack type, an envelope of materials having a coarser uniform grain size than the aquifer is mechanically placed around the screen to serve as a filter for the finer formation particles.

Illinois state water survey design criteria for either type as described by Smith (1954) 4 and Walton (1962) 5, are based on the effective size, uniformity coefficient, and other grain-size distribution considerations determined from a mechanical analysis of the aquifer material.

A natural–pack well normally can be justified if the effective grain size of the aquifer is greater than o.o1 inch and the uniformity coefficient is above 3.an artificial pack usually proves to be desirable if either the effective size or uniformity coefficient is much below these values.

For well design it is necessary to consider the following points:

1. Minimum entrance velocity,
2. Maximum open area of screen,

3. Correct design of slot to minimize blockage,
4. Selection of screen slot to fit aquifer or gravel pack material,
5. Periodic maintenance,
6. Selection of screen material for corrosion resistance,

a) Open Area of Well Screen

The entrance velocity Va of the water into the well screen is used to determine the open area of screen Ar:

$$Va=Q/Ar$$

Where

Q=yield (ft^3/sec)

Va=entrance velocity (ft/sec)

A_r= Open area (ft^2)

The entrance velocity should be kept to a minimum, and in general a velocity of o.1 ft/sec with negligible friction loss and least encrustation corrosion.

It is suggested that an open screen area more percent gives little increase in efficiency; however the performance decrease considerably when open area <15 percent (Stramel 1965) 6. It is relev to note that the higher the percentage of open area available, the more area there is to be blocked and the head loss becomes significant, and therefore additional open area should result in an increase efficiency over a longer period of time.

b) Determination of Slot size

Determination of screen slot size depends on critical particle size of aquifer or gravel pack be retained. A standard sieve analysis of the aquifer material or gravel pack material determines this slots.

A considerable range of percentage of gravel pack to be retained by the screen is suggested in both the theoretical and technical literature (Johnson technical bulletins) 7. The usual rule is that at least 90 percent of the gravel pack should be retained where the pack and aquifer is uniform; however, values as low as 40 percent have been suggested if there is bad uniformity 7.

The screen selection criteria used by the water survey are based upon optimum screen–entrance velocities considering aquifer permeability and screen area effectively open to the water–bearing material. For natural–packed wells, the proper screen length and/or optimum discharge rate are determined from the equation:

$$L_S=Q/7.48\ A_e\ V_c$$

Where: Ls=length of screen, in ft ;

Q= optimum discharge, in gpm;

Ae=effective open area per foot of screen, in sq ft;

Vc=optimum entrance velocity, in fpm.

The effective screen open area (Ae) used is one-half the actual area provided during fabrication. The remaining open area is assumed to be blocked by the aquifer material. using an appropriate aquifer coefficient of permeability, an optimum entrance velocity (Vc) value is selected from table 1.

Table 1 : optimum screen entrance velocities

Coefficients of permeability (gpd /sqft)	optimum screen entrance velocities (fpm)
>6000	12
6000	11
5000	10
4000	9
3000	8
2500	7
2000	6
1500	5
1000	4
500	3
<500	2

Vc values included were determined from studies of actual case histories of well failures due to the partial clogging of well walls and screens by over pumping.

Illinois State Water survey design criteria for either type as described by Smith (1954) and Walton (1962) are based on the effective size, uniformity coefficient, and other grain-size distribution considerations determined from a mechanical analysis of the aquifer material. The sieve size that retains 90 percent of the aquifer material is termed the effective size. The uniformity coefficient is the ratio of the sieve size that will retain 40 percent of the aquifer material to the effective size.

IV. Regional Geology

The project area is composed of Precambrian crystalline and magmatic basement, Paleozoic Sedimentary rocks and locally Quaternary sediments, figure (1) show the location of the project. The Area is affected by many faults, the stratigrhpic nomenclature of the NRA Geological Mapping project was used for description (8,9). The Ram group contains the Umm Sham Sandstone and Disi Sandstone Formations (10,11). The production section comprises a summary of the lithological descriptions based on the drill cuttings collected as follows from 310-550m, sandstone white to light grey, reddish brown, pale yellowish orange. The sandstone is fractured, which can be observed on the caliper log showing cavities not being associated with clay.

Figure 1 : Location of the Well field

V. Sieve Analysis

For naturally developed wells, well-screen slot openings need to be selected from sieve Analysis for representative samples from the water-bearing formation. For a homogeneous Formation that consists of fine, uniform sand, the size of the screen opening (slot size) is selected as the size that will be pass (50-60) % of the sand (Johnson Division, 1975) i.e. (40-50) % retained.

From the cuttings taken from the production section, many sieves analysis were performed. The samples were dried before sieving., crushed to grain and weighed on an electronic balance. Table.2 shows the results of sieve analysis drill cuttings samples(12).

Table 2 : sieve analysis of Drill cuttings Sample

No	Depth interval m	Uniformity coefficient	D50 mm	General result
1	315-318	1.87	0.34	Med to coarse uniformly graded sand
2	351-354	1.86	0.49	Med . to coarse uniformly graded sand
3	372-375	1.18	0.51	Coarse to med uniformly graded sand
4	387-390	2.14	0.38	Med to coarse uniformly graded sand
5	429-432	1.59	0.48	Med to coarse uniformly graded sand
6	459-462	1.70	0.41	Med to coarse uniformly graded sand
7	489-492	1.91	0.59	Coarse to med uniformly graded sand
8	498-501	1.44	0.38	Med to coarse uniformly graded sand
9	531-534	1.62	0.58	Coarse to med uniformly graded sand
10	543-546	1.90	0.67	Coarse to ed uniformly graded sand

The production section is characterized by mainly medium to coarse grained sandstone, with the grain size coarsening downwards. the sand stone are well sorted showing a uniformity coefficient efficient ranging from 1.44 to 2.14

Table 3 : Grain size Distribution, depth 387-390

sieve No.	sieve size mm	Retained Weight gr	Cumulative retained weight gr	Passing%	Retaind%
8	2.36	0.00	0.00	100.00	0.00
10	2	0.00	0.00	100.00	0.00
18	1	1.30	1.30	99.54	0.46
20	0.85	1.70	3.00	98.94	1.06
30	0.6	27.80	30.80	89.14	10.86
40	0.425	94.60	125.40	55.77	44.23
50	0.3	60.60	186.00	34.39	65.61
80	0.18	90.40	276.40	2.50	97.50
100	0.15	2.70	279.10	1.55	98.51
200	0.075	3	282.10	0.49	99.51
Pan		0040	282.50	0.35	99.65

Gravel	**Sand**					**Silt &Clay**
>2.00 mm	Very coarse 2.00-1.00 mm	Coarse 1.00-0.5mm	Medium 0.50-0.25 mm	Fine 0.25-0.125 mm	very fine 0.125-0.063 mm	<0.063mm
%	%	%	%	%	%	%
0.00	1.10	25.90	50.00	22.40	0.40	0.20

Grading Characteristics (size): mm
D40=0.45, D50=0.38, D90=0.21
Uniformity Coefficient CU=D40/D90=0.45/0.21=2.14

Classification of sample: medium to coarse uniformity graded sand

Figure 2 : Sieve Analyses

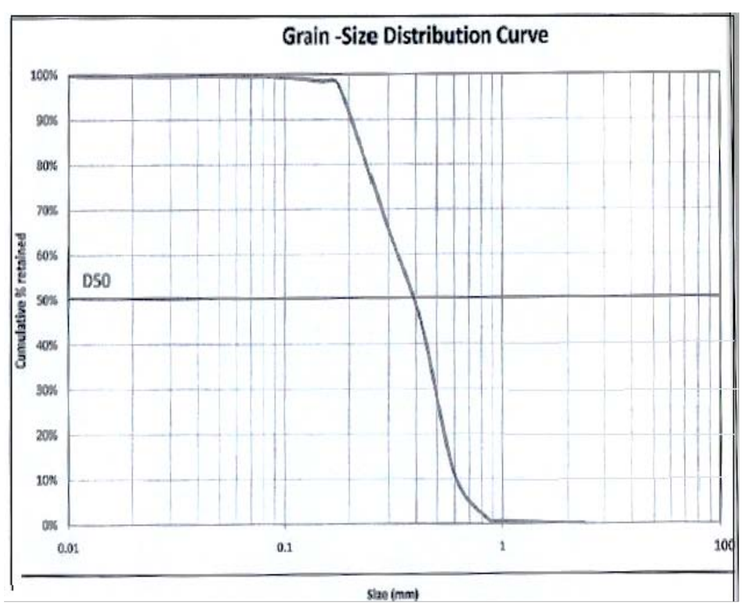

Table 4 : Grain size distribution, depth 498-501m

sieve No.	sieve size mm	Retained Weight gr	Cumulative retained weigt gr	Passing %	Retaind %
8	2.36	0.00	0.00	100.00	0.00
10	2	0.00	0.00	100.00	0.00
18	1	1.40	1.40	99.49	0.51
20	0.85	0.90	2.30	99.17	0.83
30	0.6	10.00	12.30	95.54	4.46
40	0.425	73.90	86.20	68.73	31.27
50	0.3	145.30	231.50	16.03	83.97
80	0.18	34.10	265.60	3.66	83.97
100	0.15	4.00	269.60	2.21	97.79
200	0.075	4.20	273.80	0.69	99.31
Pan		0.90	274.70	0.36	99.64

Gravel	**Sand**					**Silt &Clay**
>2.00 mm	Very coarse 2.00-1.00 mm	Coarse 1.00-0.5mm	Medium 0.50-0.25 mm	Fine 0.25-0.125 mm	very fine 0.125-0.063 mm	<0.063mm
%	%	%	%	%	%	%
0.00	1.30	25.90	14.20	77.90	5.40	0.10

Grading characteristics, cu = D40\ D 90
D40 =0.39, D50 = 0.38 D90 = 0.27
CU = D40\ D90 = 0.39/ 0.27= 1.44

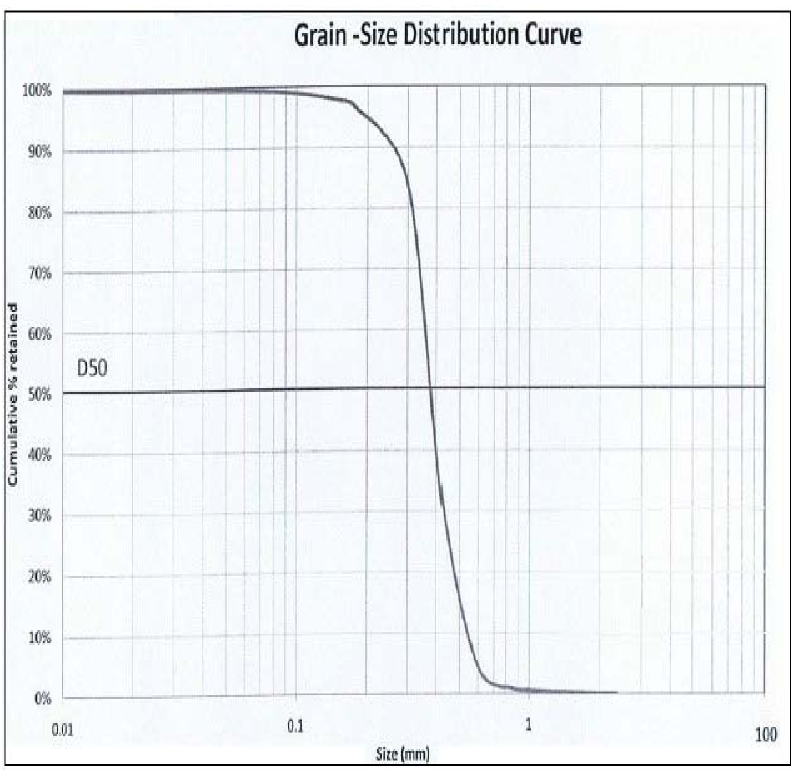

Figure 3 : Sieve Analyses

VI. Design of Well Screen

One of the most important items in the successful design of a well finished with a natural filter pack is the proper selection of slot opening in relation to the sizes of aquifer materials. For screen installed without filter packs, the corps of Engineers (1941, 1942),13,14 they found that the screen diameter had relatively little effect on the efficiency of the well system, but that the perforated section should have at least 100 perforations totaling an open area of 3 sq in per ft of section for most efficient operations. For screen installed with filter packs the perforated section should have at least 25 perforations totaling an open area of 1 sq in per ft of section.

The screen slot size depends on critical particle size of the aquifer or gravel pack be retained. The slot size shall be selected to retain from 90 to 100 percent of the filter pack material in artificially filter packed wells, and from 50 to 100 percent of formation material in naturally packed wells. All well screen is manufactured by wrapping a wire around longitudinal rod, Johnson Technical Bulletins (15,16).

The wire is welded to the rods by resistance welding producing a cage-shaped cylindrical configuration. These types of screen, commonly known as wire–wrap or continues slot, is usually manufactured from type 304 stainless steel, galvanized steel and carbon steel and other corrosion–resistant alloys are available for Defers condition (16,17,18).

The characteristics of wire–wrap screen are well suited for its original purpose. This design offers the highest surface area of opening of any screen. Consequently, with aperture sized 0.75 mm, necessary to control fine sands from thick aquifer without a gravel envelop, sufficient area of opening is still available to minimize frictional head losses through the screen. However, under such circumstances, stainless steel must be used under enlargement of openings result in sand pumping.

Terzaghi (1951) 19 he studied determine that the filter pack must be many times more permeable than the aquifer material, but the filter pack must not be coarse enough to allow the fine particles of the aquifer material to continue to wash through the pack.

Filter pack materials shall consist of clean, rounded to well rounded, hard, insoluble particles of siliceous composition (Industrial grade quartz sand). The required grain-size distribution or particle sizes of the filter pack materials shall be selected based upon a sieve analysis of the aquifer materials or the formation to be monitored.

The filter pack size is between 1 to 2 mm, the filter pack material shall also be placed under the bottom of the well screen and the borehole wall, and filter pack may need to be installed as high as five feet above the screened interval in these situations. The precise volume of filter pack material required shall be calculated and recorded before placement from caliper log for production section fig. (4) show the total annulus volume gravel pack in m3.

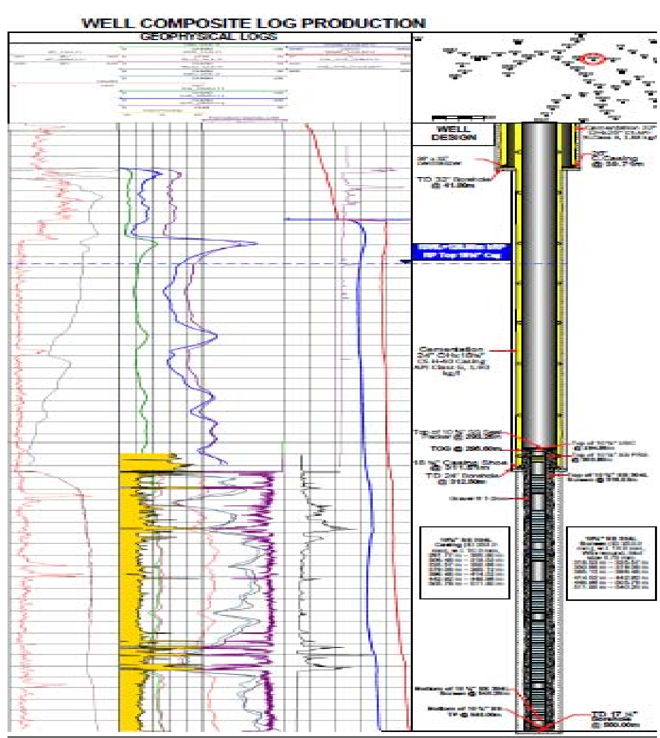

Figure 4 : well Composite Log Production

VII. Well Maintenance

a) *Development of the completed well*

Through development of the completed well is essential regardless of the drilling method used. It is believed that there is a small head loss at the well screen, and in the gravel pack, but that there is an appreciable head loss at the pack aquifer interface due to Wedging of aquifer particles.

b) *Pumping Test*

The bottom of the Hiswa formation was encountered at a depth of 105m. As the ISWL (Initial Static water level) was recorded at 126.98 m, this well and others wells which are located in the unconfined aquifer.

c) *Initial static water level*

The initial static water level was established and recorded as 126.98 m.

d) *Step Drawdown Pumping Test20 (SDPT)*

The SDPT recorded for 15 hours. It comprised five consecutive steps with average discharge rates of 41.33; 56.o3; 69.71; 90.32; 105.28 l/s, each 3 hour long. the pumping phase was followed by a 17–hours recovery period as we show in Figure (5), the SDPT and recovery data are contained in table (5)

Table 5 : Results of the SDPT Analysis and Well Efficiency ([22])

Step	Calculated Drawdown	Cumulative sum of Calculated Drawdown	Average Discharge		Calculated Specific Drawdown	Efficiency of the well	RESULTS
No.	[m]	[m]	[m3/s]	[m3/d]	[m/(m3/s)]	[%]	
1	18.49	1849	0.04133	3571	447.37	94.0	B = 434.22 m/(m3/s)
2	8.31	26.80	0.05601	4839	478.49	92.0	C = 674.74 m/(m3/s)²
3	7.74	34.54	0.06971	6023	495.48	90.2	*Efficiency E* =
4	10.23	44.77	0.09032	7804	495.68	87.7	$\left[\dfrac{BQ}{(BQ+CQ^2)}\right]*100$
5	7.51	52.28	0.10528	9096	496.58	85.9	

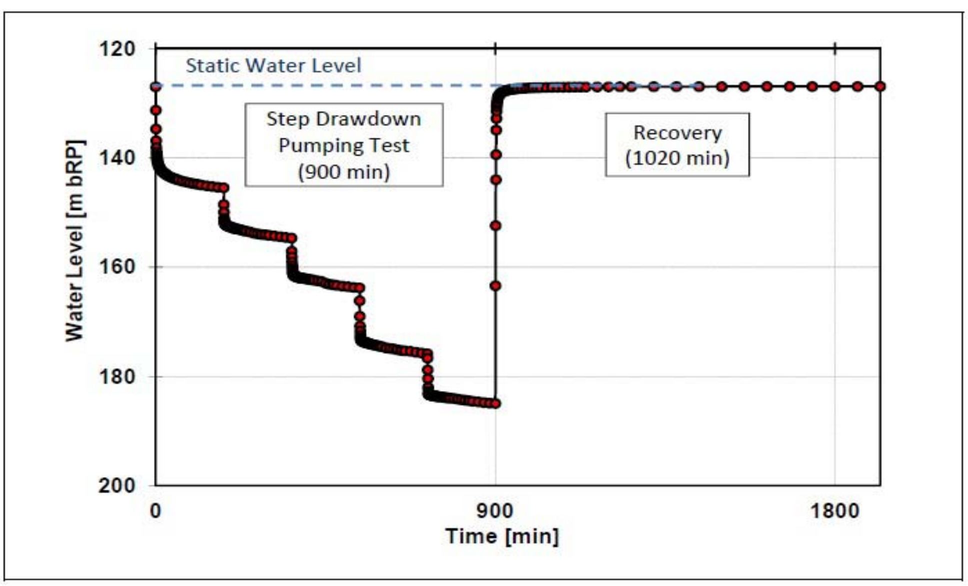

Figure 5 : Water level measurements during the SDPT and recovery

e) *Steady Rate Pumping Test (SRPT)*

The SRPT recorded for 24 hours at the average discharge rate of 80.40 l/s. The drawdown at the end of the pumping phase was 50.47m. this was followed by a 19-hour recovery period see figure (6)

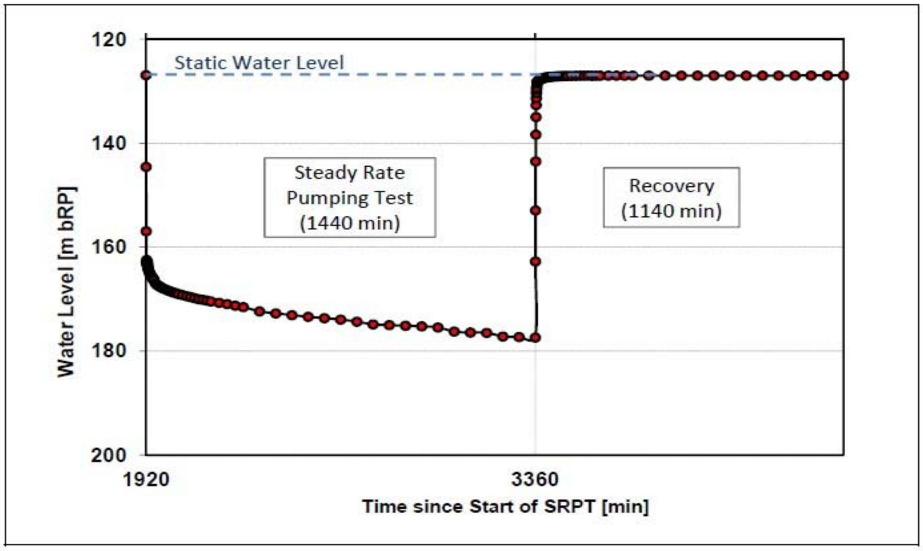

Figure 6 : Water level measurements during the SRPT and recovery

f) Test

The first step of analysis was to plot the test data with the drawdown (24), and elapsed time after pumping began Q= 100, 200, 400, 500, 550, gpm see figure (7). it can be noted that the recessions curve at 40 l/s had a "slope" of (0.33m) per cycle. the slopes at higher rates were estimated as shown on the figure (7). these slopes were used to extrapolate each step of test beyond the period of pumping of each step as shown by the dashed lines in figure (7). This extrapolation was used to obtain the incremental drawdown caused by a change in pumping rate 21.

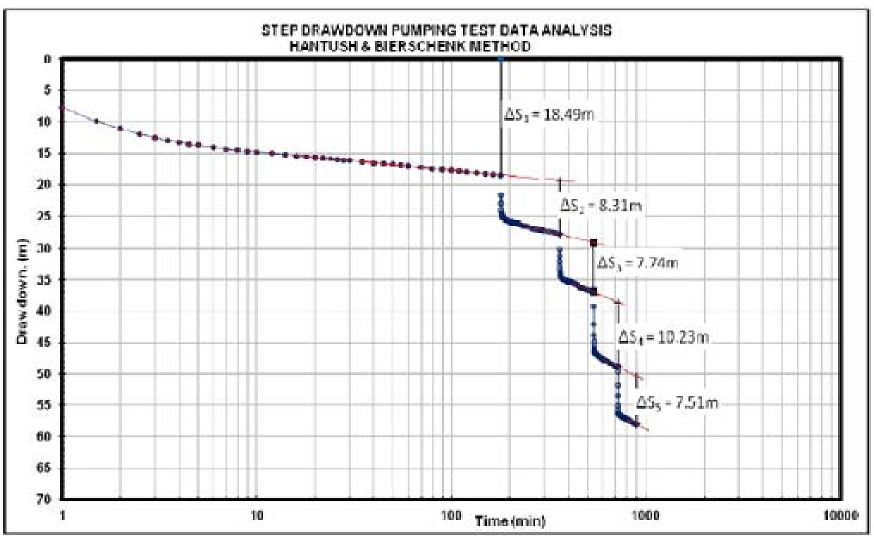

Figure 7 : Step test analysis according to Hantush-Bierschenk method 21

The equation of the form Sw/Q = B+CQ fits this line. The value of B is the value of the intercept of the line with the Sw/Q axis and the value of C is the slope of the line The equation SW = BQ+CQ2 which is the form of Jacobs equation 23 and is the approximate equation for the drawdown in the well, a pumping period of 15 hours. Figure (8) shows a plot of this equation and the observed drawdown for the five pumping rates.

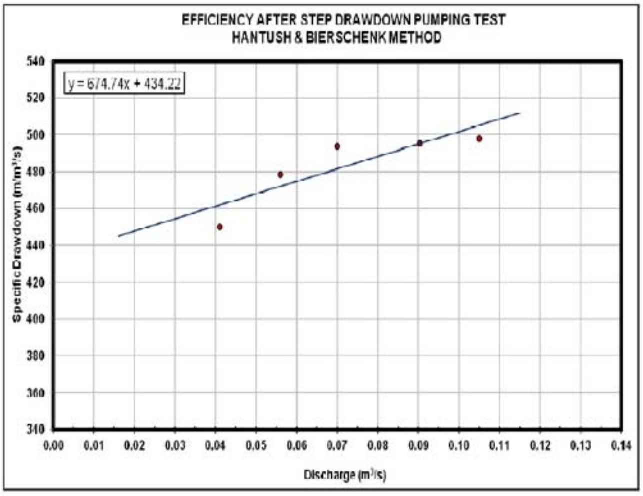

Figure 8 : Well specific curve and efficiency

Rorahaugh (25), defined "well efficiency" as the ratio of the theoretical drawdown computed by assuming that no turbulence is present (or essentially, BC) to the drawdown in the well SW, defines the efficiency of the well as the ratio of the theoretical specific capacity of the well. factors influencing the actual specific capacity include the hydraulic properties of the aquifer, coefficients of transmissibility and storage, hydrogeology boundaries of the aquifer, the partial or total penetration of the aquifer, the effective open area of the well screen, duration of pumping, and pumping rate. table (5) show the results of the SDPT analysis and well efficiency26. The figure (8) is include curves for the wells ending in formations with permeabilities in the same order of magnitude as distinguished in table (5). The figure (8) show the drop in efficiency when discharge is increased. The table (6) show the pumping test data and well specific capacity. The efficiency and the specific capacity of a well may also be increased by increasing the radius of the well and by increasing the percent penetration of the total saturated thickness of the aquifer. An increase of about any percent may be expected by increasing the effective radius of wellbore, it means that the radius becomes more and more important as discharge increase from 41 l/s to 104.53 l/s 649.9gpm to 1657 gpm.

Table 6 : Summary of the pumping tests data to calculate well specific capacity

Pumping phase	**Discharge rate*** [l/s]	**Drawdown*** [m]	**Specific capacity** [l/s/m]
SDPT	41.03	18.49	2.22
	55.69	27.69	2.01
	70.09	36.82	1.90
	90.24	48.87	1.85
	104.53	57.96	1.80
SRPT	80.83	50.47	1.60

The aquifer transmissivity, was proposed by Jacob 1963 (23) - in kasenov, 2006.

The Jacob straight line method was used to analysis the SRPT pumping phase data, the table 7, because the well location in the aquifer unconfined and drawdown at the end of pumping phase is 11.93% of the penetration aquifer thickness the drawdown data were- corrected using the following formula proposed by Jacob 1963, -In Kasenov 2006:

$$S" = S - S2/2b$$

Where S"-corrected drawdown, m;

S-drawdown measured during pumping phase, m;

b-aquifers original thickness (thickness prior to pumping),m

Transmissivity calculated from drawdown data method was used Cooper – Jacob 20 analysis between 159 to 288 [m2/d].

Table 7 : Transmissivity calculated from drawdown data

Cooper - Jacob Analysis: Transmissivity T = 0.183 x Q/ΔS x 86400 [m2/d]							
Start date and time	**End date and time**	**Discharge**	**SWL**	**ΔS**	**Transmissivity - T**		
		[m3/sec]	[mbRP]	[m]		m2/sec]	[m2/d]
--	--	0.08038	126.92	From early/medium data			
				4.42	T1	3.3E-03	288
				6.82	T2	2.2E-03	
				From last data			
				4.30	T1	3.4E-03	294
				7.99	T2	1.8E-03	159

Table 8 : Transmissivity calculated from residual drawdown data

Cooper - Jacob Analysis: Transmissivity T = 0.183 x Q/ΔS x 86400 [m2/d]							
Start date and time	**End date and time**	**Discharge**	**SWL**	**ΔS**	**Transmissivity - T**		
		[m3/sec]	[mbRP]	[m]		m2/sec]	[m2/d]
--	--	0.08038	126.92	From early/medium data			
				4.42	T1	3.3E-03	288
				6.82	T2	2.2E-03	
				From last data			
				4.30	T1	3.4E-03	294
				7.99	T2	1.8E-03	159

g) *Flow meter logging data*

Flow meter log measurements were carried out during SRPT with a discharge of 80 l/s. The integration of the flow measurements over the depth as the tool passes down the production section. Distribution of the flow over the screened section is presented in table 9.

Theis's Recovery Method: Transmissivity T = 0.183 x Q/ΔS x 86400 [m2/d]						
Start date and time	**End date and time**	**Discharge**	**SWL**	**ΔS**	**Transmissivity - T**	
		[m3/sec]	[mbRP]	[m]	[m2/sec]	[m2/d]
--	--	0.08040	126.92	1.246	1.2E-02	1026

According to the flow meter logging, 41.25% (33.0 l/s) of the total discharge (80 l/s) flows into the well from depth interval 462-525 m bgl,16.65% (15 l/s) from 414.52-431.o m bgl and 15% (12 l/s) from 318.53- 335.57 m bgl.

Very low inflow (3 l/s) was measured in the last screened section 510-540 m bgl. To calculate the screen entrance velocity, the highest inflow rate (1.79l/s/m) is used. The open area of the screen is 13.8%, as stated in the permanent material specifications. The screen entrance velocity it was calculated 0.030 m/s.

VIII. Conclusion

- The Production Section was drilled with 17½" diameter by reverse circulation with polymer mud to the final depth of 550 m.
- The 10¾" diameter stainless steel casings and screens were installed to 546.0 m and gravel pack was installed up to 295.6 m depth. The screen entrance velocity it was calculated 0.030 m/s.
- Flow meter log measurements were carried out during SRPT with a discharge of 80 l/s.
- Development and pumping test, the well was finally completed, the Initial Static Water Level was measured at 126.98 m below reference point.

References Références Referencias

1. Bieske, Erich.1961. "W ell screen and filter media in borehole ".Stockstadt am Rhein .J.F.Nold and Co. Tech.Rep no.11 4pp.
2. johnson, Edward.E. Technical Bulletins .Sr.paul; Minnesota, U.S.A.Johnson .
3. Johnson, Edward .E.Inc .1959. The principle and practical methods of developing water wells. Technical Bulletin 1033, Dec St.paul .Minnesota U.S.A .Johnson.
4. Smith, H.F.,1954, Gravel Packing Water Wells; Illinois Dept Registration and Education Circ .44 .
5. Walton, William, C. 1962.selected analytical methods for well and aquifer evaluation. Illinois state water survey Bulletin 49 .
6. Stramel, gillber F.1965. Maintenance of well efficiency, J. Am. Water works Ass.57 pp 996-1010.
7. Johnson Division, 1975 .selection of screen slot size for uniform sand.
8. Masri, Ahmed. "The geology of Halat Ammar and Al Mudawarra geo-Map Scale 1:50000-Map sheets No 3248-II and 3248 IV the Hashemite Kindom of Jordan". Natural Resources Authority, Geology Directorate, Geological Mapping Division–Bulletin 65, Amman 1998.
9. Moumani, Khaled Ali. "The Geology of Jabal Umm Sham and Bir as saladih Area. Geo Map –Scale 1:50000 Map sheets No. 3148-IVand–III. The Hashemite kingdom Of Jordan–Natural Resources Authority, Geology 10-directorate, Geological Mapping division–Bulletin 55, Amman 2003.
10. Andrews, 1j Paleozoic Lithostratgrpy in the Subsurface of Jordan. Subsurfac Geology Bulletin 2, Natural Resources Authority Amman .!991.

11. Powell, J.H. “Stratigraphy and Sedimentation of the phanerozoic rocks in central and south Jordan, part A, "Geological Mapping Division, Bulletin II A, Natural Resources Authority, Amman, 1989.
12. Final Technical Report W-39, Disi Mudauarra to Amman Water Conveyance system project 2012.
13. U.S.corps of Engineer, 1941 Investigation of filter requirements for under drain: Vicksburg, Miss, waterways Expt .sta. Tech. memo.183-1, 48p.
14. field and laboratory investigation of design criteria for drainage wells: Vicksburg. Miss., water ways Expt. sta.Tech 195-1, 103 p, 1942.
15. Johnson., E .E .1963. Basic principles of water well design, pt .3 JOHNSON Drillers, JOUR V.35, no 6 p4-5,8.
16. A.I. J., Johnson., "Filter- pack and well–screen Design, U.S..geological survey, Hydrologic Laboratory, Denever, Colorado 1963.
17. Roscoe Moss Company "Screen a guide to water well casing and screen selection.
18. Variperm Canada limited, "Water well screen Environmental Screen.
19. Terzaghi, Karl, 1951 "Theoretical soil Mechanism". Newyork, john wiley & sons, 510 p.
20. Cooper, H.H., Jr., and Jacob, C.E., 1946, A generalized graphical method for evaluating formation constants and summarizing well-field history: Am. Geophys. Union Trans., v. 27, no. 4, pp. 526-534.
21. Hantush, M.S., 1960, Modification of the theory of leaky aquifers: Jour. Geophys. Research, V. 65, no. 11, pp. 37133725.
22. Jacob, C.E., 1946, Drawdown test to determine effective radius of artesian well: Proc. Am. Soc. Civil Engineers, v. 72, no. 5, pp. 629-646.
23. Jacob, C. B., 1947, Drawdown test to determine effective radius of artesian well, with discussion by Boulton, Rohwer, Leggette, Lewis, and C.E. Jacob: Trans. Am. Soc. Civil Engineers, v. 112, paper no’ 2321, pp. 1040-1070.
24. Lohman, S.W,, 1972, Ground-water hydraulics: U.S. Geological Survey Professional Paper 708, 70p.
25. Rorabaugh, MJ., 1953, Geographical and theoretical analysis of step-drawdown test of artesian wells: Proc. Am. Soc. Civil Engineers, Hyd. Div., v. 79, no. 1, pp. 362.1-362.23.
26. A. Michel Pelletier , P.G . Well efficiency calculations for extraction wells the Rorabaugh method Re-Evaluated, Post, Buckley, Schuh & Jernigan, Inc. Columbia, south Carolina.

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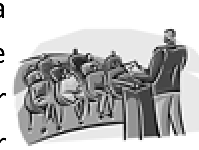

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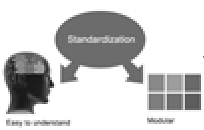

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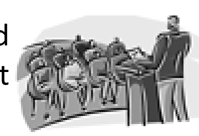

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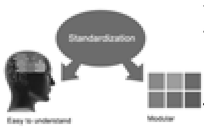

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3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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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.
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- Do not present the similar data more than once.
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- 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
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- 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

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- 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."
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- 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.
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- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
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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
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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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