

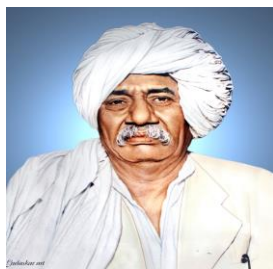
Climate Change: Causes, Consequences and Coping Strategies

Edited By
Nalini Ghatge
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Pravara Rural Education Society's
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CLIMATE CHANGE: CAUSES, CONSEQUENCES AND COPING STRATEGIES

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PREFACE

What is the approach that India should adopt in formulating policy responses to climate change, both domestically and internationally? In recent years, there has been a vibrant debate on this question (Dubash 2011, 2012; Kanitkar et al 2009; Narain 2009; Raghunandan 2012; Rajamani 2009). India has established a National Action Plan on Climate Change (NAPCC) with eight subsidiary “Missions”; each state is now in the process of producing State Action Plans on Climate Change with recommendations on how mitigation and adaptation could be mainstreamed into development policy; and at the central level, an “Expert Group on Low Carbon Strategies for Inclusive Growth” has released an interim report (Planning Commission 2011a).¹ Clearly, there is a growing body of climate-related policy in India. At the same time, there is no clear and consistent approach or framework that directs and guides these efforts. The “co-benefits” formulation in the NAPCC is promising: measures that “promote our development objectives while also yielding co-benefits for addressing climate change effectively” (Government of India 2008, section 2).² While useful as a broad concept, the NAPCC’s articulation of co-benefits is conceptually insufficient, and lacks the methodological clarity needed to actually guide policy trade-offs and priorities. The Planning Commission has also attempted an initial framing of India’s low carbon approaches within a co-benefits template (Planning Commission 2011b). Without clearer specification, however, a co-benefits approach risks being used in an ad hoc manner to either justify business as usual development policies, or to opportunistically sell a particular policy without sufficient justification of its advantages over other comparable policy options.

Climate change is already a reality for a majority of Indian farmers even as plans are being evolved at the government level mostly to create adaptive capabilities; meanwhile, Indian farmers are being forced to adapt to several CC-related changes by themselves because they have no other choice. For no fault of theirs, Indian farmers, like the most marginalized everywhere, are paying a high price for anthropogenic climate change. The worst-hit, as usual, are small and marginal holders in marginalized locations with social disadvantages to begin with. Such farmers have meager resources to buffer them from the new risks that climate change poses.

The macro-plans being created by the government in India are mostly meant for the National Agricultural Research System (NARS) and a re-arranging of their research agenda in the context of climate change – the NARS’s linear systems of “lab to land” research have been already critiqued for their non-participatory, top-down, unaccountable nature. Such systems which are centered on unilateral knowledge generation only within agricultural universities to be then carried to the farmers for adoption through the agricultural extension system, discounting farmers’ (traditional) resources and knowledge, will be grossly inadequate for the immediate needs of adaptation. The adaptation requirements are to be met urgently,

with no time lost (the time taken for conventional knowledge generation by the NARS to be then ‘transferred’ to farmers is ill-affordable here). This is where a new learning paradigm is needed – to learn from farmer innovators, from traditional knowledge and resources and disseminating useful practices and resources to others. Indian farming is at a cross-roads and climate change is one more factor adding to the existing agrarian and agriculture crisis in the country, that requires a decisive direction shift at the policy level.

Fundamental changes have to come from the acknowledgement and realization that unilateral, top-down, prescriptive “knowledge generation and transmission” models of agriculture development adopted in the country so far have in fact resulted in an ecological, economic and social crisis in the farming sector of the country within 40 years of adoption and that climate change is one more imperative for drastic change to address the situation.

Climate change is already a reality for Indian farmers and that conventional models of agricultural research and extension will fail to address the need of the hour unless some fundamental recasting is done. The immediate need for interventionist action precludes traditional models of research and support systems and requires alternative but urgent programmatic interventions, led by farmers’ institutions and their local resources, knowledge and innovations.

Sustainable agriculture, on the other hand, holds immense mitigation and adaptation potential, specifically in the context of climate change even as it improves rural livelihoods and addresses the ecological crisis in Indian farming (genetic erosion, land degradation, water depletion and contamination etc.)

In fact, there are no options in front of the Indian government and Indian farmers but to establish, promote and adopt sustainable agriculture for all of India.

Nalini Ghatage

Onkar Rasal

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Seasonal Impact on Food and Nutrient Intake of Pre School Children

N.S. Ghatge*

Abstract

Season wise food and nutrient intake of preschool children were taken by three days diet recall method. Especially in winter season (Oct, Nov & Dec) as well as in the month of Feb, March & Apr. The relevant questions were asked to the preschooler's mother. It includes what the child had at morning, in lunch time, at snacks as well as at the time of dinner? These questions were asked and careful noting of the each food items was done. Each food item was measured, which was made at home and eaten by child. The nutritional value of average food item was calculated. It has been compared with BDA table. Increase in food and nutrient intake of preschool children was observed. In winter season preschool children consume more food and nutrient.

Introduction

Good nutrition is the key to a healthy and productive life. Inadequate or imbalanced nutrition causes malnutrition which leads to increase morbidity and mortality. It also reduced life expectancy and inability to cope with infectious and other environmental hazards. Similarly the season plays an important role. The majority of children belonging to poor income group in developing countries suffer from various degrees growth retardation due to nutritional deprivation. Malnutrition is assistive factor not only in physical growth but also mental retardation It is very common in India (Dahiya and Kapoor 1992). Nutritional status and health depends to a large extent on nutrition and nutritious food. Food is most important single factor in connection with the attainment and maintenance of health Swaminathan(1996) and Khor geak(2000).

Materials and Methods: 24 Hours Dietary Recall

The 24 hours dietary recall method is commonly used in large nutritional surveys to collect dietary intake data of the individuals. The food intake for the 24 hours was recorded in the structured questionnaire. The type of food consumed, amount of food, food preparation method used, time of food consumption and other details related to food intake were asked to the preschooler's mother and recorded.

Key Words: Food and Nutrient Intake

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The dietary intakes were assessed in terms of cooked food with the help of standardized cup measures appropriate for the local conditions. The 24 hours dietary recall was taken for subsequent three days and mean of each ingredient was taken as 24 hours dietary recall. The selection of the preschool children was done randomly. The differences noticed in food and nutrient intake in different season were calculated by statically. The obtained data was analyzed statically (Gomez and Gomez 1986).

Result and Discussion

Food Intake

The data regarding average food intake pattern of the preschool children was given intake Table 1. It explains that, Cereal intake by preschool children noted as 96.5 gm. in winter whereas it was 91.7 gm in summer. Per cent of adequacy of Cereal was not up to the mark as compared with the BDA of the same age group. Which may cause for calorie deficiency and leads to malnutrition. The legume intake was found very poor. In summer, it was noted 32.0 gm., whereas it was recorded 40.6 gm. in winter. The legume intake was not observed at adequate level. It may also cause to protein deficiency and leads to malnutrition. A similar observation recorded by Lawrence and Smith (1995). In their study the average legume intake in girls found significantly lower than boys.

Average intake of green leafy vegetable was recorded as very poor (14.0 gm) in both the season. As compared with the daily requirement of green leafy vegetable, it found very inadequate level i.e. 22.2 per cent. Intake of other vegetable and roots and tuber noted as better than that of other food groups. It shows that 30.5 gm. in winter and 29.0gm in summer. The per cent of adequacy level of other vegetables and roots and tuber found 76.3 in winter and 72.5 in summer. The intake of sugar and jaggary in winter was observed as 16.0gm and it was noted 15.0 gm in summer. A non significant difference was seen in sugar intake in winter and summer. However, the intake of sugar and jaggary was found inadequate in boys (45.7 per cent) and girls (42.0 per cent). The consumption of milk and milk products was recorded very poor in both the season i.e. 55.0 gm. Adequacy level in the intake of milk and milk products seen very lower i.e. 27.6 per cent. The average intake of non vegetarian foods including eggs, meat, fish and poultry was taken 22.0 gm. in winter and 20.0gm. in summer. Though the majority of preschoolers liked non vegetarian foods but in reality their intake adequacy level of this food group shown not upto the mark, when it compared with their BDA. A significant difference was noticed between the adequacy level of non vegetarian foods in winter (63.6 per cent) and in summer (57.1per cent). Oils and fats taken in the diet of preschool children were also observed in winter (72.5gm) and in summer (10.0gm). Per cent intake of oils and fat in winter (62.6) and in summer (50.0) not shown at adequate level among these preschool children. (Leitzmann 2003)

Nutrient Intake

The major and minor nutrient intake of preschool children was assessed from daily diet. The major nutrient intake like energy (kcal), protein (g) and fat (g) were assessed. The average calorie intake in winter were 643.4 (kcal) $\pm$ 6.0(43.9) per cent and summer children were 611.3(kcal) $\pm$ 6.7(42.2)per cent (Ghatge 2012). The average protein consumption was as 20.9(g) $\pm$ 5 (80.3) per cent and 19.9(g) $\pm$ 4.7(76.4) per cent per day which was also inadequate. Daily inadequate consumption of protein leads to protein deficiency. The average fat consumption was 12.5(g) $\pm$ 4.0(50.0) per cent and 10.0 (g) $\pm$ 3.8(38.4)per cent, it was less than their required amount.

The minor nutrient intake i.e. B complex vitamins like B₁ (mg), B₂ (mg) and vitamin B₃ (mg) were 0.44(mg) $\pm$ 0.1(58.7 per cent), 0.55 mg $\pm$ 0.2 (61.7per cent) and 1.84 mg $\pm$ 0.3 (19.4 per cent) respectively in winter by children. It was noted vitamin B₁ as 0.41(mg) $\pm$ 0.1(54.7 per cent), vitamin B₂ as 0.52 (mg) $\pm$ 0.2(58.4 per cent) and vitamin B₃ as 1.74 (mg) $\pm$ 0.2(18.3 per cent) in summer.

The consumption of β Carotene (μ g) and vitamin c were noticed as 326.1(μ g) $\pm$ 2.3(20.6 per cent) and 28.5(mg) $\pm$ 1.8 (71.3 per cent) winter and 309.9(μ g) $\pm$ 2.2(19.36 per cent) ,27.1 (mg) $\pm$ 1.2(67.5 per cent) respectively in summer. The mineral intake like calcium, iron and zinc were ranging 168 (mg) $\pm$ 2.4(46.5 per cent), 5.1(mg) $\pm$ 2.0(33.7 per cent) and 1.29 (mg) $\pm$ 0.2(12.9 per cent) by in winter. The consumption of mineral in summer was noted as 159.6 (mg) $\pm$ 2.6(39.9 per cent), 4.80 (mg) $\pm$ 1.9(32.0 per cent) and 1.22(mg) $\pm$ 0.2(12.2per cent) (Massari 2003).

Conclusion

It can be concluded that the food and nutrient intake of preschool children in different seasons varies. It has been seen that the consumption of food & nutrient were increased by preschool children in winter season.

Table 1 Average Food Intake Pattern by Preschool Children

Sr. No.	Food Group	Winter	Summer	'Z' value
1	Cereals (g)	96.5 $\pm$ 25.9(55.3)	91.7 $\pm$ 24.6(52.4)	1.3 NS
2	Legume (g)	14.25 $\pm$ 3.4(40.6)	14.5 $\pm$ 2.7(32.2)	2.7 *
3	Green leafy vegetable (g)	14.00 $\pm$ 5.5(22.2)	14.0 $\pm$ 5.5(22.2)	0.1 NS
4	Other vegetable Roots and tuber (g)	30.5 $\pm$ 15.0(76.3)	29.0 $\pm$ 4.2(72.5)	1.3 NS
5	Sugar and jaggery (g)	16.0 $\pm$ 5.2(45.7)	15.0 $\pm$ 4.8(42.9)	1.3 NS
6	Milk and milk product (g)	55.0 $\pm$ 33.4(27.6)	55.0 $\pm$ 33.4(27.5)	0.01 NS
7	Egg meat fish poultry (g)	22.0 $\pm$ 18.0(63.6)	20.0 $\pm$ 16.3(57.1)	2.6 *
8	Oil / fat (g)	12.5 $\pm$ 2.6(62.6)	10.0 $\pm$ 2.0(50.0)	2.8 *
9	Fruits (g)	—	—	—

Source: Calculated from field survey

Figure in parentheses indicate percentage, * significant at 5 per cent level, NS non significant levels

Average Food Intake Pattern by Preschool Children



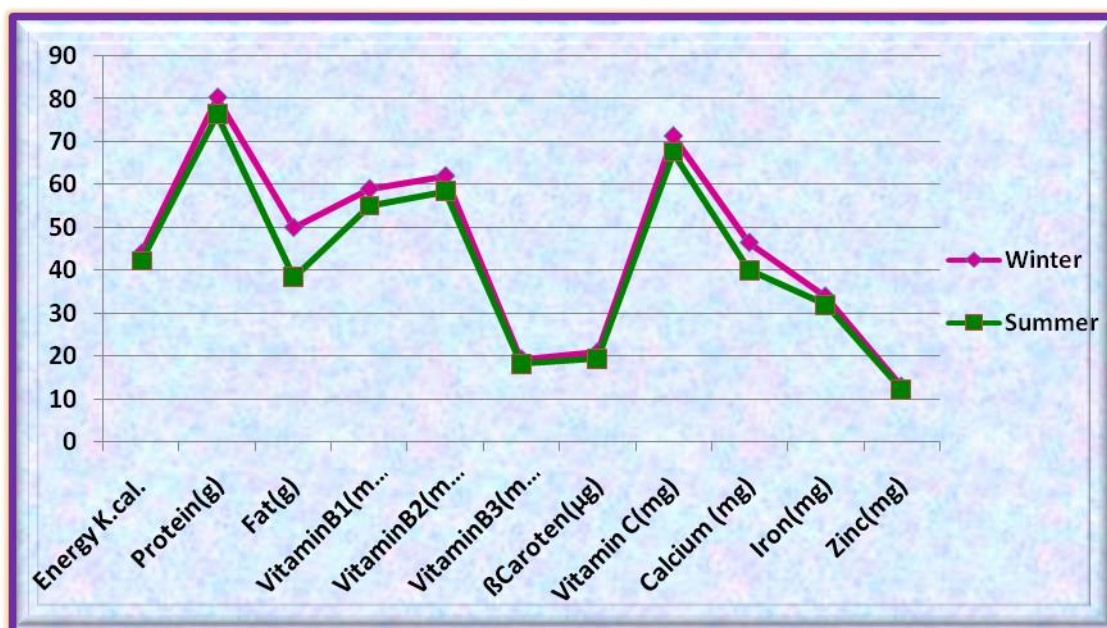
Table 2 Average Nutrient Intake by Preschool Children

Sr. No.	Nutrients	Preschool Children		'Z' Value
		Winter	Summer	
1	Energy K.cal.	643.4±6.0(43.9)	611.3 ±6.7(42.2)	2.8*
2	Protein (g)	20.9±5.0(80.3)	19.9 ±4.7(76.4)	0.3 NS
3	Fat (g)	12.5±4.0(50.0)	10.0 ±3.8(38.4)	0.7NS
4	VitaminB ₁ (mg)	0.44±0.1(58.7)	0.41 ±0.1(54.7)	0.3 NS
5	Vitamin B ₂ (mg)	0.55±0.2(61.7)	0.52 ±0.2(58.4)	0.3 NS
6	Vitamin B ₃ (mg)	1.84±0.3(19.4)	1.74 ±0.2(18.3)	0.3 NS
7	β Caroten(μg)	326.1±2.3(20.6)	309.8 ±2.2(19.4)	2.6 *
8	Vitamin C (mg)	28.5±1.85(71.3)	27.1 ±1.2(67.5)	0.4 NS
9	Calcium (mg)	168.0±2.4(46.5)	159.6 ±2.6(39.9)	2.2 NS
10	Iron (mg)	5.1±2.0(33.7)	4.8 ±1.9(32.0)	0.1 NS
11	Zinc (mg)	1.29±0.2(12.9)	1.22 ± 0.2(12.2)	0.4 NS

Source: Calculated from field survey

Figure in parentheses indicate percentage, * significant at 5 per cent level, NS non significant levels

Average Nutrient Intake by Preschool Children



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Can Climate Change and Monsoon Fluctuations Assure Sustainable Agricultural Development in India?

Onkar Rasal*, Anuradha Dubey**

Abstract

Agrarian relations in India had undergone a sea-change during the period of green revolution in general and to that of last two decades of economic reforms in particular. One of the serious outcomes of these changes is the incidence of suicides of farmers in different states of the country. Changes in agrarian relations occurred due to the changing policies and change in ecology. Changing macroeconomic policies and other changes led to the gross neglect of agriculture consisting of 60 per cent of the population and one fifth of the electorate. This took agriculture and rural economy towards distress. The number of suicide cases in rural parts has been mounting in last fifteen years. During the period of 1995 to 2012 (2, 87, 967) farmers has been committed suicide in the country. Since the mid 1990s, large section of farm households have been facing a distress as a consequence of decline in agricultural income and loan repaying capacity and increased debt burden. Rain-fed areas are particularly prone to year to year fluctuations in production and degradation in environmental resources. The present paper tries to analyze and criticize the reciprocal relationship between the agrarian reforms and environmental degradation. As well as it also focuses on the functional relationship between climate changes, declined agricultural productivity, unremunerative profession and thereby agrarian crisis and farmers suicides in India.

Introduction

Indian agriculture is passing through a difficult situation. It is widely acknowledged by major political parties, statutory bodies and underlined by the research studies. In the last five decades, majority of farmers have become poor and harried outcasts in their own country, with no respectful place in the public policies.

Key Words: Environmental Degradation, Agrarian Crisis, Farmers Suicides

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Hence, farming community has been at the marginal in Indian economic, social and political life. Agriculture has become relatively an unrewarding activity due to the unfavorable monsoon, price regime and low value addition. It causes abandon of farming and increases migration from rural areas. According to the Commission on Farmers' Welfare in Andhra Pradesh (2005), "agriculture in India has been in an advanced stage of crisis. The most extreme manifestation of the crisis is in the suicides by farmers in different parts of the country." This brings out that something is terribly wrong in the countryside (Swaminathan-2006).

Half of the Indian farmers are indebted and much of the indebtedness is due to a sharp increase in agriculture expenses and declined returns during the late 1990s. Inequality in income between the rural and urban households and between the cultivators and non-cultivators has been growing very fast. The monthly per-capita consumer expenditure of three forth of the farmers was less than Rs.615 (NSSO-2003). As well as, the food consumption of the rural masses has been below the consumption level of the famine period of the 1939. Hence, the question arises; does Indian agriculture achieve a food grains security after the four decades of green revolution? In the last 15 years, the proportion of marginal and small holdings has been on the rise and the share of agriculture in GDP decelerated fast and has become 14.5 per cent. But the proportion of the population depending on agriculture for their livelihood has remained more or less stable (i.e. 58.5 per cent) (RBI-2009). Agrarian distress is not a new phenomenon for India; but the suicide by farmers is a surprising apathy. During the British and post British periods, farmers faced droughts, crop failures, and worst price falls, also the burden of debt and excess land revenue. But, it is never heard that they ended life through suicides.

Conceptual Framework

The post green revolution period is witnessed massive increase in the food grains production but to limited extent. It is observed that the green revolution is limited for the some crops and region too. Uncertainty is the fundamental characteristic of Indian monsoon. Which is further aggravated by the change in climate i.e. increase in temperature and green house gases. As well as the excessive uses of pesticides and fertilizers causes for the declined fertility of soil and quality of underground water. It has resultant impact of the quality and quantity of agriculture produce. On the one hand the quality and quantity of output has been declined with increase in cost of cultivation on the other the minimum support prices has been mere stagnant or declined particularly during post reforms period. It leads to increase in the gap between cost of cultivation

and income from the agriculture. As a result farmers trapped in the deep valley of economic crisis and committed suicides. As farmers felt the suicides is the only way to come out this mercy of life. The studies conducted by various researcher and institutes also observed that the natural calamities are the one of the causes of agrarian crisis in India. The question unanswered who is responsible for the growing numbers of natural calamities or failures of monsoon? M. Nazeeruddin (2004) studied farmers suicides in Rayalseema region of Andhra Pradesh. 85 farmers suicide affected households were select for the purpose of the study. According to the study, an erratic rainfall has become a worrying factor for the farmers particularly after the period of 1996. But the main reasons for agrarian crisis are the mounting debt burden, frequent droughts, crop failures, spurious seeds and pesticides, unfavorable prices for their produce and increasing expenditure on the private health services in the absence of the public health facilities. It compelled farmers to commit suicides. V Ratna Reddy and S Galab (2005) studied agrarian crisis and farmers suicides in Andhra Pradesh. The study found that farmers suicides is a result of the deep rooted agrarian and rural distress rather than a temporary phenomenon associated with society. Indebtedness is the important factor, which pushed farmers towards suicide trap but, the factors that are responsible for indebtedness are more significant. Study categorized factors as technological, ecological, social and economic. Excessive use of pesticides and fertilizers over the years for cash crops has not only affected bio-diversity but also led to increase in resistance power among the pests. It resulted in the higher cost of cultivation and frequent crop failures. The combine study by S. Vijaya Kumar and K.S.Bhat (2007) of Andhra Pradesh depicted that the state has been suffering from drought since 1996. And it has become root cause of the agrarian crisis and farmers suicides in the state. T. Prabhakar Reddy (2007) argues on the basis of the study on Andhra Pradesh that the successive droughts and the irrigation backlog are causes of the distress in agriculture sector of the state. The heavy use of pesticides and fertilizers further resulted into a decline in soil fertility and environmental degradation. It created problems to the ecology which have long term impacts on the rural and agricultural economy of the state. A.R.Vasavi (1999) observed that the spate of suicide in farming community is largely an ecological, economic and social crisis in the state of Karnataka. R S Deshpande (2002) studied agro-economic causes of agrarian crisis and farmers suicides in the state of Karnataka. Most of the farmers committing suicides belonged to northern Karnataka region which is a drought prone area of the state. Cost of cultivation increased because of higher use of fertilizers, pesticides and

for the irrigation facilities at individual farm level. The same trend is observed in the Vidarbha region of the state of Maharashtra. Sometimes excessive or erratic rainfall causes for the double or triple sowing in the region. Which increase the cost of cultivation. The increase in number of sowing did not consider while accounting the cost of cultivation. As a result the gap between income and expenditure has been widened. As well as the increase in the use of fertilizers and pesticides also boost the cost of cultivation.

The Debate

Since the mid 1990s, large section of farm households have been facing a distress as a consequence of decline in agricultural income and loan repaying capacity and increased debt burden. Rain-fed areas are particularly prone to year to year fluctuations in production and degradation in environmental resources. The growth rate of agriculture has decelerated noticeably during the post reforms period. The crisis has been exacerbated further by rapid environmental degradation and plate aching the existing agricultural technology. The liberalization of economy has failed to give a big push to agriculture sector and to increase income and employment in agriculture. The gradual withdrawal of state from active participation in development activities has resulted in sharp decline in public investment in agricultural infrastructure in general and agriculture science and technology in particular. This has resulted in deterioration of rural infrastructure and thereby stagnation in agriculture development. The glory of the green revolution has been darkening since the mid 1980s. The income from agriculture had been declined with increased cost of cultivation. The widening gap between income and expenditure causes for the indebtedness and thereby act of suicide by the farmers.

Table– 01 All India Consumption of Nutrients in terms of (N, P & K,) (000' Tonnes)

Year	N	P	K	Total
1	2	3	4	5
1950-51	58.7	6.9	-	65.6
1955-56	107.5	13.0	10.3	130.8
1960-61	210.0	53.1	29.0	292.1
1965-66	574.8	132.5	77.3	784.6
1970-71	1487.0	462.0	228.0	2177.0
1975-76	2148.6	466.8	278.3	2893.7
1980-81	3678.1	1213.6	623.9	5515.6
1985-86	5660.8	2005.2	808.1	8474.1
1986-87	5716.0	2078.9	850.0	8644.9
1987-88	5716.8	2187.0	880.5	8784.3

1988-89	7251.0	2720.7	1068.3	11040.0
1989-90	7386.0	3014.2	1168.0	11568.2
1990-91	7997.2	3221.0	1328.0	12546.2
1991-92	8046.3	3321.2	1360.5	12728.0
1992-93	8426.8	2843.8	883.9	12154.5
1993-94	8788.3	2669.3	908.4	12366.0
1994-95	9507.1	2931.7	1124.7	13563.5
1995-96	9822.8	2897.5	1155.8	13876.1
1996-97	10301.8	2976.8	1029.6	14308.1
1997-98	10901.8	3913.6	1372.5	16187.9
1998-99	11353.8	4112.2	1331.5	16797.5
1999-2000	11592.7	4798.3	1678.7	18069.7
2000-01	10920.2	4214.6	1567.5	16702.3
2001-02	11310.2	4382.4	1667.1	17359.7
2002-03	10474.1	4018.8	1601.2	16094.1
2003-04	11077.0	4124.3	1597.9	16799.1
2004-05	11713.9	4623.8	2060.6	18398.3
2005-06	12723.3	5203.7	2413.3	20340.3
2006-07	13772.9	5543.3	2334.8	21651.0
2007-08	14419.1	5514.7	2636.3	22570.1
2008-09	15090.5	6506.2	3312.6	24909.3

Source: Department of Fertilizers, Various Years

After the green revolution the uses of chemical fertilizers had been increased massively. At the initial stage it gives the remunerative result through increase in the productivity and thereby production. But on the contrary policy makers neglect the negative impact of the heavy uses of fertilizers and pesticides. It has been continuously affecting the ecology of the country. It is a fact that agricultural productivity should be increased to achieve the goal of inclusive development. But one thing was neglected that the productivity not only depends upon the quantity of fertilizers but also other factors of production too. The existing ‘Crony Capitalism’ in India force farmers to consume higher quantum of fertilizers. The increased uses of fertilizers since late 60s caused for the declining soil fertility as well as the quality of produces.

The free entry of the MNCs and indigenous companies in the seeds and fertilizers market leads to increase in the supply of spurious seeds in the market. Unwillingness and the intentional relationship with traders of the government officials help in the further exploitation of the farmers. The National Commission on Farmers, call for making Vidarbha “an organic farming zone”. But as usual the state government neglected the recommendation of the commission and continued with the existing policy. Here we observed a paradox in the policy domain. In 1966,

when the Green Revolution was introduced the government focused on the excessive use of the high yielding variety of seeds and chemical fertilizers to increase the productivity and thereby production of the agriculture sector. And after the forty years of green revolution the policy makers and environment scientist realized that the use of the chemical fertilizers is harmful to the human being. Hence, now they force to use the bio- fertilizers or the adoption of organic farming. The incidences of farmers suicides is an outcome of the first green revolution and now government talks about the second green revolution what does it give to the farming community and society as a whole is a big question. The Indian policy makers have been blind followers of the successful policy implemented in developed countries. As all are aware about the uses and importance of the organic farming. Nonetheless, the several questions are unanswered and the policy makers should think over it otherwise Indian agriculture and economy as a whole may be in a deep crisis in recent future. Whether the organic farming can fulfill the total demand of food-grains of the country? Does the farmer accept the new techniques of farming? If farmers incurred losses at the initial stage of the farming who will compensate them and what is the criteria for the same? Government should think on the existing rate of compensation for crop loss which is not proportionate to the losses. Does the country have the sufficient amount of the organic fertilizers to fulfilling the demand for the same? What about the chemical fertilizer industry and the engaged labour force? Where to merge them? Already we have excess labour force in the agriculture sector and still we can't incorporate them. Then who will bear the burden of this excess labour force? All these issues should have the concern before implementing the policy of organic farming. The existing situation can be defined as 'Prisoners Dilemma' mentioned by Paul A Samuelson in 'Game Theory'.

Table- 02 All India Rainfall Distribution (1992-93 to 2009-10)

Year	Monsoon Season			Post-Monsoon			Winter Season			Pre-monsoon Season			Over all rainfall		
	(June-September)			(October-December)			(January-February)			(March-May)			(June-May)		
	A	N	% (Δ)	A	N	% (Δ)	Ac	N	% (Δ)	A	N	% (Δ)	A	N	%(Δ)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
92-93	830.7	899.2	-7.6	106.5	114.1	-6.7	37.9	41.0	-7.6	116.5	121.3	-4.0	1091.6	1175.6	-7.1
93-94	902.1	908.9	-0.7	131.6	119.6	10.0	44.5	40.8	9.1	106.1	123.3	-13.9	1184.3	1192.6	-0.7
94-95	999.2	906.8	10.2	121.5	119.6	1.6	53.1	41.1	29.2	123.5	123.2	0.2	1297.3	1190.7	9.0
95-96	904.5	904.7	0.0	117.8	119.9	-1.8	37.4	40.8	-8.3	94.9	123.9	-23.4	1154.6	1189.3	-2.9
96-97	927.6	905.7	2.4	128.0	120.8	6.0	21.0	40.6	-48.3	118.9	123.2	-3.5	1195.5	1190.3	0.4

97-98	927.4	908.6	2.1	187.7	119.5	57.1	44.1	41.9	5.3	132.3	128.3	3.1	1291.5	1198.3	7.8
98-99	945.2	903.6	4.6	178.8	121.8	46.8	28.4	42.8	-33.6	123.1	130.6	-5.7	1275.5	1198.8	6.4
99-00	866.9	903.2	-4.0	144.7	121.8	18.8	43.1	42.5	1.4	128.8	129.5	-0.5	1183.5	1197.0	-1.1
00-01	833.7	902.3	-7.6	64.1	121.7	-47.3	16.2	42.2	-61.6	129.7	129.3	0.3	1043.7	1195.5	-12.7
01-02	826.0	901.1	-8.3	137.7	121.7	13.1	35.0	41.2	-15.0	121.5	132.0	-8.0	1120.2	1196.0	-6.3
02-03	737.1	911.7	-19.2	83.4	123.7	-32.6	53.2	38.3	38.9	107.7	131.7	-18.2	981.4	1205.4	-18.6
03-04	947.3	902.7	4.9	134.6	125.0	7.7	34.5	39.2	-12.0	161.6	129.6	24.7	1278.0	1196.5	6.8
04-05	779.6	893.3	-12.7	111.8	125.7	-11.1	69.8	43.8	59.0	124.7	134.5	-7.3	1085.9	1197.3	-9.3
05-06	879.3	892.5	-1.0	138.4	125.8	10.0	27.8	43.9	-37.0	139.9	134.6	3.9	1185.4	1196.8	-1.0
06-07	886.6	892.2	-0.6	99.3	125.9	-21.1	34.3	43.8	-21.7	112.8	133.6	-15.6	1133.0	1195.5	-5.2
07-08	936.9	892.2	5.0	85.4	125.9	-32.2	42.6	43.2	-1.4	115.3	133.5	-13.6	1180.2	1194.8	-1.2
08-09	873.2	892.2	-2.1	87.2	125.9	-30.7	23.6	43.8	-46.1	91.0	134.5	-32.3	1075.0	1196.4	-10.1
09-10	689.8	892.2	-22.7	135.5	125.9	7.6	24.6	43.8	-43.8	122.9	137.7	-8.1	972.8	1195.6	-18.6

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation

A-Actual, N- Normal, Δ- Percentage Change

Uncertainty and inadequacy are the fundamental characteristics of the Indian monsoon. Variations in the monsoon affect the agricultural production. The first major setback in the rainfall is observed in 2000-01 i.e. -12.7 per cent. And this is the beginning of the agrarian crisis and the spate of farmers suicides in several states of the country. The following years have been shows the decrease in rainfall in proportionate to normal. Which further aggravate the crisis in India. Conflicts arising from man-made drought are on the rise. Deforestation does enormous damage. Villagers are increasingly losing control over the common water resources. A process of privatization of water resources is apparent in most of the real drought areas. There are now two kinds of droughts; the real and the rigged. Both can be underway at the same time and in the same place. The farming community was suffered badly through the institutional and natural factors in recent past which is the root cause of the agrarian crisis and thereby farmers suicides in countryside.

Table- 03 Area, Production and Yield of Food grains along with Irrigation Coverage 1950-51 to 2010-11

Year	Area	% change	Production	% change	Yield	% change	Area under irrigation
1950-51	97.32	--	50.82	--	522	--	18.1
1951-52	96.96	-3.41	51.99	2.250	536	2.61	18.4

1952-53	102.09	7.11	59.2	12.17	580	7.58	18.1
1953-54	109.07	15.46	69.82	15.21	640	9.37	18.1
1954-55	107.86	6.73	68.03	-2.63	631	-1.42	18.4
1955-56	110.56	13.00	66.85	-1.76	605	-4.29	18.5
1956-57	111.14	11.66	69.86	4.30	629	3.81	18.2
1957-58	109.48	7.96	64.31	-8.63	587	-7.15	19.3
1958-59	114.76	19.36	77.14	16.63	672	12.64	18.7
1959-60	115.82	16.73	76.67	-0.613	662	-1.51	18.8
1960-61	115.58	15.37	82.02	6.52	710	6.76	19.1
1961-62	117.23	18.63	82.71	0.83	706	-0.56	19.1
1962-63	117.84	18.35	80.15	-3.19	680	-3.82	19.8
1963-64	117.42	17.06	80.64	0.60	687	1.01	19.8
1964-65	118.11	18.69	89.36	9.75	757	9.24	20.2
1965-66	115.1	12.48	72.35	-23.51	629	-20.34	20.9
1966-67	115.3	15.47	74.23	2.53	644	2.32	22.2
1967-68	121.42	26.46	95.05	21.90	783	17.75	21.6
1968-69	120.43	19.60	94.01	-1.10	781	-0.25	23.6
1969-70	123.57	26.11	99.5	5.51	805	2.98	23.7
1970-71	124.32	24.92	108.42	8.22	872	7.68	24.1
1971-72	122.62	21.23	105.17	-3.09	858	-1.63	24.5
1972-73	119.28	16.47	97.03	-8.38	813	-5.53	25.4
1973-74	126.54	32.27	104.67	7.29	827	1.69	24.5
1974-75	121.08	16.57	99.83	-4.84	824	-0.36	26.5
1975-76	128.18	33.71	121.03	17.51	944	12.71	26.5
1976-77	124.36	21.28	111.17	-8.86	894	-5.59	27.4
1977-78	127.52	29.99	126.41	12.05	991	9.78	27.7
1978-79	129.01	30.16	131.9	4.16	1022	3.03	28.8
1979-80	125.21	22.17	109.7	-20.23	876	-16.66	30.3
1980-81	126.67	27.82	129.59	15.34	1023	14.36	29.7
1981-82	129.14	31.052	133.3	2.78	1032	0.87	29.6
1982-83	125.1	21.87	129.52	-2.91	1035	0.28	30.8
1983-84	131.16	35.78	152.37	14.99	1162	10.92	30.9
1984-85	126.67	23.12	145.54	-4.69	1149	-1.13	31.9
1985-86	128.02	29.07	150.44	3.25	1175	2.21	31.4
1986-87	127.2	26.55	143.42	-4.89	1128	-4.16	32.6
1987-88	119.69	13.41	140.35	-2.18	1173	3.83	33.5

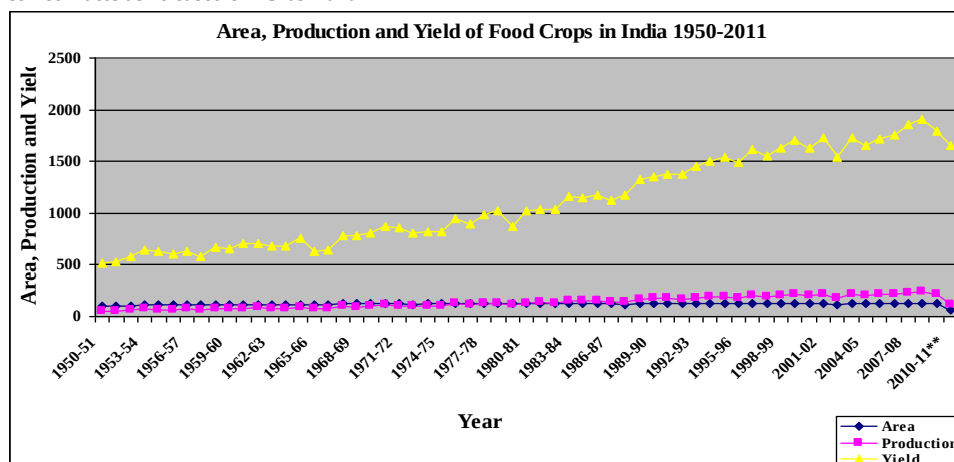
1988-89	127.67	33.92	169.92	17.40	1331	11.87	34.4
1989-90	126.77	26.06	171.04	0.65	1349	1.33	35.0
1990-91	127.84	28.67	176.39	3.03	1380	2.24	35.1
1991-92	121.87	16.97	168.38	-4.75	1382	0.14	37.4
1992-93	123.15	24.18	179.48	6.18	1457	5.14	37.4
1993-94	122.75	22.42	184.26	2.59	1501	2.93	38.7
1994-95	123.86	24.75	191.5	3.78	1546	2.91	39.6
1995-96	121.01	18.65	180.42	-6.14	1491	-3.68	40.1
1996-97	123.58	25.65	199.44	9.53	1614	7.62	40.0
1997-98	123.85	24.06	192.26	-3.73	1552	-3.99	40.8
1998-99	125.17	26.22	203.61	5.57	1627	4.60	42.4
1999-00	123.1	21.41	209.8	2.95	1704	4.51	43.9
2000-01	121.05	19.35	196.81	-6.60	1626	-4.79	43.4
2001-02	122.78	24.18	212.85	7.53	1734	6.22	43.0
2002-03	113.86	6.025	174.77	-21.78	1535	-12.96	42.8
2003-04	123.45	31.21	213.19	18.02	1727	11.11	42.2
2004-05	120	17.12	198.36	-7.476	1652	-4.53	44.2
2005-06	121.6	22.91	208.6	4.90	1715	3.67	45.5
2006-07	123.71	25.41	217.28	3.99	1756	2.33	46.3
2007-08	124.07	24.36	230.78	5.84	1860	5.59	46.8
2008-09	122.83	21.82	234.47	1.57	1909	2.56	NA
2009-10*	121.37	20.16	218.2	-7.45	1798	-6.17	NA
2010-11**	69.05	-106.72	114.63	-90.35	1660	-8.31	NA

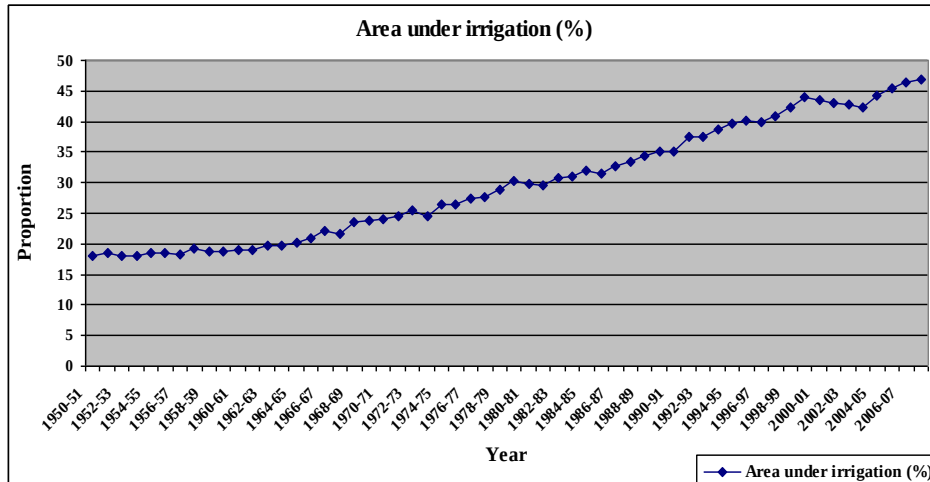
Source: Directorate of Economics and Statistics, Department of Agriculture and Co-operation

Area- Million Hectare, Production- Million Ton, Yield- Kg/ per hectare

* Fourth advance estimates released on 10-07-2010,

** First Advance Estimates as released on 23-09-2010





The data in the above table revealed the area production and yield for the period of 1951 to 2011. Initially the plan target i.e. first five year plan was food security. And we received the success more than level of expectation. But during the 1960s the situations of food-grains became worst. During that period the Indian agriculture was introduced with the new technological innovation i.e. the Green Revolution. Which has resultant impact on the crop productivity and it increased substantially. Irrigation is the key factor for the agricultural development. At the initial stage only 18.1 per cent of the total area under food-grains had irrigation coverage which was increased later but very slowly. At present 46.8 per cent of the total area under food crops is under irrigation. Still 54.2 per cent of the area is out of the purview of institutional and individual irrigation. This is the obstacle in the 11th five year plan goal of food security. After the implementation of the new policy during the mid 60s there were a boost in the agricultural production and thereby productivity. Till the late 1980s the crop productivity increased substantially. But during the period of new economic reforms and WTO amendment the production of food-grains has been volatile. Further the situation became worse during East Asian Economic Crisis in 1996-97. Another reason of the deceleration or mere stagnancy in the food grains production is the fundamental Law of Returns. According to the law; at the initial stage of production all factors of production are efficient hence there is incremental trend in production. As a time passes, the sector experiences a stagnation and thereby deceleration due to the over exploitation of technology and natural resources. The law is applicable for the agriculture sector. In India, the boom in agriculture sector during the period of 1970-1990 was the resultant impact of green revolution of 1966. After 1991 the agriculture sector faced the stagnation and since 2003 the agricultural production decelerated considerably. And the country

experienced the food insecurity and thereby food price inflation which has almost crossed the limit of 18 per cent. Hence now the policy makers are thinking about the second green revolution which is expected to give the sustainable food security.

Table- 04 Minimum Support Price for Major Agricultural Commodities

Commodity	Variety	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Kharif Crops								
Paddy	Common	560	570	580^	850	850	950&	1000
	Grade 'A'	590	600	610^	880	880\$	980	1030
Jowar	Hybrid	515	525	540	600	840	840	880
	Maldandi	-	-	555	620	860	860	900
Bajra		515	525	540	600	840	840	880
Maize		525	540	540	620	840	840	880
Ragi		515	525	540	600	915	915	965
Arhar(Tur)		1390	1400	1410	1550	2000	2300	3000
Moong		1410	1520	1520	1700	2520	2760	3170
Urad		1410	1520	1520	1700	2520	2520	2900
Cotton	F-414/H-777/J34	1760	1760	1770	1800	2500	2500	2500
	H-4	1960	1980	1990	2030	3000	3000	3000
Groundnut In Shell		1500	1520	1520	1550	2100	2100	2300
Sunflower Seed		1340	1500	1500	1510	2215	2215	2350
Soyabean	BLACK	900	900	900	910	1350	1350	1400
	YELLOW	1000	1010	1020	1050	1390	1390	1440
Sesamum		1500	1550	1560	1580	2750	2850	2900
Nigerseed		1180	1200	1220	1240	2405	2405	2450
Rabi Crops								
Wheat		640	650\$	750	1000	1080	1100	--
Barley		540	550	565	650	680	750	--
Gram		1425	1435	1445	1600	1730	1760	--
Masur (Lentil)		1525	1535	1545	1700	1870	1870	--
Rapeseed/Mustard		1700	1715	1715	1800	1830	1830	--
Safflower		1550	1565	1565	1650	1650	1680	--
Toria		1665	1680	1680	1735	1735	1735	--
Other Crops								
Copra	Milling	3500	3570	3590	3620	3660	4450	4450
(Calender Year)	Ball	3750	3820	3840	3870	3910	4700	4700
De-Husked Coconut		-	-	-	-	988	1200	1200
Jute		890	910	1000	1055	1250	1375	1575
Sugarcane@		74.50	79.50	80.25	81.18	81.18	129.84	139.12
Tobacco(Vfc)	Black Soil(F2 Gr)	32.00	32.00	32.00	32.00	-		
(Rs. per kg.)	Light Soil (L2 Gr)	34.00	34.00	34.00	34.00	-		

Source: Directorate of Economics and Statistics, Ministry of Agriculture and Co-operation

The minimum support price is declared by the CACP on the basis of cost of cultivation and the recommended support price by the state governments. The thrust of the price mechanism is to give a remunerative returns to agricultural commodities. The situation of open market operations for agricultural commodities is always fluctuating which have the adverse impact on the returns from the agricultural operations. While declaring the support prices for agricultural commodities it is expected that the market prices should be above the support price. And whenever the market price is below the support price the government will enter the market for the procurement. Basically the methodology of accounting of cost of cultivation is not beyond doubt. Due availability of the factors of production the cost of cultivation may vary but the accounting mechanism doesn't consider it. The transportation cost is only considered for the crops of Sugarcane and Jute. The cost of transportation is substantially higher for the Cotton due to the time lagging at government procurement centers. As a result the support price is benefited for the less and incurred losses for the large section of farming community. The average gap between the cost of cultivation and support prices for the year 2005-06 was about 38 to 50 per cent. However the gap between the recommended prices from state government and price announced by CACP is around 50 to 55 per cent. It means center announced the support price below the recommended prices by the states. During the field visit for the collection of primary data for the present study we observed that around 80 per cent of the surveyed farmers are unaware of the Minimum Support Price mechanism. For the year 2010-11 the support price for Cotton is Rs.3000/- per quintal and market price during the period is observed around Rs.4500/-. The fact is that the difference between the support and market prices is due to the decline in the production of Cotton. The cost of cultivation of Cotton is around Rs.4000/-. It means the cost of cultivation and support price have no positive relationship. The declining returns from agriculture and increase in cost of cultivation resulted in to increase in indebtedness of farmers.

Table- 05 Income, Expenditure and Indebtedness of Farmer Households: July 2002-June 2003 (Rs.)

State	Annual cultivation income	Annual total income	Annual cultivation expenditure	Annual total expenditure	(2) – (4)	(3) – (5)
1	2	3	4	5	6	7
Andhra P.	8916	19608	12085	28632	-3169	-9024
Assam	21504	37932	3370	32568	18134	5364
Bihar	10152	21720	6809	29508	3343	-7788

Gujarat	13968	32208	11456	37524	2512	-5316
Haryana	17928	34584	18270	52963	-342	-18384
J & K	29112	65856	6342	49308	22770	16548
Karnataka	15192	31392	10344	31296	4848	96
Kerala	13440	48048	7793	51000	5647	-2952
M. P.	11952	17160	8886	28068	3066	-10908
Maharashtra	15156	29556	10793	32268	4363	-2712
Orissa	4032	12744	3143	20364	886	-7620
Punjab	33864	59520	25945	58080	7919	1440
Rajasthan	4308	17976	7668	39456	-3360	-21480
Tamil Nadu	7908	24864	8597	30072	-689	-5208
U. P.	10032	19596	9151	34788	881	-15192
West Bengal	8844	24948	8429	32016	415	-7068
All-India	11628	25380	8791	33240	2837	-7860

Source: NSSO (2005a & 2005c)

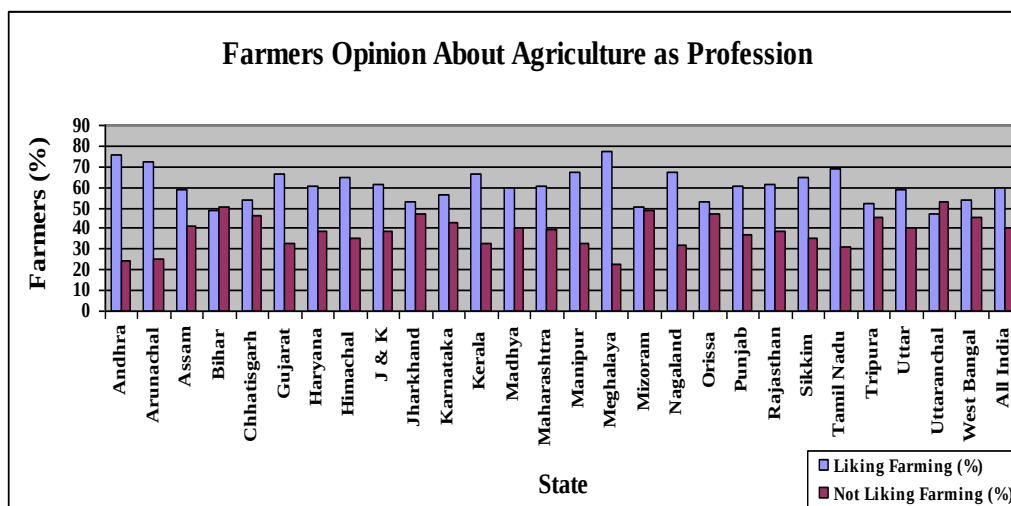
Looking at the prospects of profitability of farmers through comparison between the annual cultivation expenditure and the annual income from cultivation, the prevalence of crisis in rural countryside of India comes out vividly. Deducting the all India household average annual income from cultivation (Rs.11628.00) from the annual household cultivation expenditure (Rs.8791.00) the average household net income remains Rs.2837 which is available for the family consumption and maintenance. In states like Andhra Pradesh, Haryana, Rajasthan and Tamil Nadu the annual average net income is negative. And in states of Orissa, Uttar Pradesh and West Bengal the average annual net income from cultivation is less than Rs.1000 per farm household. When calculated the farm household annual net balance comparing the annual total income and annual consumption expenditure the picture becomes further worst. This clearly supports the observation that something is terrible in rural countryside of India. It means the cost of cultivation rises sharply but the minimum support price mechanism has failed to give remunerative prices to the agriculture produce. Increased gap between income and expenditure forced farmers to borrow from private sources to fulfill this gap. Due to the inadequate institutional credit support farmers resorted to private moneylenders who charged heavy rates of interest. In all, these vagaries accumulate debt and it goes beyond the repaying capacity of farmers.

Table- 06 Farmers Opinion about Agriculture as Profession

States	Liking farming (%)	Not liking farming		Total (%)
		Not Profitable (%)	Other (%)	
Andhra Pradesh	75.4	16.7	7.5	24.2
Arunachal Pradesh	72.1	10.7	14.3	25
Assam	59	21.2	19.7	40.9

Bihar	48.6	35.5	15.3	50.5
Chhatisgarh	53.7	24.2	22.1	46.3
Gujarat	66.8	25.4	7.5	32.9
Haryana	60.3	29.9	8.4	38.3
Himachal Pradesh	64.6	18.4	16.7	35.1
J & K	61.5	20.9	17.6	38.5
Jharkhand	52.8	30.2	16.8	47
Karnataka	56.7	27.9	15.4	43.3
Kerala	66.6	27.9	5.1	33
Madhya Pradesh	59.5	21.4	18.9	40.3
Maharashtra	60.7	28.6	10.7	39.3
Manipur	67.4	28.2	4.2	32.4
Meghalaya	77.4	15.2	7.4	22.6
Mizoram	50.8	34.1	14.6	48.7
Nagaland	67.6	26.8	4.5	32.3
Orissa	53.1	33.8	12.9	46.7
Punjab	60.8	27.2	9.7	36.9
Rajasthan	61.2	21.5	17.3	38.8
Sikkim	64.6	30.2	5.2	35.4
Tamil Nadu	68.9	25	6	31
Tripura	52.5	20.2	25.1	45.3
Uttar Pradesh	58.8	24	16.5	40.5
Uttaranchal	46.8	42.3	10.9	53.2
West Bengal	53.8	35.4	10.1	45.5
All India	59.4	26.5	13.6	40.1

Source: NSSO (2005 a; 2005b)



Farmers in India have perhaps reported willingness at first to leave agriculture as a profession provided that the substitute way of livelihood is available mainly because that the cultivation is no more remunerative. Overall proportion of the negative desire is of 40.1 per cent with Uttaranchal, West Bengal, Tripura, Uttar Pradesh, Karnataka, Maharashtra, Haryana and Andhra Pradesh leading the list. All the states from where farmers don't prefer agriculture is because it is

not profitable to them due to increased cost of cultivation, stagnated productivity and mismatch between input and output prices.

Conclusion

The foregoing analysis on the agrarian relations clearly indicates that the relationship between environmental degradation and the agrarian crisis is reciprocal. Without using the chemical fertilizers and pesticides country could not achieve the target of food grains security. But it is widely acknowledged that the excessive use of fertilizers is harmful to the ecology as well as human being. The cropping pattern should be designed as per the suitable agro climatic conditions. Nonetheless, inadequate cropping education and extension services the majority of farmers had undertaken the mono cropping pattern for which the cost has gone up due to the declining returns to scale. The poor performance of the extension and support services to the agriculture also aggravates the situation. Hence these services should be strengthening. Post green revolution extensive use of nitrogen fertilizers and the chemicals for Integrated Pest Management had resultant impact on declining soil fertility and increase in cost of cultivation. The eleventh plan which has expected 8.5 per cent of annual growth rate with 10 per cent for the last two years plus 4 per cent of the growth of agriculture with an inclusion of all has already been proved to be difficult to achieve. Hence, unless the plan incorporates the rural and farming classes with policy intervention on the one front and special targeting of agriculture on the other it will not be possible like the earlier plan targets to achieve. Planned shift in cropping pattern according to the agro climatic conditions can improve productivity of land and labour which will reduce the cost of cultivation and improve the situation emerging out of declining returns to scale from agriculture. Development of rural and agro based industries along with policy for allied activities like animal husbandry and promoting policies of extension facilities and the rural non farm sector can help to include farmers in the mainstream activity shall divert dependence from agriculture and promote the aimed objective of inclusive growth in years to come.

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Biodiversity and Environment

A.G. Devi Prasad*

Biodiversity is defined as species richness of a habitat. It is sum total of genes, species, populations and ecosystems. It is also defined as “all hereditary based variations at all levels of organization, from the genes within a single local population or species, to the species composing all or part of a local community themselves that compose the living parts of the multifarious ecosystems of the world” [Edward O Wilson].

As the very name suggests, it refers to diversity in biological field. It could be defined as the number and variety of different species of organisms who are found within a specified geographic region. About 5-50 million species have been estimated to be present on the biosphere of which only 1.7million species have been described to date (Groombridge and Jenkins, 2000) and the distribution is highly uneven. About 7% of the world’s total land area is home to half of the world’s species with the tropics alone accounting for 5million. India contributes significantly to this biodiversity.

Earth’s total surface area is 510,065,284 km² with a forest cover of 38.7 million sq.km. (26%), as on 2000 (Global forest resource assessment, FAO). Tropical forest covers about 17.6 million sq km. 40% of the global forest land is in South America, Africa and South Asia. Tropical forest covers about 40% of global forest land. Along with deciduous forest represent about 75% of all tropical forest and cover about 13.1million sq km (5 million square miles). India is one of the major centers of biodiversity with a land mass of only 2.4% of the world’s land area sharing about 12.53% of world’s biodiversity. India is the 7th largest country in the world and one among the 17 mega diversity centers.

Biodiversity is described at three levels or types, namely:

- 1] Genetic diversity.
- 2] Species diversity.
- 3] Ecosystem diversity.

Values of Biodiversity:

Biodiversity provides a variety of environmental services economic, social and ethical benefits. Human society relies on bio resources. Bio diversity provides food, fodder, fuel wood, timber, fruit, building material, medicine, energy and wide gene pool. Various values have been assigned to biodiversity though it is difficult to estimate the total value of biodiversity. It is not easy to assign values to biodiversity especially in terms of monetary values. The roles played by various species are many, complex and often hidden or insufficiently understood by humans.

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Role of biodiversity:

Biodiversity in India particularly, is important for its religious, spiritual, ecological and other cultural uses. These values are briefly discussed as follows-

- Every species of biodiversity plays an important role in the functioning of an ecosystem. A species may be a producer, consumer, or decomposer. The species help in nutrient recycling, soil erosion control, regulation of climatic changes etc. The normal functioning of an ecosystem is due to biodiversity. It is an indicator of healthy, stable ecosystem. Biodiversity is helpful in efficient organic residue management (Microbial diversity play a significant role in soil microclimate).
- Many species of flora and fauna have ritual significance. In many parts of the country flowers are used as offerings to Gods and Goddesses.
- Biodiversity is helpful in maintaining water cycle or hydrological cycle.
- Biodiversity plays a significant role in soil fertility management. The humus, mineral content, soil erosion, soil hydrology etc are being mainly regulated by microbial diversity.
- Biodiversity contributes for reduction of all kinds of pollution that possibly occur due to anthropogenic activities.
- Biodiversity offers considerable scope for its utilization in research and education.
- Biodiversity has rich potential medicinal properties which is being used by people at various places. There traditional, ecological knowledge and religious practices have helped in protecting many of the species. Sacred group is one such outcome for conserving biodiversity.
- Biodiversity is used as raw materials for scientific activities.

Threats to Biodiversity:

- Deforestation and overgrazing.
- Habitat destruction and fragmentation of the area.
- Poaching and hunting for flesh, fur, skin, horn, nail and recreation.
- Forest fires including smoking in the woods.
- Over-exploitation of the resources.
- Natural calamities like floods, high wind velocities, earthquakes, etc.
- Pollution of various kinds and release of toxic substances.

- Soil erosion and loss of soil nutrients.
- Population pressure and unequal distribution of the resources.
- Agricultural expansion.
- Spreading urbanization and establishment of industries.

Impact of Biodiversity Reduction:

- The loss or reduction of biodiversity has a significant impact on global climate resulting in global warming and climate change. Climate change will impinge on the sustainable development of most developing countries of Asia-Pacific. Global climate would be affected due to the removal of rainforests.
- Glacier melt in the Himalayas is projected to increase flooding, and rock avalanches from destabilized slopes, and to affect water resources within the next two to three decades.
- Freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease, could adversely affect more than a billion people by the 2050s.
- Endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected to rise in East, South and South-East Asia.
- Increases in coastal water temperature would exacerbate the abundance and/or toxicity of cholera in South Asia.
- Polar ice is melting and sea levels are rising at double the rate of 50 years ago. Current sea level rise has occurred at a mean rate of 1.8 mm per year for the past century and more recently at rates estimated near 2.8 to 3.1 mm per year.
- Millions of people around the globe threatened with water shortages, hunger and poverty.
- Distribution of the climatic regions and ocean currents would be changed.
- Pests could become more active and grow faster.
- Over the last 100 years, the global sea level has risen by about 10 to 25 cm. Regarding the increase in temperature, one study put the minimum at 1.5°C and maximum at 4.5°C or 6.2°C and another study puts the minimum at 2.5°C

What can we do to solve the problems of global warming and climate change?

- Use “cleaner energy”.
- Forestation.
- Use less air conditioner.
- Turn off the light when leaving the room.
- Take public transport.
- Restore a damaged environment.

Impact of Climatic Changes on Nutritional and Health Status

Rajkumar M. Kamble*

Abstract

Climatic favorable changes are the key factor in better living status of the population on geographical planet. Whereas quality of life is depend on the standard of living status including health and nutritional status. However, the climatic changes are both desirable and undesirable which affects the living status of the family and community. Its impact especially affects on the health and nutritional status of vulnerable segment of the population. Most of the research studies are crossly examined the impact of climatic changes on the living status of the population. Agricultural produces, food security, socio-economic status, malnutrition, nutrition life cycle, infectious diseases of human health are the major threats affected due to climatic variations. Hence, it is emerging issues to study the directives in relation with reducing the unfavorable climatic conditions, improving the nutritional and health status and strengthen the quality of life. Climatic drastic change is now global challenge of this century. The climatic changes broadly in relation with sun's output, earth's peripheral, volcanic eruptions, drifting continents, reduction in ozone layers due to greenhouse gases. Increased level of CO₂ directly correlates with rising climatic temperature by 0.7°C since 1950; which results into ice melting and increasing sea level by 25-40 meters higher than today (Tripathi, et.al. 2009). Impact of climate change is directly affects physical and biological cycles in the ecology and particularly on human health. The rate of hospitalization is increased by 7 per cent (Checkley et.al. 2008) majorly due to malnutrition, diarrhoea, malaria, dengue fever etc.

How Environmental Process Affects:

Natural environmental process is disturbed by many ways. However this processes is decreased mainly due to human pressure on environment and man created problems.

- i. Human pressure in terms of :
 - a. Increased urbanization
 - b. Decreased biodegradation

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ii. Human created problems in relation with –

- a. Increased population size
- b. Increased un eco-friendly activities
- c. Increased uncultured practices

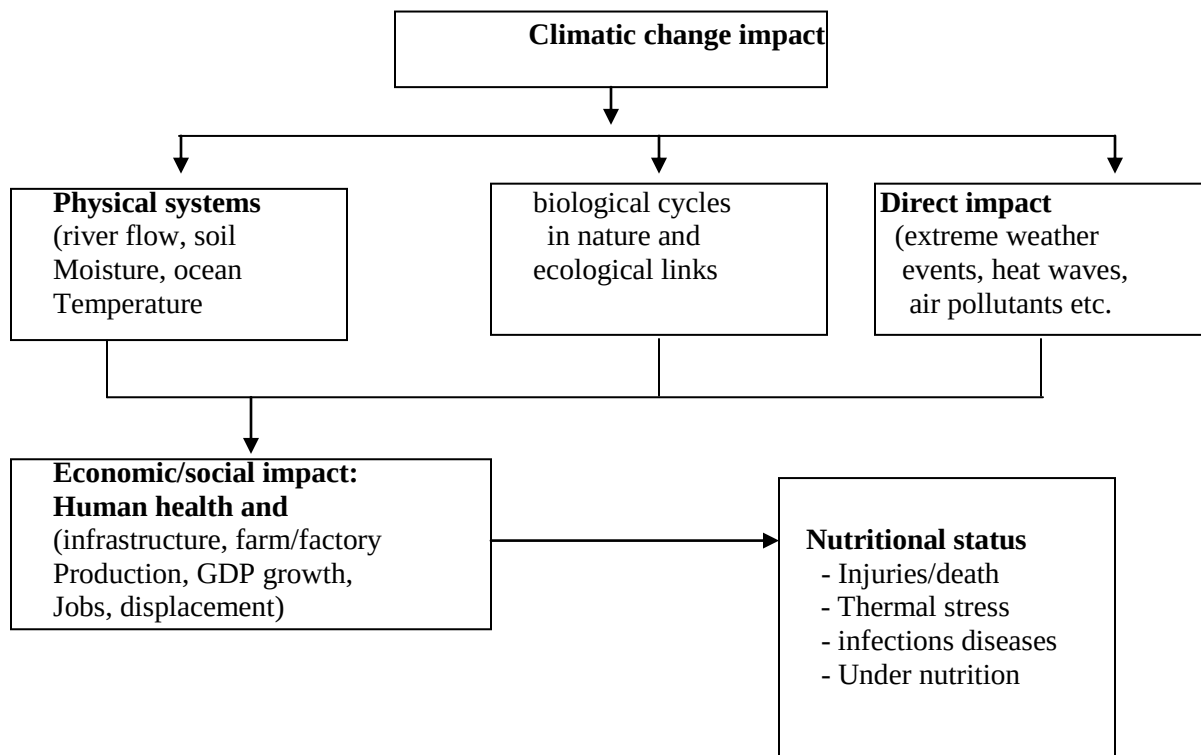
How Disturbed Environmental Process Affects?

The disturbed environmental process by different ways is affects on mainly:

- a) Meteorological conditions
- b) Water level
- c) Food production
- d) Ozone layer protection
- e) Microbial activities
- f) Extreme weather events

Thus factors further results on mostly the health and nutritional status of the family and community.

Impact of Climate Change on Health and Nutritional Status



A) Impact of climate change on food security

Food security has deteriorated since 1995 and reduction in malnutrition is proceeding too slowly to meet the millennium development goal target for having hunger by 2015. Food security has four dimensions

- i) Food availability
- ii) Access food
- iii) Stability of supply
- iv) Access and safe and healthy food utilization

It is a key factor in good nutrition along with health, sanitation and care practices. Globally one billion people are currently without access to safe water and over 2 billion lack of adequate sanitation facilities. Present global scenario of food supplies are more than to provide everyone with all the needed calories, if the food were equally distributed. But over 820 million people in developing countries have calorie deficient (Cohen, et.al. 2008, FAO).

Impact of Climate Change on Agricultural Production

Increased temperature and altered rainfall pattern may result in increased losses of soil minerals with large uncertainty and complexities in mineral availability and plant mineral nutrition (Sinclair, 2013). It also affects on decreased photosynthesis activities in plants which reflects on abiotic stress in plants and decreased food production and reduces agricultural resilience. Increased frequency of extreme climatic events increases the sea water level, flooding of coastal lands which leads to salination and contamination of water and agricultural land. It directly results on plants and animal physiology and disease. It damage to forestry, livestock, fisheries and aquaculture.

Impact of Climate Change on Malnutrition

Climate change will tend to reduce global agriculture production, increase food prices and intensity the risk of hunger and malnutrition. The number of people at risk of hunger is projected to increase by 10-20 per cent by 2050 as a consequence of climate change (Martin Parry et.al. 2009). Children are in a rapid stage of growth and formation with evolving physical and cognitive functions. The environment has long been recognized as a crucial determinant of child survival and health the children especially susceptible to air, water quality, temperature, humidity and vector born infections due to their developed physiology and immunity. Deprivations such as poor nutrition are irreversible by the age of 24 months and have lifelong cognitive, physical and reproductive repercussions for children. Longer floods and droughts leads to more intense of food scarcity which diminish dietary diversity, reduce overall food consumption. It further results into malnutrition and reflects on a new nutrition life cycle (UNICEF, 2008).

Impact of Climate Change on Human Health

Climate change will affect human health in many ways. Health extreme weather events lead to thermal stress and infectious diseases. The risk of flooding may increase in the number of people exposed to diarrhoeal and other infectious diseases. Increased frequency of cardiovascular respiratory diseases due to heat waves, storms, droughts and decreased immunity due to malnutrition.

Conclusion

Climate change is projected to affect the health and nutritional status of the vulnerable population in the family and community. Millions of people particularly those with low adaptive capacity are suffer more due to increased malnutrition and consequent disorders with implications for child growth and development as well as through increase in diarrhoeal disease. Malnutrition linked to extreme climatic events may be one of the most important health consequences of climate change. Agricultural production including access to food is projected to be severely compromised by climate variability which further adversely affects food security and exacerbate malnutrition.

For coping with these serious problems, agriculture, food, nutrition issues needs to be placed effectively in the agendas of proper policies. Increased awareness about adoption, mitigation, finance, technology and capacity building and policy coherence in future to prevent the risks and strengthen the quality of life of both human as well as climate.

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Effects of Global Warming On Human Being

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Abstract

In recent years there has been a great scientific and public debate on global warming and its direct as well as indirect effects on human health. According to World Health Organization (WHO, 2006), some 2.5 million people die every year from non-infectious diseases directly attributable to environmental factors such as air pollution, stressful conditions in the workplace, exposure to chemicals such as lead, and exposure to environmental tobacco smoke. Changes in climatic conditions and climate variability can also affect human health both directly and indirectly, via changes in biological and ecological processes that influence the transmission of several infectious diseases (WHO, 2003). In the past fifteen years a large amount of research on the effects of global warming on human health has addressed two fundamental questions (WHO, 2003).

Introduction

Global warming means an increase in the average temperature of the atmosphere, oceans, and landmasses of Earth. In recent years there has been a great scientific and public debate on global warming and its direct as well as indirect effects on human health. According to World Health Organization (WHO, 2006), some 2.5 million people die every year from non-infectious diseases directly attributable to environmental factors such as air pollution, extreme weather events, stressful conditions in the workplace, exposure to chemicals such as lead, and exposure to environmental tobacco smoke. In particular, lead exposure has been estimated to account for 2 percent of the ischaemic heart disease burden and 3 percent of the cerebrovascular disease burden (WHO, 2003). Exposure to outdoor air pollution accounted for approximately 2 percent of the global cardiopulmonary disease burden (WHO, 2003). In the US, about 12 percent of the ischaemic heart disease burden has been related to occupation, for the age group 20-69 years. This estimate has been based on the specific risk factors of job control, noise, shift work and environmental tobacco smoke at work (Steenland et al., 2003). In Finland, it has been estimated that occupational risks account for 17 percent of the deaths from ischaemic heart disease, and 11 percent of those from stroke (Nurminen and Karjalainen, 2001). In Denmark, the occurrence of cardiovascular diseases is related to the type of occupation.

Keywords: Global warming, Climate change, Health, Non-infectious diseases, Infectious diseases.

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Specifically, a reduction of 16 percent in the cardiovascular disease burden can be attributable to men (women) with non-sedentary occupations (Olsen and Kristensen, 1991). Global warming and climate variability represent a further factor which can affect human health directly or indirectly via changes in biological and ecological processes that influence the transmission of several infectious diseases (WHO, 2003). Direct effects on human health include, for example, thermal stresses due to increased frequency and intensity heat waves (cardiovascular and respiratory diseases, heat exhaustion), and deaths and injuries due to extreme weather events. Indirect effects include malnutrition, food- water- and vector-borne diseases, together with increased morbidity due to the combined effect of exposure to high temperature and air pollution.

Empirical evidence suggests that malaria varies seasonally in highly endemic areas and is probably the vector-borne disease more sensitive to long-run climate changes. For example, the comparison of monthly climate and malaria data in highland Kakamega, Western Kenya, highlights a close association between malaria transmission and monthly maximum temperature anomalies over the years 1997-2000 (Githeko and Ndegwa, 2001). The effects of soil moisture to determine the causal links between weather and malaria transmission has been studied by Patz et al. (1998). For the most common mosquito species *Anopheles gambiae*, the soil moisture predicts up to 45 percent and 56 percent of the variability of human biting rate and entomological inoculation rate, respectively. The link between malaria and extreme climatic events has long been the subject of study on the Indian subcontinent as well as in various other countries. Early in the twentieth century, the Punjab region experienced periodic epidemics of malaria. Excessive monsoon rainfall and the resultant high humidity were clearly identified as major factors in the occurrence of malaria epidemics. More recently, time-series analyses have shown that the risk of a malaria epidemic increased approximately five-fold during the year following an El Niño event in the Indian region (Bouma and van der Kaay, 1994). Furthermore, a strong correlation is found between both annual rainfall and the number of rainy days and the incidence of malaria in most districts of Rajasthan and in some districts in Gujarat (Akhtar and McMichael, 1996). The relationship between reported malaria cases and El Niño has also been documented for Venezuela, where, during the whole twentieth century, malaria rates increased on average by over one-third in the year immediately following an El Niño event (Bouma and Dye, 1997). However, it is widely acknowledged that global warming are only one of many important factors

influencing the incidence of infectious diseases and that their effects are very unlikely to be independent of socio-demographic factors (e.g. human migrations, transportation, nutrition), or of environmental influences (e.g. deforestation, agricultural development, water projects, urbanization). In particular, it has been estimated that about 42 percent of the global malaria burden, or half a million deaths annually, could be prevented by environmental management, although this proportion varies significantly across different regions: it is 36 percent in the Eastern Mediterranean Region; 40 percent in the Western Pacific Region; 42 percent in sub-Saharan Africa; 42 percent in the South-East Asia Region; 50 percent in the European Region; 64 percent in the Region of the Americas (WHO, 2006). Nevertheless, in the past fifteen years a large amount of research on the effects of global warming on human health has addressed two fundamental questions (WHO, 2003).

Objective

Assess effects of global warming on human being.

Data used

The data used in this study is obtained from primary as well as secondary sources.

Results and Discussions

This paper has focused on the critical evaluation of recent assessments of health risks associated with global warming. The main contribution of this paper is to offer an integrated vision of the main scientific conclusions on the effects of global warming on human health, which are supported by the use of formal analyses.

As far as more extensive reports on this subject are concerned, this specific classification has been found difficult to apply, since several contributions of this kind compare analyses of different data. Therefore, we have chosen to avoid any predetermined classification, and to concentrate on the relevant findings of each outlook.

Global warming is already affecting human health, livelihoods, safety, and society and the expectation is that these effects will become greater. The climate impact is still difficult to assess with accuracy because it results from a complex interplay of factors. It is challenging to isolate the human impact of climate change definitively from other factors such as natural variability, population growth, land use and governance. In several areas, the base of scientific evidence is still not sufficient to make definitive estimates with great precision on the human impacts of climate change. However, data do exist which form a robust starting point for making estimates

and projections that can inform public debate, policy-making and future research. Global warming aggravates existing problems, e.g. seasonal rainfall leading to floods or water scarcity during extended droughts. Global warming as a multiplier of these existing risks. For example, as the international community struggles to reduce hunger-related deaths, a warmer, less predictable climate threatens to further compromise agricultural production in the least developed countries, thereby increasing the risk of malnutrition and hunger. Think of a region suffering from water scarcity. That scarcity reduces the amount of arable land and thereby aggravates food security. The reduced crop production results in loss of income for farmers and may bring malnutrition. Health issues arise that could further diminishes economic activity as family members become too weak to work.

The definition of “being seriously affected” by global warming includes someone in need of immediate assistance in the context of a weather-related disaster or whose livelihood is significantly compromised. This condition can be temporary, where people have lost their homes or been injured in weather-related disasters, or permanent, where people are living with severe water scarcity, are hungry or suffering from diseases such as diarrhea and malaria. Below we give the current best estimates of the level of impact of climate on health and likely trends in those impacts.

An estimated 325 million people are seriously affected by global warming every year. This estimate is derived by attributing a 40 percent proportion of the increase in the number of weather-related disasters from 1980 to current global warming (climate change) and a 4 percent proportion of the total seriously affected by environmental degradation based on negative health outcomes. Gradual environmental degradation due to global warming has also affected long-term water quality and quantity in some parts of the world, and triggered increases in hunger, insect-borne diseases such as malaria, other health problems such as diarrhea and respiratory illnesses. It is a contributing factor to poverty, and forces people from their homes, sometimes permanently.

Intuitively, if someone is affected by water scarcity, poverty or displacement, this also translates into health outcomes and food insecurity. Typically, global warming today mostly affects areas already seriously suffering under the above mentioned factors. Likewise, health outcomes and food insecurity lead to displacement and poverty which might result in competition for scarce resources and strains on mostly already limited government capacity to deal with deteriorating conditions and might ultimately lead to conflict. Therefore health outcomes and food security are taken as the basis for all climate change related impacts. Using this approach, the update of

WHO Global Burden of Disease study shows that long term consequences of global warming affect over 235 million people today. Global warming is expected to increasingly impact food security, water availability and quality, and exact a toll on public health, spurring chronic disease, malaria prevalence, and cardiovascular and respiratory diseases.

Current weather conditions heavily impact the health of poor people in developing nations, and global warming has a multiplying effect. A changing climate further affects the essential ingredients of maintaining good health: clean air and water, sufficient food and adequate shelter. A warmer and more variable climate leads to higher levels of some air pollutants and increases transmission of diseases through unclean water and contaminated food. It compromises agricultural production in some of the least developed countries, and it increases the hazards of weather-related disasters.

Therefore global warming, together with the changes in food and water supplies it causes, can indirectly spur increases in such diseases as malnutrition, diarrhea, cardiovascular and respiratory diseases, and water borne and insect-transmitted diseases. This is especially worrisome because a massive number of people are already impacted by these diseases - for example upwards of 250 million malaria cases are recorded each year and over 900 million people are hungry today. Also, there is an inter-relationship among these health outcomes. For example malnutrition is linked with malaria and diarrhea which can cause significant weight loss in affected children when accompanied with food scarcity. Malaria and diarrhea can be both cause and effect of malnutrition. Malnutrition is the biggest burden in terms of deaths. Global warming is projected to cause over 150,000 deaths annually and almost 45 million people are estimated to be malnourished because of climate change, especially due to reduced food supply and decreased income from agriculture, livestock and fisheries. Climate change-related diarrhea incidences are projected to amount to over 180 million cases annually, resulting in almost 95,000 fatalities, particularly due to sanitation issues linked to water quality and quantity. Climate change-triggered malaria outbreaks are estimated to affect over 10 million people and kill approximately 55,000. Malaria is expected to increase as an effect of increased transmission windows in some regions and because a shift in transmission to new areas is expected.

Over 90 percent of malaria and diarrhea deaths are borne by children aged 5 years or younger, mostly in developing countries. Other severely affected population groups include women, the elderly and people living in small islands developing states and other coastal regions, mega-cities

or mountainous areas. These groups are the most affected due to social factors like gender discrimination, which can restrict women's access to health care, and age-based susceptibility as children and elderly often have weaker immune systems. Additionally, people living in certain geographic areas are more affected due factors such as high exposure to storms along coastlines, inadequate urban planning etc. Almost half the health burden occurs in the population dense Southeast Asia region with high child and adult mortality, followed by losses in Africa (23 percent) and the Eastern Mediterranean region. Overall, the per capita mortality rate from vector borne diseases (diseases like malaria that are transmitted by insects) is almost 300 times greater in developing nations than in developed regions (14 percent).

Conclusion

Humans have successfully adapted to environmental change over time, from evolving natural physiological responses to the use of science, technology, and knowledge to improve our lives and advance our health. From the dawn of the industrial age, people have made great strides in improving health, and enjoy a markedly improved quality of life. However, these improvements have come at a cost that must now be understood and addressed. Global warming will force humans to negotiate with their changing environment as never before to find ways to reshape it both for short-term protection and long-term alleviation of health consequences. There is no doubt that we have the capacity to find ways to avoid many of the worst health effects of global warming, and indeed, given the universality and potential magnitude of such effects, we have an ethical imperative to do so. The research needs described in this paper should guide the process, helping us to develop the proper tools and make informed choices that will ultimately result in better health and better lives for the citizens of the world.

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Climate Variability in Vizianagaram District of Andhra Pradesh

N. Appala Raju*, P. Suneetha** and S. Sachi Devi***

Abstract

The annual rainfall has large spatial and temporal variations. Over a given region, there are spells of good rainfall alternate with periods of little rain. Since rainfall plays a vital role in the economy of the district as it influences agriculture, an attempt has been made to study the inter annual variability of rainfall and to identify wet and dry years over a period of 107 years (1901-2007). Annual rainfall of each year is expressed as percent deviation from normal. The bars above the mean value shows the positive departures from the normal rainfall i.e., excess rainfall years. The bars below the mean value indicate negative deviations i.e., deficit of rainfall from normal. For the purpose of the present description of annual rainfall exceeding 125 percent of the normal considered as excessive rain or wet year. If the annual rainfall is less than 75 percent of the normal, it is treated as dry year. Annual rainfall of an individual year is classified as wet or dry when the percentage departure is above or below by 25 percent from normal rainfall. Six stations have been selected from the study area to examine the rainfall variability. Analysis of annual rainfall data was carried out to identify wet and dry years and results are presented in Fig 9 to 14. The large scale excess and deficit rainfall years have been identified for the stations under study. Since rainfall data was available for a quite long period of 107 years, the analysis was carried out for two climate periods, 1901-50 and 1951-2007.

Introduction

Climate change/variability affects everyone. But the worst sufferers would be hundreds of millions of small and marginal farmers and people depending upon agriculture. Indian agriculture is dependent on monsoon and as a result, there have been fluctuations in food production over the years. It has about 186 million. ha of arable land of which 57 percent is rain-fed. The average size of holding is only 1.84 ha and nearly 74.5 percent of the total holdings in the country one of this category posing a great challenge to enhance productivity and production with sustainability. Indian agriculture is required to produce 265 million tons of food grains to feed an estimated population of 1.4 billion in 2025 A.D. The inter annual variability of summer monsoon/southwest monsoon rainfall is well known. Parthasarthy and Mooley (1978), Sikka (1980) and Mooley (1997) have analyzed summer monsoon rainfall over India. Mohapatra (2004) has studied monsoon rainfall variability over Orissa.

Key Words: Climate, Rainfall, Wet years, Dry years and Departures

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Rainfall variability over Andhra Pradesh in relation to cyclonic disturbances was studied by Patnaik (2006). Vinod Kumar (2003) has correlated maximum and minimum temperatures with southwest monsoon rainfall over Gaya. Bhadram (2003) has analysed active and weak southwest monsoon over Andhra Pradesh. Variability of extreme rainfall in Maharashtra was examined by Gore and Potdar (2007). Spatio-temporal variability of summer monsoon rainfall over Chhattisgarh was studied by Mohanlal Sahu and Nandankar (2006). Guhathakurta et al (2005) have made a study on extreme rainfall analysis of Andhra Pradesh using a probability distribution model.

Methodology

Daily and monthly rainfall data have been collected for six Climatologically stations in Vizianagaram district of Andhra Pradesh (Fig.1) for a period of 107 years, from 1901 to 2007 from the publications of the India Meteorological Department. Daily rainfall data have been analyzed to identify extreme rainfall events. From monthly rainfall data, seasonal total (June to September) rainfall was obtained for each year and for each station under study. Rainfall intensity and variability have also been computed.

Discussion

Trend analysis of rainfall over India is reported by several researchers. Bland ford was the first to study the trends in rainfall over India. Mooley (1997) made detailed examination of rainfall series of India as a whole. Since monsoon plays a vital role in the economy of the district and also in the socio-economic conditions of the people, an attempt has been made to examine rainfall trends over a period of 107 years. Vizianagaram district belongs to semiarid type of climate (Dd) as per Thronthwaite's climatic classification. Annual rainfall varies from 1000 mm along the southern part of the district to more than 1200 mm in the northwest. The district receives 80 percent of its annual rainfall during southwest and northeast monsoons and crop production is highly influenced by the amount of rainfall. Hence, about 6 stations have been chosen for assessing rainfall trends over the study region (Fig.1).

Annual rainfall data have been analyzed and presented in Fig 2 to 7. The total study period is divided into two climatic periods, 1901–1950 and 1951–2007 and trend analysis was carried out for each climatic period. The temporal distribution of rainfall at Parvathipuram is shown in fig 2. It is observed that there is insignificant positive trend in annual rainfall during 1901-1950 since “R” value is 0.029 which is less than 0.5. The same trend is observed during the second climatic period, 1951-2007 also. Bobbili station exhibits slight negative trend during both the climatic periods (Fig3). The trend is insignificant since “R” value is –0.049 during the period 1901-50 and it is –0.03 during 1951-2007. Saluru shows positive trend i.e. an increasing trend of rainfall over the first 50 years (1901-1950) and decreasing trend of rainfall during 1951-2007 (Fig4). A positive trend of rainfall is observed at S.Kota (Fig.5) and the trend is

insignificant since “R” value is very low. Vizianagaram shows slight positive trend of rainfall (Fig.6) during the period 1901 -1950 and insignificant negative trend of rainfall during 1951-2007 Cheepurupalli also shows similar trend, an increasing trend of rainfall during 1901-1950 and insignificant negative trend during the climatic period of 1951-2007 (Fig. 7).

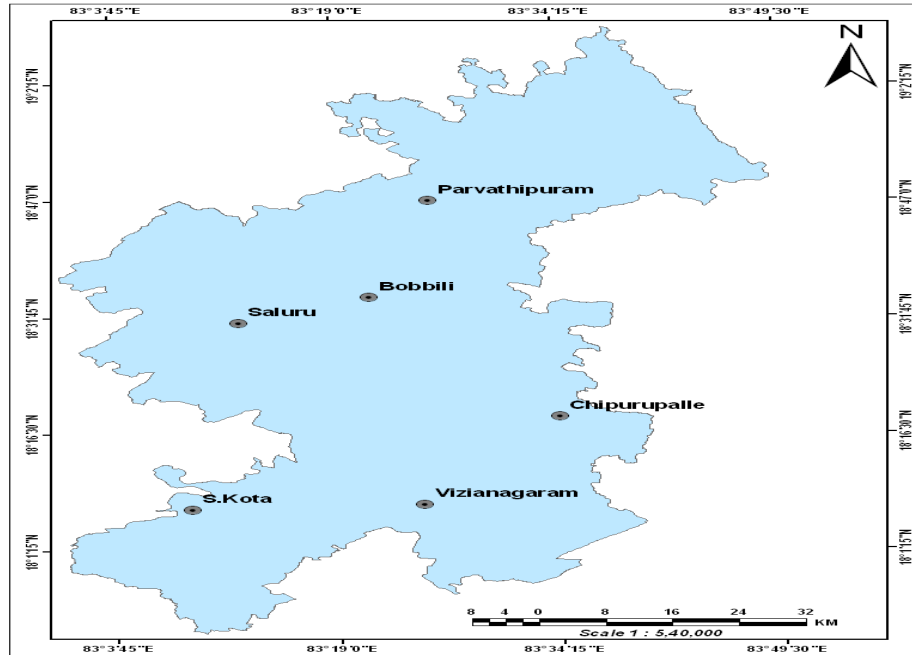
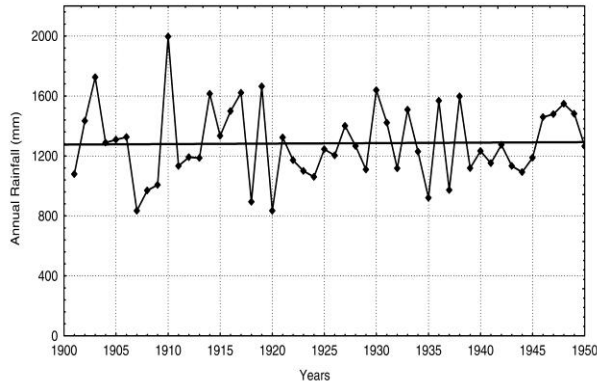


Fig .1 Locations of climatic stations under study

It can be concluded that the trend analysis of all the stations is similar except Saluru, Vizianagaram and Cheepurupalli which show slight positive trend during the period 1901-50. All the stations show slight negative trend during 1951-2007, indicate that decreasing trend of rainfall in the recent years. Whether the trend is positive or negative, all stations under study exhibit insignificant trend.

An attempt has been made to study the rainfall variations/trends during each decade. Hence, rainfall data over a period of 100 years i.e., 1901–2000 have been analyzed and results are presented in fig.8. Decade wise analysis of rainfall indicates that the decade 1961-70 was the driest in the district with low amount of decadal average rainfall of 988.8 mm and 1951 -60 was the wettest decade with decadal average rainfall of 1259.5 mm (Fig.8). All the stations under study have shown the same trend of rainfall.

$$Y = 656.929 + 0.32566 X \quad (R = 0.02)$$



$$Y = 1812.021 - 0.32566 X \quad (R = 0.02)$$

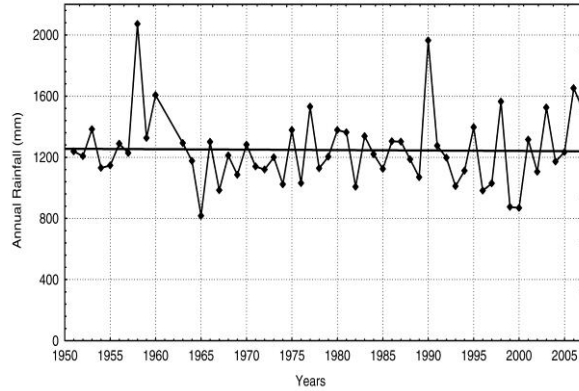
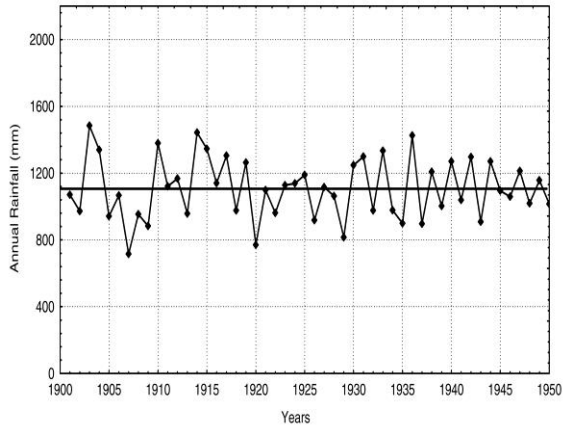


Fig.2 Parvathipuram – Rainfall Trends

$$Y = 1143.1195 - 0.019111 X \quad (R = -0.001)$$



$$Y = 1843.8025 - 0.367018 X \quad (R = -0.3)$$

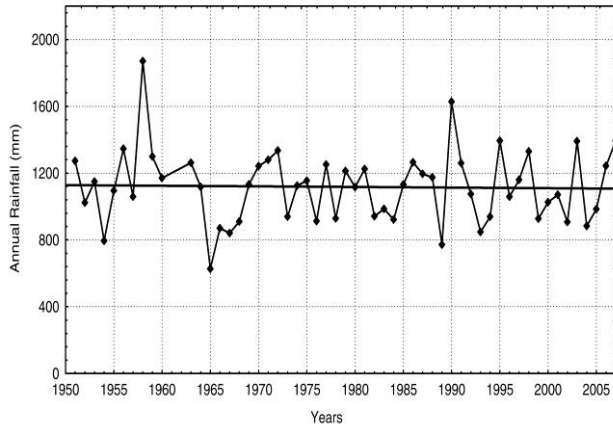
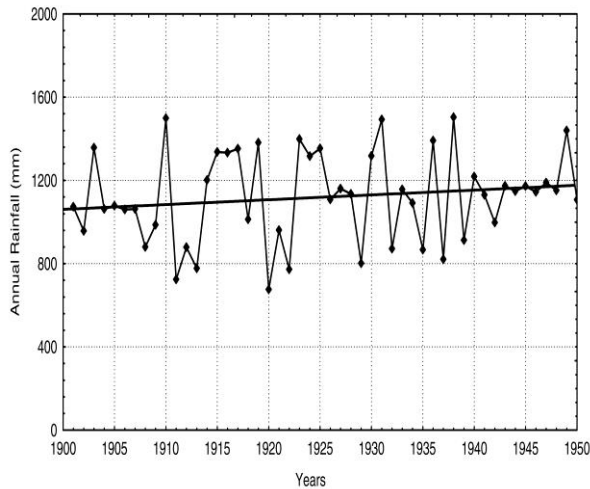


Fig.3 Bobbili – Rainfall Trends

$$Y = -3346.7901 + 2.3198 X \quad (R = 0.156)$$



$$Y = 4512.27339 - 1.72609 X \quad (R = -0.12)$$

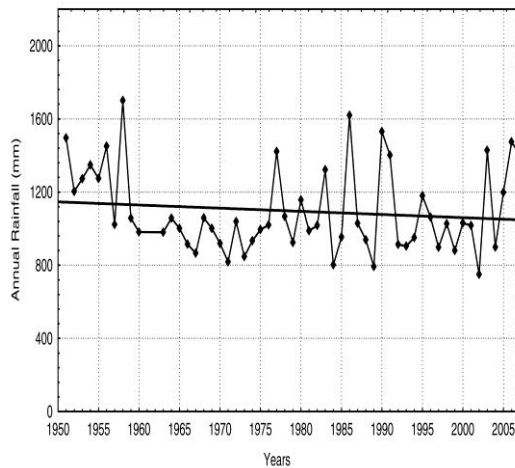


Fig.4 Saluru – Rainfall Trends

$$Y = -721.5948619 + 0.97863 X \quad (R = 0.059)$$

$$Y = -2509.43075 + 1.8703958 X \quad (R = 0.12)$$

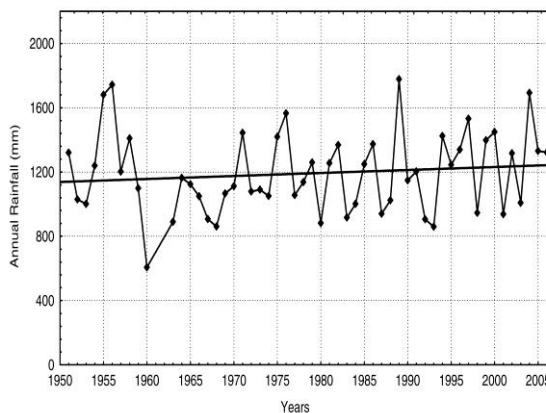
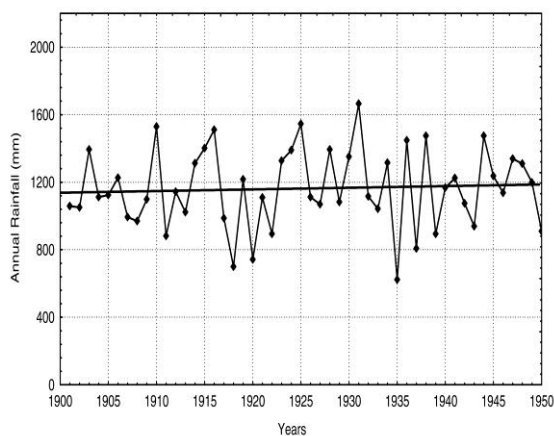


Fig.5 S.Kota – Rainfall Trends

$$Y = -14.9210084 + 0.552605 X \quad (R = 0.036)$$

$$Y = 2179.2752 - 0.530614 X \quad (R = 0.03)$$

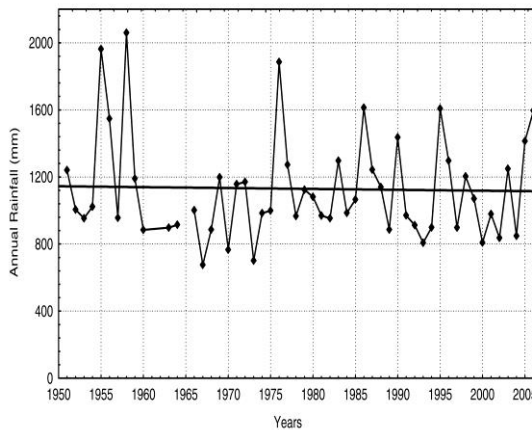
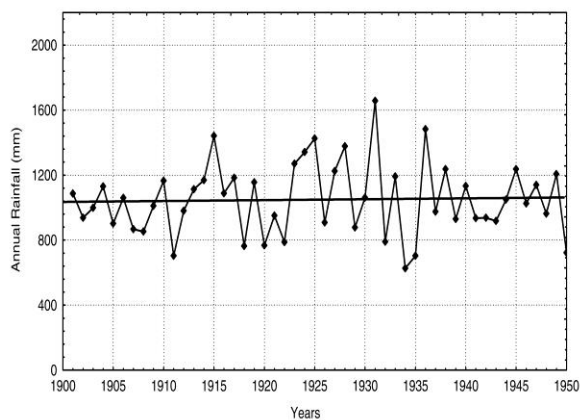


Fig.6 Vizianagaram – Rainfall Trends

$$Y = -6572.56 + 3.965 X \quad (R = 0.273)$$

$$Y = 3230.6249 - 1.1051 X \quad (R = -0.07)$$

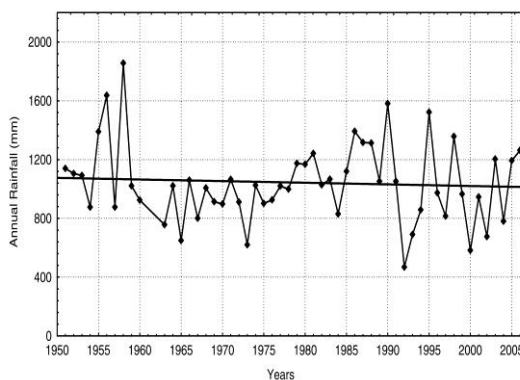
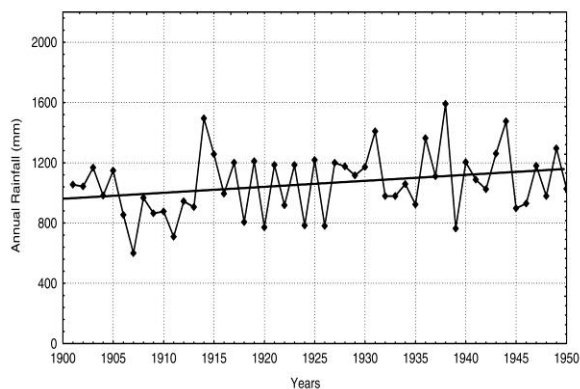


Fig.7 Cheepurupalli – Rainfall Trends

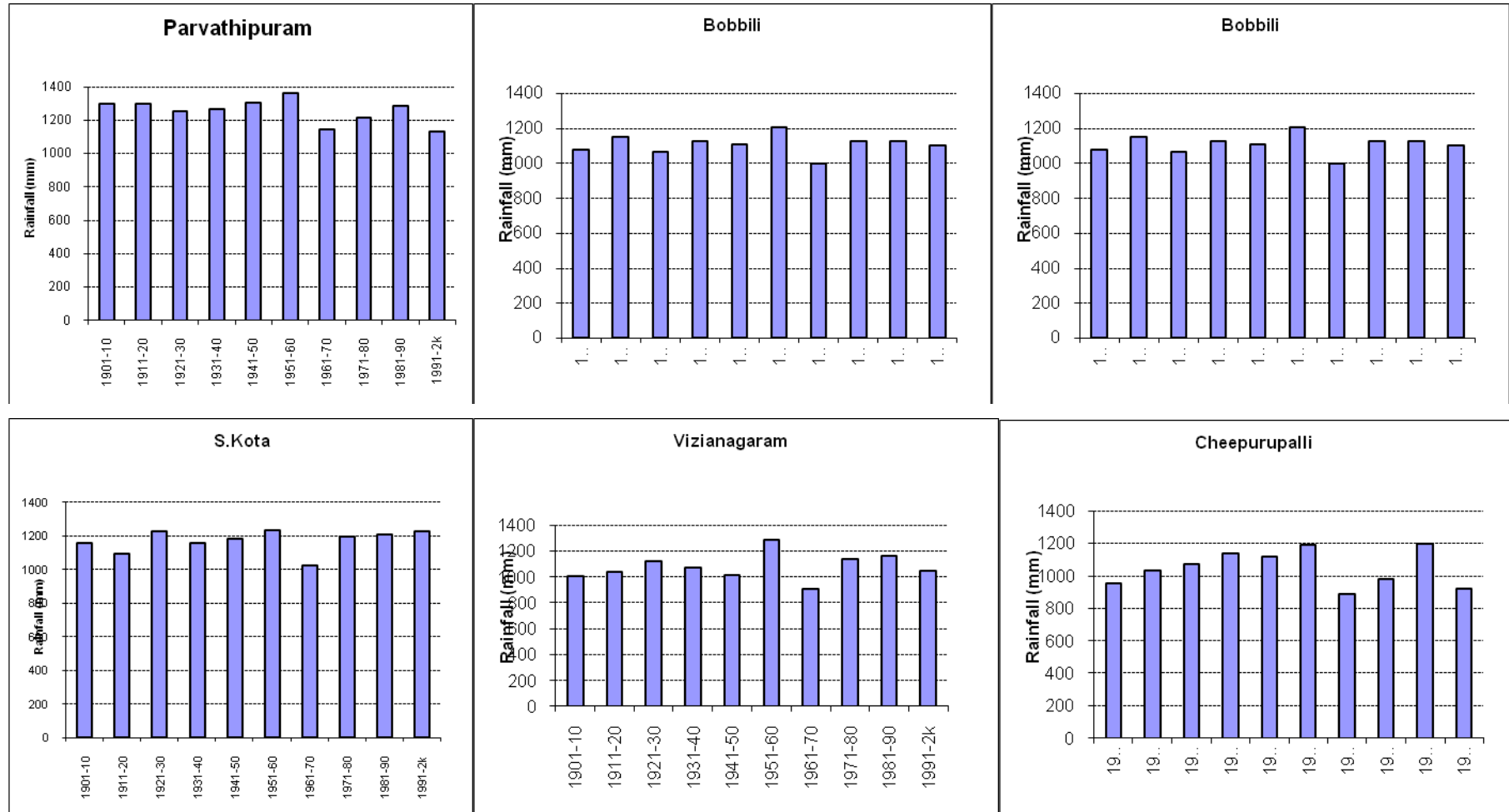


Fig.8 Decadal Trend of Annual Rainfall

Rainfall Variability

The annual rainfall has large spatial and temporal variations. Over a given region, there are spells of good rainfall alternate with periods of little rain. The problem of variability of rainfall either in the annual series or seasonal has been the subject of numerous studies because of its importance with regard to water resources and crop production. Since rainfall plays a vital role in the economy of the district as it influences agriculture, an attempt has been made to study the interannual variability of rainfall and to identify wet and dry years over a period of 107 years (1901-2007).

Annual rainfall of each year is expressed as percent deviation from normal. The bars above the mean value shows the positive departures from the normal rainfall i.e., excess rainfall years. The bars below the mean value indicate negative deviations i.e., deficit of rainfall from normal. For the purpose of the present description of annual rainfall exceeding 125 percent of the normal considered as excessive rain or wet year. If the annual rainfall is less than 75 percent of the normal, it is treated as dry year. Annual rainfall of an individual year is classified as wet or dry when the percentage departure is above or below by 25 percent from normal rainfall.

Six stations have been selected from the study area to examine the rainfall variability. Analysis of annual rainfall data was carried out to identify wet and dry years and results are presented in Fig.9 to14. The large scale excess and deficit rainfall years have been identified for the stations under study. Since rainfall data was available for a quite long period of 107 years, the analysis was carried out for two climate periods, 1901-50 and 1951-2007. Parvathipuram being hilly station experienced 10 wet years and 1910 was the wettest year during the period 1901-50 with 50 percent of positive departure of rainfall from mean rainfall (Fig.9). During the period 1951-2007, there were 2 wet years, 1958 and 1992 with more than 50 percent of positive departure from normal of 1265 mm. There were about 7 wet years with 25 percent positive departure of rainfall and 9 years identified as dry years with 25 percent of negative departure from normal rainfall (Fig.9). The temporal distribution of rainfall at Bobbili is shown in Fig.10. 1958 was the wettest year with nearly 70 percent of positive departure of rainfall from normal followed by the year 1991 with the positive deviation of 50 percent of rainfall. Among the dry years, 1966 was the driest year with more than 40 percent negative departure from normal. There were 6 wet years with 25 percent and above positive departure from normal and 4 dry years with 25 percent negative departure of rainfall. Among the dry years, none of the years exceeded 50 percent of negative departure from normal rainfall. There were 90 years with average rainfall with negligible deviation from normal.

Saluru, another hill station of the district exhibits more number of dry years. It is evident from the figure 4.11 that there were many years with negative departures from mean rainfall especially during the period 1951 to 2007.

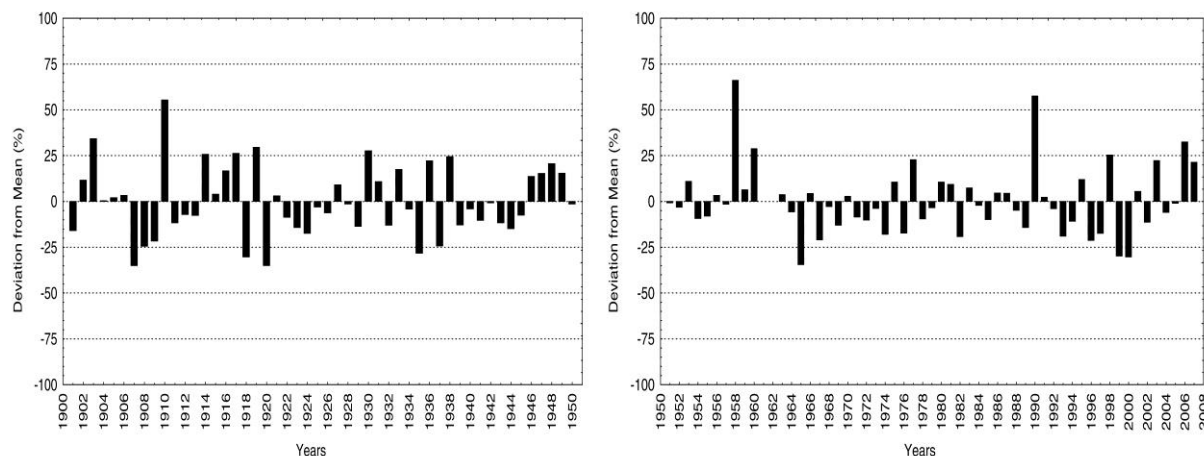


Fig.9 Parvathipuram – Annual rainfall departures

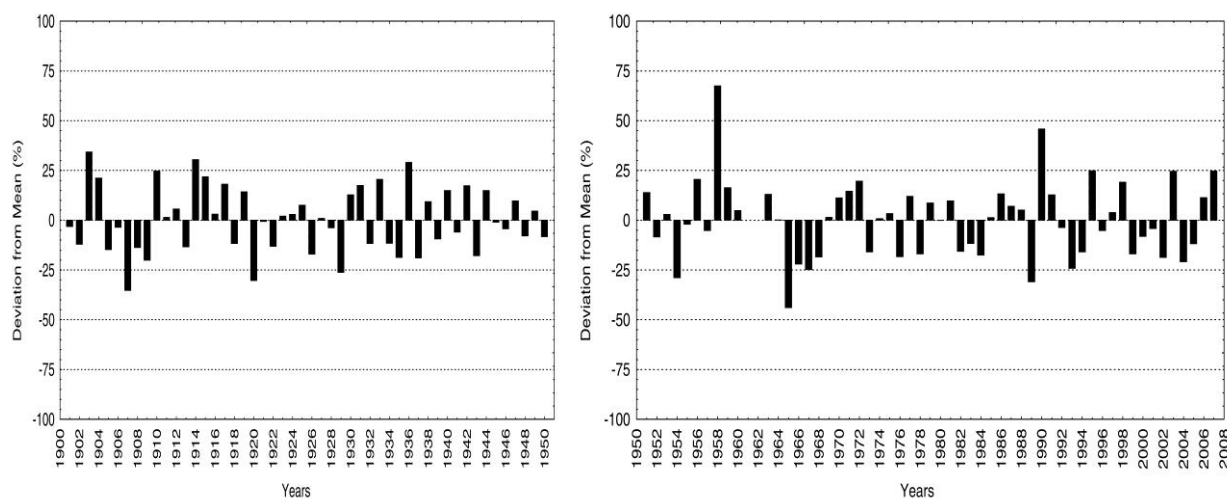


Fig.10 Bobbili - Annual rainfall departures

There were two wet years, 1957 and 1987 with 50 percent of positive departure from the mean rainfall of 1106 mm (Fig.11). About 16 wet years were identified with 25 percent and above positive departure from normal and about 8 years with 25 percent negative departure from the mean rainfall. S.Kota, which is located in the southwestern part of the district shows 13 wet years and 11 dry years. 1990 was the wettest year with 50 percent of positive departure of rainfall from normal rainfall of 1178 mm. It is observed that S.Kota recorded many wet years during the recent years from 1995 – 2007, which indicates that an increasing trend of rainfall. 1935 was identified as the driest year with 50 percent of negative departure from mean (Fig.12) followed by the year 1960. There were 12 wet years with the positive deviation of 25 percent and above and 10 years were identified as dry years with 25 to 50 percent negative departure from the normal rainfall.

Vizianagaram shows more number of wet years (Fig.13).1958 was the wettest year with more than 70 percent of positive departure of rainfall followed by 1956 and 1976 with 70 percent of positive departure. The year 1931 was also identified as wet year with 50 percent of positive departure of rainfall. There were no dry years with 50 percent of negative departure of rainfall. There were about 13 wet years with 25 to 50 percent of positive departure and 14 dry years with 25 to 50 percent of negative departure from mean rainfall of 1088 mm. Altogether Vizianagaram experienced 17 wet years and 15 dry years over a period of 107 years (Table.1). About 65 years had normal rainfall with slight positive or negative deviations. Cheepurupalli shows more number of dry years (Fig.14) when compared to other stations in the study region. The decade 1903 to 1913 was a dry period with negative departures of rainfall from the mean value. Similar trend was observed with negative deviation of rainfall from 1962 – 1980 (Fig.14) Again from

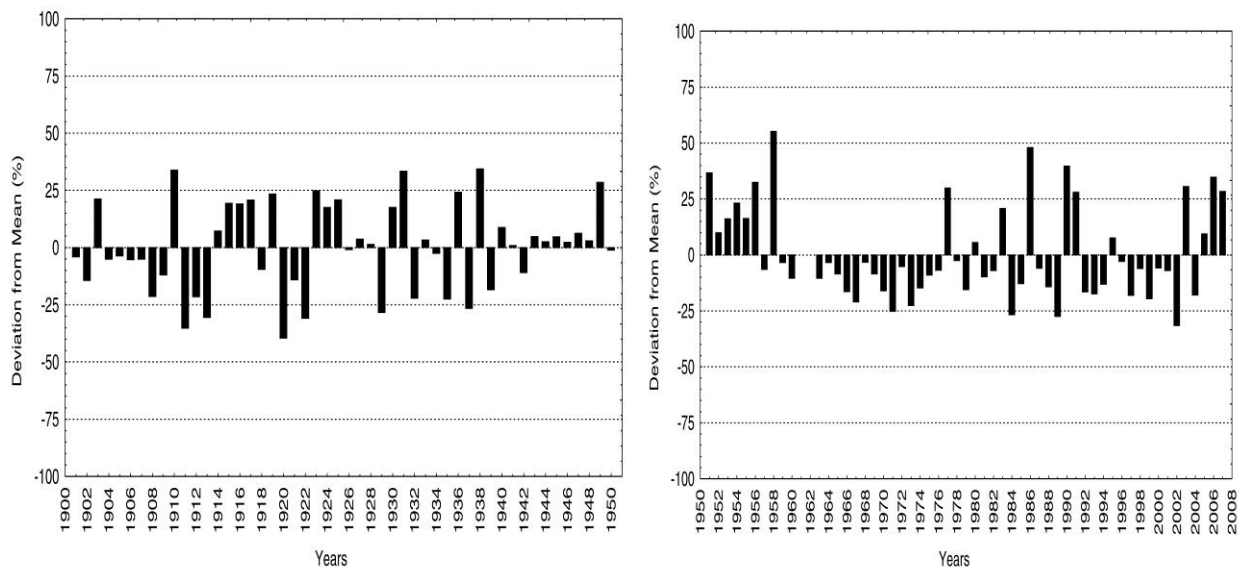


Fig.11 Saluru – Annual rainfall departures

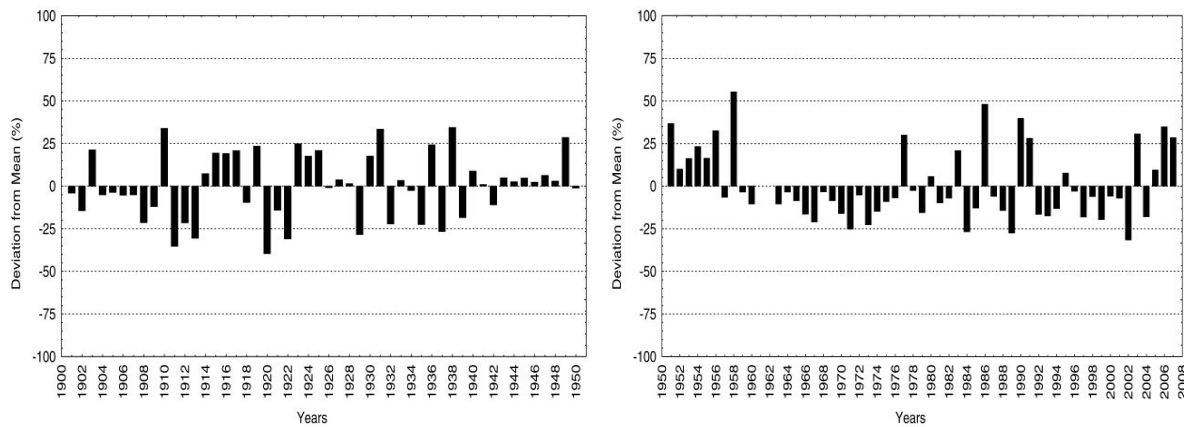


Fig.12 S.Kota – Annual rainfall departures

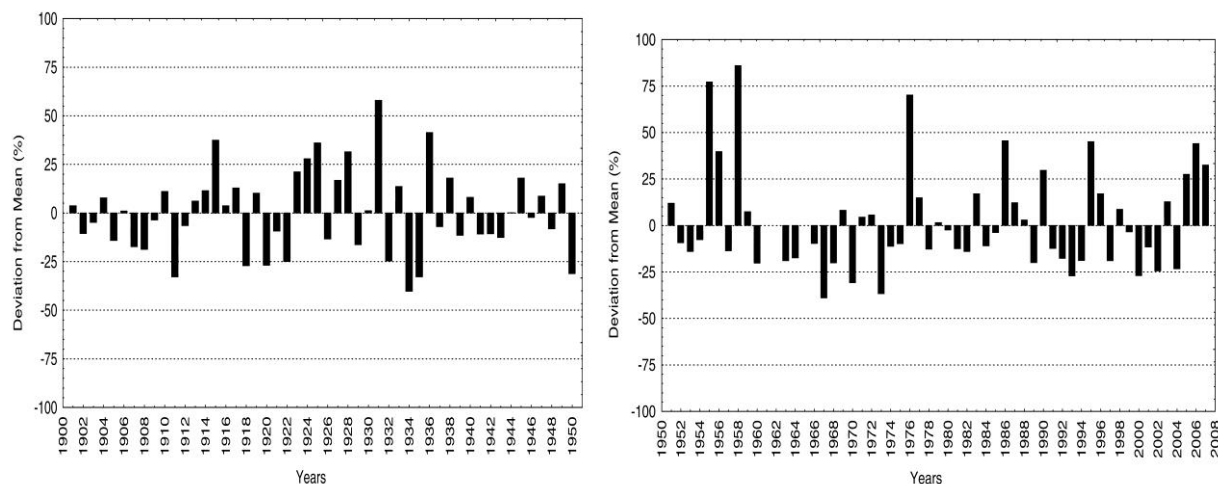


Fig.13 Vizianagaram – Annual rainfall departures

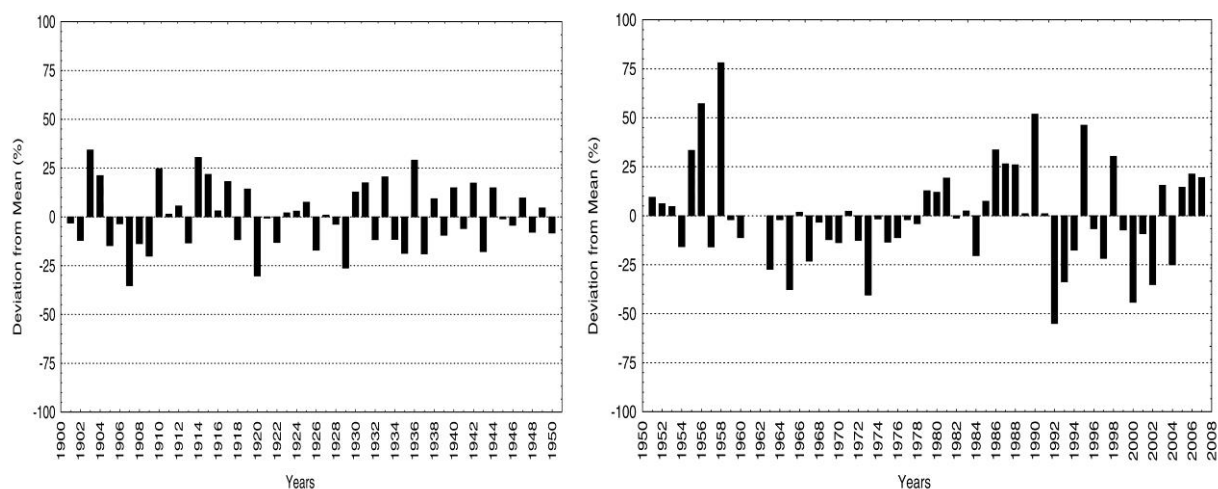


Fig.14 Cheepurupalli – Annual rainfall departures

Table.1 Vizianagaram District – Wet & Dry Years (1901-2007)

Name of the Station	Wet years	Dry years	No .of. years	
			Wet	Dry
Parvathipuram	1903,1910,1914,1917,1919,1930,1958,1960,1990,1999,2006	1907,1918,1920,1935,1965,1966,1998,1999,2000,2001,	11	10
Bobbili	1901,1903,1914,1936,1958,1990,1995,1996, 2003	1907,1920,1929,1954,1965,1966,1989	9	7
Saluru	1910,1931,1938,1949,1950,1956,1958,1977,1986,1990,1991,2003,2005,2007	1911,1913,1920,1922,1929,1937,1971,1984,1989,2002	14	10
S.Kota	1910,1916,1925,1931,1937,1938,1944,1955,1956,1977,1990,1998,2005	1918,1920,1935,1937,1960,1963,1968,1969,1981,1993,1994	13	11

Vizianagaram	1915,1924,1925,1928,1931,1936,1947,1955,1956,1958,1976,1986,1990,1995,2005,2006,2007	1911,1918,1920,1922,1932,1934,1935,1950,1967,1970,1973,1993,2000,2002,2004	17	15
Cheepurupalli	1914,1931,1936,1938,1944,1955,1956,1958,1987,1988,1989,2000,1991,1996	1907,1911,1918,1920,1926,1939,1963,1966,1968,1974,1993,1994,2001,2002,2004,2006	14	16

1994 to 2006 there were many years with 25 to 50 percent negative departure of rainfall from mean value of 1048 mm.

Conclusion

It can be concluded that the rainfall variability is less in the study region since 70 to 80 years were normal rainfall years with slight positive or negative deviations. There were about 10 to 17 wet years and 8 to 16 dry years over a period of 107 years. Though it is a continental region and experienced dry climate with average annual rainfall of 1100 mm, it exhibits less variability of rainfall.

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Genesis of Climate Change: A Holistic View

Padma Lochan Barma*

“The forest is a peculiar organism of unlimited kindness that makes no demands for its sustenance & extends generously the products of its life activity; it affords protection to all beings, offering shade even to the axe-man who destroys it”.- **Gautam Buddha**.

Climate change is the most sensitive and challenging issue so far today. Most of us seriously know & I think all of you agree that this beautiful creation is on the verge of destruction¹. At any point of time anything can happen (none has thought in their wildest thought of the recent-Himalayan Tsunami). Planet earth is now geared & attacked with such overarching environmental problems as flash floods (as happened in Uttarakhand now), rising sea levels, depleting forest resources, fast eroding soils, ever expanding deserts, rapidly rising temperatures, vanishing of species, melting glaciers, rising sea level, dying coral reefs, increasing green house gases, falling water tables, deteriorating range lands, worsening air quality, extreme weather conditions and what not the world over. The phenomena of natural calamities have been very frequent in recent times around the globe like Tsunami, flash floods, droughts and famines, earthquakes, water scarcity, storms and hurricanes and the likes which have caused innumerable loss of lives and severe damages to natural & man-made capitals.

Now host of questions arise as to why such disasters are consequent on planet earth? Why melting of glaciers? Why rising sea levels? Why extreme climatic conditions around us? Why disappearances of different species? Why flash floods? Why Tsunami? Why changes in seasons? Why environmental problems of greater magnitude & intensity playing havoc on human civilization? Why ozone hole? Why climate change and global warming? Are we not in the early stages of greatest extinction of plants and animals since the dinosaurs disappeared 65 million years ago? Are we not facing issues of near-whelming complexity & unprecedented urgency?

With food scarcity driven by falling water tables, eroding soils & rising temperatures, control of arable land & water resources is moving to centre stage in the global struggle for food security. In this era of tightening food supplies, says, Brown, the ability to grow foods is fast becoming a new form of geo-political leverage. Food is the new oil and land is the new gold”².

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This paper in its modest effort, tries to trace out the root causes of all those hard hitting issues holistically and suggest certain possible remedial measures if at all we have any time left.

Few examples of such nature & magnitudes happened over the years are presented in the following table-

Magnitudes of Disaster

Date	Type of Disaster	Place of Disaster	Intensity/Extent	Loss of Lives	Other Losses
Nov-1970	Cyclone Bhola	Banlgadesh	-	3-5 Lakhs	Hundreds of villages
July- 1976	Earth Quake	China	8.2 Richer Scale	6.55 Lakhs	
Dec-1984	MIC Gas Leak	Bhopal,India	40 Tons Toxic Gas	2500	
April-1986	Nuclear Disaster	Chernobyl,Ukraine			3.5Lakhs Evacuated
June-1990	Earth Quake	Iran	7.6 R.S.	0.50 Lakhs	
Oct-1991	E'quake	UttarKasi,India	6.8	768	3096 Livestock
April-1991	Storm	B'desh	-	1.40 Lakhs	
Sept-1993	E'quake	Latur,India	6.3	10,000	52 Villages Demolished
October-1998	Storm(Mitch)	Central America	-	0.09 Lakhs	
Aug-1999	Earth Quake	Turkey	7.4	0.17 Lakhs	0.5 Million homeless
Oct-1999	Super Cyclone	Coastal Odisha,India	Wind Blew 155-161/Mile	10,000	1828532 Houses Damaged
Jan-2001	Earth Quake	Bhuj,India	7.6	19727	6Lakhs left homeless
Dec-2003	Earth Quake	Iran	6.6	26000	30000 injured
May-June 2003	Scorching Heat	India		1200	Victims were poorer Class
Dec-2004	Tsunami	Indian Ocean(12 Countries)	9.1	2.3 Lakhs	5000 presumed Dead
July2005	Flash Floods	M'Rastra,India	-	11000	
Aug-2005	Storm Katrina	Mississippi,USA	100-140 winds blew/per mile	1600	\$ 1 Billion worth Damage
Oct-2005	Earth Quake	Entire Kashmir Region	7.6	78000	
May-2008	Nargis Storm	Myanmar		30000	30000 Lost
May-2008	Earth Quake	Siachina	7.9	20000	
May-2009	Cyclone Aila	India & B'desh		200	1Million Displaced
June-2013	Flash Floods	U'Khand,India	-	10000	1 Lakhs Rescued

Sources-www.ibtimes.com/hurricane watch, asianhistory.about.com

The root causes of the global environmental problems & issues may be traced back to the then American President Harry S. Truman's historic declaration of the **development design** on 20th January 1949 from the White House by saying-

“We must embark on a bold new program for making the benefits of our scientific advances & industrial progress available for the improvement & growth of under-developed areas of the world.

The old imperialistic exploitation for foreign profit has no place in our plans. What we envisage is a program of development based on the concept of fair dealing. Greater production is the key to prosperity & peace. And the key to greater production is a wider & more vigorous application of modern scientific & technological knowledge”.³

According to Esteva, “never before had a word been universally accepted on the very day of its political coinage. On that day two billion people became under-developed”⁴. But conceptually it was inflated. Critics pointed out that **development** was impoverished even in the hands of its first promoter who reduced it to economic growth⁵(P-16). It was not only hailed by the IMF & the Vatican City alike but also by revolutionaries & field experts world over. For the advocates of **development**, it consisted of simply of growth in the income per person. The philosophical foundation for this assumption was laid by W.Arthur Lewis⁶ in the year 1944 & later endorsed by the UN Charter (1947) Lewis’s dictum was that,” first it should be noted that our subject matter is growth & not distribution. This was later reflected the mainstream emphasis on economic growth which revolutionized the entire field of **development thinking**. After that Lewis was joined by the powerful leftist economic thinker (1957) Paul Baran on the political economy of growth. He defined growth or development as the increase in the per capita production of material goods. ⁷ Walter Rostow an economic American historian presented in his “Non-Communist Manifesto” in 1960 as a description of the stages of economic growth, presuming that this single variable i.e. **economic growth** can characterize a whole society ⁸.

Before this Lord Keynes-most influential economist of the 20th Century had laid the philosophical foundation for the dominant modern belief that the soundest foundation of peace is universal prosperity based on the materialistic principles of “enrich yourself”⁹. It had an irresistible temptation which suggested that the faster you get one desirable thing, the more securely do you attain another. According to Schumacher it was doubly attractive because it completely by-passes the whole question of ethics. There is no need for renunciation or sacrifice; on the contrary to which Lord Keynes’s message was “beware; ethical consideration are not merely irrelevant, they are an actual hindrance, for foul is useful & fair is not”¹⁰. If analyzed critically of the economists’ principles, it can be said that the economic growth- the highest of all values- is achievable only by adopting the powerful human drives of selfishness or greed. The present day economy is propelled by a frenzy of greed & indulges in an orgy of envy & these are not accidental features but the very causes of its expansionist success. If whole societies are to be inspired by greed & envy they of course achieve the wonders but at the end they become increasingly incapable of solving the most basic issues of our everyday existence. The question is whether such **causes** can sustain for long or whether they carry within themselves the seeds of destruction. Now there is

enough evidence to disprove Keynes idea that foul is useful & fair is not. That might have been useful for shorter term but in the long run it is false. Schumacher explains it in a very practical sense. If human vices such as greed & envy are systematically cultivated, the inevitable result is nothing less than a collapse of intelligence. A man driven by greed or envy loses power of seeing thing as they really are, of seeing things in their roundness & wholeness and his successes become failures¹¹. In case entire human society gets infected by those vices, the result may be wonders but they become increasingly incapable of solving the most basic green issues of our utmost concern. Man shall not live by bread alone but by every word of God.

Thus the very idea of infinite economic growth (growth mania) and material prosperity (no country has till date expressed its satisfaction of having enough & now halts) which makes blind for more & more until everybody is saturated with wealth, now seriously requires to be asked on two moot points;-

1. The availability of basic resources such as fossil fuel, crop lands, forest & others &
2. The capacity of the environment to cope with the degree of interference¹²

Now the natural environment of the planet earth-which supports entire life system- is so hard pressed & stressed that it is manifesting in the form of unprecedented natural disaster of greater & greater magnitude to balance itself as shown in table no.1. For example energy is in ever rising demand on the part of the nation-states which are from coal & nuclear. These two are now hard pressed. They have no sustainability of their own. Likewise the forest and mines. According to Hettne presently alarming concern for the ecologists are the destruction of the four major biological system- 1) oceanic fisheries, 2) grass lands, 3) forest and 4) crops lands are in the process of first depletion. Climate change mostly due to insensible human activities causing global warming & giving rise to temperature day by day which according to scientific calculation may play havoc on the productivity of the above system. Global food insecurity owing to the greed culture of the mainstream development has turn vast tract of cultivable lands from subsistence production to cash crops production, from indigenous food crops to imported foods¹³. As one problem is being solved, ten new problems arise as a result of the first solution. Prof. Barry Commoner opines, “new problems are not the consequences of incidental failure but of technological success; the development of science & technology over centuries have been such that the dangers have grown even faster than the opportunities”. Nature has enough to fulfill everybody’s need but not the human greed. An attitude to life which seeks fulfillment in the single minded pursuit of wealth- in short, materialism-does not fit into this world, because it contains within itself no limiting principle, while the environment in which it is located is strictly confined.

Ecology Vs Economy

The moot question is whether the environment is part of the economy or vice versa. Because this has been responsible for the present stage of fast environmental degradation. According to Lester Brown

economists have created confusion to understand the modern world. Theirs is the economy that is out of sync with the eco-system on which it depends¹⁴.

Brown argues, that the economic theory & economic indicators don't explain how the economy is disrupting & destroying the earth's natural system. It does not explain why ice is melting (as in Arctic sea), why grasslands are turning into deserts (as in North-West China), why coral reefs are dying (as in the South Pacific), why cod fishery has collapsed (as in the Newfoundland), why flash floods happened in U'Khand? Further it remains silent in explaining why the planet earth is in the early stages of the extinction?

According to Brown the economy is in conflict with the earth's natural system whose reports are widely read and watched in the news dailies and TVs & Nets respectively about ever rising temperatures, rising carbon dioxide, fast eroding soils, ever deteriorating rangelands, expanding deserts, extreme weather conditions, rising sea levels, untimely changed of seasons, rampant deforestation etc. these ever rising stressed relationship between the economy & the earth's eco system are taking heavy economic toll. He forecasts at some point or other, this could overwhelm the world wide forces of progress ultimately paving the way for total economic decline. For the Gen-Next this has to be reversed before further environmental deterioration leads to long term negative impact.

Those increasing trends signals that in case the operation of the sub- system, the economy is incompatible with the behavior of the larger system-the earth's eco system- both are to suffer in the end. Further Brown maintains that the larger the economy becomes relative to the eco system & the more it presses against the earth's natural limits, the more destructive this incompatibility will be¹⁵.

Therefore the concrete suggestion forwarded by Brown is that the rules governing the ecology must establish the framework for the formulation of economic policy & that economists and ecologists work together to redesign the new economy.

It is a naked truth that all our economic activities rather all lives are very much relies on the earth's ecosystem which is the complex of individual species living together, interacting with each other & their physical abode. Millions of species live by an intricate balance, woven together by food chains, nutrient cycles, the hydrological cycle & the system of climate. These are well known to the ecologists. On the other economists know how to translate goals into policy. Both economists & ecologists sitting & working together can design and build an economy which can ensure sustainable development.

The need of the hour according to Brown is to turn the tide of development unsustainability to development sustainability which at present requires Copernican shifts¹⁶ in our economic mind set i.e. to accept the economy as the sub-set of earth's eco system.

The challenge is according to Brown is to design our economy in consonance with the principle of ecology. Further the redesigned economy can be integrated into the eco system in a way that will stabilize

the relationship between the two, enabling economic progress to continue. The prevailing mode of development is divorced of conceptual outline required to build eco economics. This must be designed in such a way as to comprehend the fundamental eco concepts like sustainable yield, carrying capacity, nutrient cycles, the hydrological cycles as well as climate system. It is to be kept in mind that natural system supply goods along with services which are comparatively precious than the goods. Instead of having fossil fuels Brown proposes solar or hydrogen energy economy, an urban transport system centered on advanced designed public rail system and which depends more on bi-cycles and less on the automobiles. And the last but not the least is comprehensive reuse of recycle economy and stabilization of population must move along side¹⁷

According to Hettne, development cannot be a universal process & it has no model to emulate. An under-developed country ought to look for its own image of its future rooted in ecology and culture. The hot slogan must be inter- generational equity- a development that meets the needs of the present without compromising the lives of the future generation. Hettne maintains ‘sustainable development’ is development in the interest of another excluded: the not yet born¹⁸. The rationale behind this is that development in longer period ought to be adapted to the available resource base.

Yogic Interpretation of the Present Environmental Degradation

In the early part of this Millennium a rare stone was discovered in the Western Part of the Odisha state, deciphered by the archeologist as the SRSTI Yantra or the Yantra of Creation reveals the mystery of the creation¹⁹. According to Dr.J.P.Deo the chiseled stone with a right triangle design has a Tantric significance. It represents *Siva Kameswar (Purush)*, *Shakti Kameswari (Prkriti or Nature)* and *Samarasya*. It is a tantric formula to describe the mystery of the creation. It reveals states Dr. Deo, that the “Bhugoladhayaya of Surya Siddhanta” discusses the creation of the universe including the earth & the evolution of *Pancha-Mahabhutas* i.e. air,water, ether,light and earth. It narrates that the three *Caranas* being immortal are obscure. It means they are beyond the comprehension of the human mind. Only the fourth *Carana* is manifested²⁰.

The discovered SRSTI Yantra represents one fourth of a circle. According to Tantric Text SARADA-TILAKA TANTRA the three points of this yantra represents *Siva-Kameswara*, *Shakti-Kameswari* and *Samarasya*. The later implies equilibrium or balance. Thus according to Dr. Deo’s Yogic interpretation Samarasya signifies that everything of the creation has evolved in balance & maintains its equilibrium. Once this is destroyed or lost (by the man made activities) then natural calamities take place²¹ as described elsewhere. Thought-less and merciless exploitation of the natural resources to its maximum have taken place on earth which are creating unprecedented and severe disturbances in maintaining equilibrium of the creation and therefore the disasters. Dr. Deo says all the thoughts of all departments of knowledge & wisdom in India has dealt to live in proper harmony with nature. Mainstream development

trajectory based on mass production driven by profit motives founded on greed culture only is a great aberration to nature's principles.

The collapse of early three civilizations namely Summerian Civilization(4th Millennium B.C.), Maya Civilization (250A.D.) and Easter Iceland (400A.D.)²² were collapsed one after another due to environmental flaws in the design of the irrigation system, deforestation & soil erosion and tree cutting respectively. All the three suggest that the early civilizations declined at some point or other they moved on to an economic path that was environmentally unsustainable. Brown opines are not we in the same path? Any one of several trends of environmental degradation could undermine civilization just as the irrigation system that defined the Summerian economy had a flaw so too does the fossil fuel energy system that defines our present economy. Latest release of the Earth Policy Institute reveals that the “increasing global emissions of CO₂ – a heat trapping gas are pushing the world into dangerous territory, thus closing the door of time to avert the worst consequences of higher temperatures such as melting ice and rising seas. To quote further, since the dawn of the Industrial Revolution, carbon emissions from burning fossil fuels have grown exponentially. Despite wide agreement by government world over on the need to limit emissions, the rate of increase ratcheted up from less than 1% each year in the 1990s to almost 3% annually in the first decade of this century. After a short dip in 2009 due to global financial crisis, emissions from fossil fuels rebounded in 2010 & have since grown 2.6% each year, hitting an all-time high of 9.7 billion tons of carbons in 2012’²³

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Nicolas Copernicus's world view was that earth revolves around the sun and not the vice versa led to a revolution in thinking to a new world view. It set the stages for advances in astronomy, physics & other related sciences. Similarly there is every need to shift in our mind set to consider economy as the sub-set of the earth's eco system.

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Climate Change Its Effect – On Nutritional Quality of Food

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Introduction:

Food and Agriculture Organization (FAO) defines food security as a “situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. Which includes four key dimensions of food supplies: availability, stability, access, and utilization. Landless agricultural labourers, who almost wholly depend on agricultural wages, would be at high risk of losing their access to food. However, who fall sick and cannot earn their daily wages would lack stable access to food if, for example, they cannot take out insurance against illness. Access, covers by individuals to adequate resources to acquire appropriate foods for a nutritious diet. The widespread agreement that anthropogenic greenhouse gas(GHG) emissions are leading to climate change(stern 2006). In the literature, there is much focus on the effects of climate change on food security (defined as access to sufficient, safe, nutritious food to maintain an active and healthy lifestyle) in the developing world [world health organization (WHO) 2010]. For example, by end of this century, the average summer temperature will exceed the hottest summer on record through the tropics and subtropics, which potentially serious consequences for the food production that could affect the 50% of the world’s population living in such regions (Battisti and Naylor 2009). However, in developing countries, food shortages are uncommon and shortage of energy is not a major problem, although micronutrient deficiencies and over nutrition are prevalent. The nutritional quality and safety of food are the primary concerns related to food in these areas. Climate change will directly influence food choice. Food consumed in one part of the world may be produced thousand kilometers away. Countries also buy food on an international market, so changes in food production one part of the world may affect the price of food produced in other parts of the world. The possible impact that anthropogenic climate change may have on nutrition and food safety and on the subsequent consequences for health in developed countries.

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Impacts of Climate Change on Food prices and availability

Crop prices are likely to be higher than the published assessments. Example, the impact of current climate variability occurred in 2006 when extreme weather in many parts of the world, led to reductions in world cereal production. These yield reductions were partly to blame for rising global food prices (Piesse and Thirtle 2009).

If rises in food prices occur, then individuals may shift to lower cost food items, which in turn, may have health consequences. During the recent increases in food prices, there is evidence from Scotland that consumers shifted from more expensive to cheaper brands of food, and away from organic produce (Rural and Environment Analytical services 2009). Therefore, these rises in food prices associated with climate change may reduce the nutritional quality of dietary intakes and lowers the nutritional status of some groups.

Changes in food consumption because of increasing costs driven by climate change may affect safety as different foods carry varying risks of food borne illness (Adak et al.2005) and different levels of pesticide and chemical residues. For example, as the cost of food increases, consumers may shift from more expensive fresh poultry to frozen poultry, which may increase the likelihood of consuming chicken contaminated with Salmonella, but reduce the likelihood of consuming chicken contaminated with campylobacter (FSA 2009a).

Changing production methods

Under different climatic conditions, food will be produced, which will alter ecosystems, which will alter agricultural conditions and be compounded by adaptation to such change. The food sector is a significant source of GHG emissions and food production, processing, transport, storage, preparation, purchase, and consumption contributes 15-30% of global GHG emission (Garnett 2008).

Climate change may alter the seasonal patterns and abundance of pests and diseases, which may affect pesticide use, including herbicides and fungicides (Boxall et al. 2009). Climate change could affect existing pathogens or lead to the emergence of new pathogens in food (Tirado et al. 2010), through animal husbandry and animal to animal transmission, pathogen survival, and other mechanisms. Salmonella infections in humans are positively associated with temperature (Kovats et al.2004). This is biologically possible because Salmonella bacteria will reproduce in food that is kept at ambient temperature. Pathogens with good stress tolerance responses to temperature and pH (e.g., E. coli and Salmonella) may also compete better against other

pathogens under climate change (FAO 2008). Consuming food from a small geographical area may also increase the risk of nutrient deficiencies or toxic effects reflecting the chemical characteristics of local soils (Oliver 1997).

Impacts on food sourcing and consumption:

Climate change is expected to lead to shifting food belts, which implies that food consumed in the future, will be sourced from different parts of the world (Easterling et al.2007). The source of food may affect its micronutrient and macronutrient composition because of different varieties grown, varying soils and growing conditions, different methods of harvesting, processing, and storing methods. In addition, climate change- induced shifts in where food is produced will alter food safety risks. For example, food from the tropics carries an elevated risk of mycotoxin exposure, and the country of origin may affect microbial risks because of varying policies on the use of wastewater for irrigation (Drechsel et al .2009).climate affect the human behavior, and so in an altered climate, individuals may choose to consume different foods.

Adaptation to climate change:

Climate change could affect the nutritional composition of diets and the safety of food. Whether this changes occur will depend upon local policies and structures to regulate food production, monitor the quality and safety of food, and record and respond to any nutritional or safety issues that arise.

Nutritional adaptation:

Climate change leads to changes in the nutritional composition of individual diets, and then the overall effects will depend upon the ability of society to adapt to these changes. Regular monitoring of nutritional composition of staples such as as grains and potatoes, meat, fruits, and vegetables . But food intake and the nutritional status of the population monitored through the National Diet and Nutritional survey (Aswell et al. 2006), which measures food and nutrient intake and nutritional status of a stratified sample of the population. Climate change on nutrition may be localized or only affect specific subgroups of the population, there is a need for more targeted monitoring of vulnerable populations such as low income individuals who are most likely to be affected by rises in food price, those already at nutritional risk (e.g., children, elderly), and consumers who choose a diet predominantly sourced from a small geographical area.

Conclusion and recommendations

In the future, food systems are likely to change for a number of reasons, including increased global affluence and the challenges of feeding a global population that may reach nine billion persons by the 2050s (Royal society 2009). The global temperature can increase more than 3 degree centigrade, which may lead to increasingly unhealthy food choices and exacerbate existing health inequalities. These changes can cause in emerging pathogens, new crop and livestock species, altered use of pesticides and veterinary medicines and will likely affect the main transfer mechanisms through which contaminants move from the environment to food. All these may have implications for food safety and the nutritional content of food. Individuals from vulnerable groups where dietary intakes are already suboptimal (e.g., persons with low incomes, migrant workers) and nutrient density requirements are elevated (e.g., pregnancy, childhood, old age) also may be at increased risk. Consumption of more locally produced and seasonal food may lead to insufficient fresh fruit and vegetable intake s at various times of the year in temperate countries. Environmental and health sectors must work together to take advantage of areas of common ground. Such cooperation is essential to provide consistent health and environmental messages to the public and develop suitable interventions.

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Impact of Climate Change on Rural Women in India - An Overview

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“We have read the science. Global warming is real, and we are a prime cause. . . . We must set an agenda—create a roadmap to the future, coupled with a timeline that produces a deal by 2009. In this, it helps to have a vision of how the future might look if we succeed.”—BAN Ki-moon

Abstract

Climate change has the potential to turn into a ‘crisis for humankind’ as its potential multiple impacts can exacerbate the scarcity of natural resources, crop failure, hunger, malnutrition and disease, and can undermine economic growth and development in the long run. Climate-change-induced natural disasters affect women and men differently. Women are more vulnerable to the effects of climate change than men as they bear more responsibilities which are dependent on nature. Although, the majority of rural women's life style certainly have direct relation with the climate. They are the major contributors towards wellbeing of their family members. This paper aims to ascertain and discusses issues especially how for the climate change impacts upon their abilities, socio-economic and health status of rural women in India. The paper also attempted to identify their inabilities and crisis situations they suffer. The facts presented in the paper demonstrate that the women despite of cultural restrictions that limit their access to education and health services, and these impose serious constraints on their autonomy, mobility, and on the types of livelihoods that are available to them.

Introduction

The term climate is commonly perceived as the “average weather” in a place. According to State Department of Ecology Washington; 2013 it includes patterns of temperature, precipitation (rain or snow), humidity, wind and seasons. Climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. But the climate we've come to expect is not what it used to be, because the past is no longer a reliable predictor of the future.

Key Words: Climate Change, Weather and Rural Women

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Our climate is rapidly changing with disruptive impacts, and that change is progressing faster than any seen in the last 2,000 years. NOAA National Weather Service, 2007 explains that climate change is a long-term shift in the statistics of the weather (including its averages). For example, it could show up as a change in climate normal (expected average values for temperature and precipitation) for a given place and time of year, from one decade to the next. We know that the global climate is currently changing. The last decade of the 20th Century and the beginning of the 21st have been the warmest period in the entire global instrumental temperature record, starting in the mid-19th century.

The changes to the global climate system, the water system, biodiversity, land cover, marine ecosystems and ecosystem services in general are closely linked to human activities, and that these changes cannot be understood and addressed without closer attention to the interactions between human and physical systems. Human interventions are largely causing these changes in the global and local climate systems (IPCC 2001). Emissions of greenhouse gases due to human activities continue to alter the atmosphere. Higher concentrations of greenhouse gases, such as carbon dioxide and methane, warm the earth's surface. About three-quarters of the human emissions of carbon dioxide are due to fossil fuel burning; the rest is due to land-use change, especially deforestation. More than half of the increase in methane emissions is caused by human activities, such as use of fossil fuels, cattle, rice agriculture, and landfills. (Dankelman . I, 2002)

The growth of population is a major factor behind climate change today. Human-caused climate change is fundamentally an imbalance of scale, as people release heat-trapping gases into Earth's atmosphere faster than the oceans and living things can remove them. This imbalance stems from both the explosion of technologies made possible through the combustion of fossil fuels since the late 1700s and the more than sevenfold increase in human numbers since that time. The size of today's population and its continued growth also put at risk the social and institutional resilience needed to adapt successfully to the impacts of climate change, ranging from sea-level rise to more extreme weather events. Slower population growth followed by a gradual decline in population size would facilitate future reductions in greenhouse gas emissions and help societies adapt to the changes in climate that are now all but inevitable, since (due to the long lag times built into the climate system) they will be the product of emissions that we failed to cut in past years and decades. (Robert Engelman, 2010)

The effects of global climate change act as local and specific threats to particular eco-geographical regions, particular cities, and the lives of particular communities, families and individuals. And they interact adversely with many already existing problems – such as poverty, class, caste and gender inequalities – resulting in highly complex realities of inequity and crisis. Society therefore requires knowledge grounded in local conditions and the lives of individuals and particular communities for climate change mitigation and adaptation and strengthening of the people's resilience. (Gandham, S. 2010). The women members particularly from rural areas are more severely affected by the climate change or the natural calamities. The women issues in climate change have been attracting the attention of various social scientist, social activists, researchers, policy makers and planners etc. The paper is based on the secondary information.

Impact of Climate Change in General

Climate change effects and related disasters have occurred predominantly in the developing world: in 1998 the melting of snow in China and India caused 5550 deaths. Typhoons, cyclones, and hurricanes in the Philippines, Bangladesh, and the Caribbean and Central America caused 15,800 deaths. In 1999, 50,000 people died in Venezuela due to heavy rains and mud floods. In 2000, a major disaster occurred in Mozambique when rains, floods, and cyclones affected 800,000 people, caused 700 deaths, made 250,000 homeless, increased the incidence of malaria and other tropical diseases, and impacted negatively on food production. People with low incomes affected by such disasters have very little to fall back on: they lack insurance, savings, or adequate social welfare structures to cope with such dramatic events. As a result, they suffer death, injury, illness, become homeless, and are forced to seek refuge in other areas or countries. This contributes to a rising number of environmental refugees, who are still not recognized by the UN (CJN 2001).

Agriculture is one of the prime livelihoods of majority of the population in India. Due to climate change and droughts agriculture was not yielding remunerative income, the life of the farmers became very desperate. Many of them committed suicide as a last resort. As revealed by Sharad Pawar, the Union Agricultural Minister, in the Lok Sabha in 2004, over one lakh farmers committed suicide in India. According to the National Crime Records Bureau, 17,060 farmers committed suicide in the country in 2006 with Maharashtra having the highest number of (4453) suicide deaths. Punjab is the latest in the list of States having farmers' suicide. This is a record in

the agricultural history of India. It points to the acute nature of the problem which has affected the vast majority of the population, and which has created a real crisis.

According to RM Vidyasagar and K Suman Chandra (2004) about 3,000 Andhra Pradesh farmers committed suicide in the past five years owing to debt trap, drought and crop failure. The incidence of suicides has been very high during 2001 as many farmers have sustained loss in agriculture owing to erratic monsoon during 2000. Farmers' suicides in Anantapur district at present indicate that the incidence is again very high during 2002-03 due to severe drought conditions and crop failure.

Impact of Climate change on women

Climate change is often seen as a technical problem, requiring technical solutions. But in fact there are many social and political aspects to this complex issue. Similarly, it is often argued that climate change is gender neutral – that is, that it affects women and men in the same ways. Yet, in many cases, communities interact with their physical environment in a gender-differentiated way. (Dankelman . I (2002)

Women—particularly those in poor countries—will be affected differently than men (Parikh, 2013). They are among the most vulnerable to climate change, partly because in many countries they make up the larger share of the agricultural work force and partly because they tend to have access to fewer income-earning opportunities. Women manage households and care for family members, which often limits their mobility and increases their vulnerability to sudden weather-related natural disasters. Drought and erratic rainfall force women to work harder to secure food, water and energy for their homes. Girls drop out of school to help their mothers with these tasks. This cycle of deprivation, poverty and inequality undermines the social capital needed to deal effectively with climate change.

Nine women turned widows on International Women's Day in Vidharbha. That's how many farmers took their lives on March 8. The highest on a single day in the region's recent history. Till two weeks later, when it happened again. There have been some 250 farm suicides in just the first three months of this year. Things could be a lot worse after June. And, as always, the farm suicides are a symptom of the crisis, not its cause. They are its outcome, not its engine.

A study conducted by Regional Meteorological Centre, found decline in the income due to rainfall deficiency in Assam- Meghalaya between 2001 and 20011. It further points out that the women folk, who were basically homemakers, now have started to work to supplement the

family income and in many places they have even started working as daily wagers. In hundreds of households, women are now compelled to take up weaving, daily wage labour and other related activities to make ends meet, and in many areas women of the households are taking up fishing to make up for lost agricultural produces. The findings of the study also point out that in some areas; the adverse effects of climate change have also pushed many prosperous families to take up work as domestic helps and daily wage labourers.

The study , " Impact of Climate Change on Marginalized Women " conducted by Guwahati-based Centre for Environment, Social Policy Research (CESPR) Rashtriya Gramin Vikas Nidhi(RGVN) and Indian Network on Ethnic and Climate Change (INECC) said more and more women, who were already marginalized, are bearing the brunt of climate change in the form of decline in livelihood and social security. The study revealed that manifestations of climate change like erratic weather pattern, rainfall deficiency and high-intensity floods are seriously affecting the socio-economic development of marginalized and rural women in the state.

"The changing dynamics of the Indian family, the increased stress upon women to be financially independent and the whittling down of the familial support structure have all put tremendous physical, emotional and mental strain on our women," observes Dr Vidhi Chowdhury, obstetrician and gynecologists, Spring Meadows Hospital, New Delhi. "These pressures, coupled with the lack of proper nutrition and education about health play havoc with female hormones, resulting in a skewed menstrual pattern."

Gendered divisions of labor often result in over representation of women in agricultural and informal sectors, which are more vulnerable to climate change. Many poor women are also actively engaged in agricultural activities, including paddy cultivation and fishing, which will be affected by changing weather patterns in India. Loss of livelihood will increase their vulnerability and marginalization.(UNDP,2007/08) Indian women, in general, are also responsible for tasks such as food collection and energy supply for the household as well as many care-giving tasks such as caring for the children, sick, elderly, the home and assets. (Enarson, 2000) For instance, in hill and mountain regions, and in arid and semi-arid areas where forests have disappeared and agriculture remains poor, women spend between six and ten hours daily collecting the resources they need to meet their basic survival needs. (Centre for Science and Environment (CSE), 1999)

Though the IUCN (World Conservation Union) has celebrated by releasing a disturbing report on global warming predicting that the physical, economic, social, and cultural impacts of global warming will jeopardize women far more than men. Just as Hurricane Katrina and the 2004 Indian Ocean Tsunami disproportionately affected women far more than men. The report, *Gender and Climate Change*, concludes that women are more severely affected by climate change and natural disasters because of their social roles and because of discrimination and poverty. To make matters worse, they're also underrepresented in decision-making about climate change, greenhouse gas emissions, and, most critically, discussions and decisions about adaptation and mitigation. (Whitty J, 2007)

Women bear a disproportionate burden of climate change consequences

Decreased food security: With changes in climate, traditional food sources become more unpredictable and scarce. This exposes women to loss of harvests, often their sole sources of food and income.

Impact on livelihoods: Women are more dependent for their livelihood on natural resources that are threatened by climate change. For instance, climate change causes a rise in the sea level, affecting the fishing community (both men and women) not only in terms of fish-catch but also with regard to water scarcity, as seawater gets into fresh water. Besides, when the land is inundated, infrastructure (roads and houses) are damaged. Large scale migration from inundated areas is expected and much of the burden of migration falls on women.

Water resources - shortage and access: Climate change may exacerbate existing shortages of water. Women are largely responsible for water collection in their communities and are therefore are more affected when the quantity of water and/or its accessibility changes.

Increased burden of care giving: As primary caregivers, women may see their responsibilities increase as family members suffer increased illness due to exposure to vector borne diseases such as malaria, water borne diseases such as cholera and increase in heart stress mortality. (Parikh, J 2010)

With no one in the home, girls have to leave school to look after younger children and do the chores.

Assam is home to more than 31 million people, 14 percent of them under six years old. Described by the Intergovernmental Panel on Climate Change as part of the highly eco-sensitive and fragile eastern Himalayan region, the territory has been witnessing marked climatic changes

over the past 60 years. According to official figures collated by local meteorologists, there has been a steady decline in annual rainfall in the state over the 1950-2010 period, with the trend particularly evident over the past decade. Meanwhile the mean annual temperature has risen by more than 1° Celsius since 1950.

A new study by three organizations working in the northeast, including the Indian Network on Ethics and Climate Change, investigates how these changes in climate are affecting the more marginalized groups in society, in particular women in rural areas.

The study, involving 900 households in six different locations around the state, found that climate change is having a serious impact on poor women in various ways: increased flooding in some areas has led to soil erosion which in turn has meant farmers have struggled to earn a living. As a result, women are forced to leave the home in search of work, often as cleaners or weavers. With no one in the home, girls have to leave school to look after younger children and do the chores.

Child marriages on the rise

Increased periods of drought in another area mean there is no fodder for cattle, and milk production, a vital income source, has declined. Farmers find it impossible to work in the intense heat that now often bakes the land. Again, women are forced to leave their homes and find wage-paying work. Such families struggle to get by; the study found the number of child marriages has increased in recent years as "parents of impoverished families find it an easy way to provide a better future for their girl children."

Assam is famous for its tea gardens. "The unusual rain pattern is playing havoc with the tea plantations," says the study. Declines in tea production mean there are fewer jobs available and more people move to the towns and cities. As has happened in other parts of the world, once such a trend of urbanization is under way, it's hard to reverse. Some young girls from the tea gardens, says the study, are forced into the flesh trade.

More pesticides

As increased flooding and rising temperatures bring more crop diseases, farmers are applying more pesticides. Increased flooding and rising temperatures have led to a rise in disease, particularly malaria. In the tea-growing regions, more pesticides are being used to counteract crop diseases. The result is that garden workers – older ones are paid US\$1.50 per day while girls earn half that amount – are noticing more skin infections.

While local authorities and the state government have taken action to limit soil erosion and tackle floods in some areas, there is an urgent need for more to be done, says the study. And with only 40 percent of the state's irrigation systems functioning properly, that includes harvesting and sustaining precious water resources. A massive tree planting program is also required. Far more attention has to be paid to poverty alleviation.

The study shows a people bewildered by what's happening. "It rains excessively when unexpected and does not rain when it is expected," one farmer says.

Gender as a factor of vulnerability to climate change

It is estimated that women produce over 50% of all food grown worldwide. In India, more than 84% of women are involved in agricultural activities, and as a result they become the greatest victims of climate change's impact. In addition, gender inequality makes them disproportionately vulnerable to environmental alterations.

Discrimination against women also plays an enormous role in how women experience the effects of climate change. In India, for example, where women have seen their crop yields cut in half and the quality of grain diminish because of climate changes, women's health is impaired from the double whammy of inferior crops and inequality.(Conversation for better world, 2009)

Conclusion

The studies indicate that India is vulnerable to climate change leading to heightened food and economic insecurity and a humanitarian crisis. It also depicts the picture that there is gender differentiation regarding the impact of climate change due to different roles that gender plays and its different capabilities and situations. To ensure well-being of women and promote their development, National Missions on climate change should address the concerns of women and incorporate gender-sensitive measures to make adaptation strategy more robust. The existing gender inequalities and discrimination pose a significant additional challenge for women to build their resilience and adapt to a changing climate. Given that climate change is not gender natural, social justice funders need to incorporate a gender lens into their strategies and support groups that are promoting women's leadership in community-based climate action and people advocacy movements.

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Climate Change and Mental Disorders

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Abstract

"Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The main cause of climate change is rising of global temperature and emissions of green gases that endanger the human's mental health and related behaviour. Extreme weather events such as droughts, floods, cyclones, and hurricanes lead emotional stress which in turn triggers depression, post traumatic stress disorder and suicide. So, one should take the urgent steps to reduce the green gas emissions otherwise mental disorders will be another social cost for a country.

Climate change is a change in the statistical distribution of weather over periods of time that range from decades to millions of years. It can be a change in the average weather or a change in the distribution of weather events around an average (for example, greater or fewer extreme weather events). Climate change may be limited to a specific region, or may occur across the whole Earth. It is the most important global environmental challenge facing humanity with applications of food productions, natural ecosystems, fresh water supply and health.

Introduction

Climate change stems from the burning of oil, coal and other fossils fuels that are central to our current way of life but the resulting green house gas emissions not only are fuelling global warming but are also increasing environmental degradation that imperils our very lives. Over this century, the average global temperature is expected to rise between 1 degrees and 6 degrees Celsius. Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gasses such as Carbon Dioxide (CO₂) produced by human activities. According to him glaciers will melt, seas will rise, extremes in precipitation will occur. According to data from 2009 India is the third biggest emitter of CO₂ after China and the United States – pushing Russia into fourth place.

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The world mostly agrees that something needs to be done about global warming and climate change. The first stumbling block, however, has been trying to get an agreement on a framework. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was created by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to assess the scientific knowledge on global warming. The IPCC concluded in 1990 that there was broad international consensus that climate change was human-induced. That report led way to an international convention for climate change, the United Nations Framework Convention on Climate Change (UNFCCC), signed by over 150 countries at the Rio Earth Summit in 1992. The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 12.5 to 10 degrees Fahrenheit over the next century. According to the IPCC, the extent of climate change effects on individual regions will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change. The IPCC predicts that increase in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increase.

The recent catastrophic climatic events like the massive floods in Pakistan and India, the Hurricane Katrina in the United States, the prolonged droughts in Australia, China, Pakistan, India and Texas, are all the results of increased temperatures due to global warming. During the 21st century, climatic disasters occurred five times as frequently and killed or affected seventy times as many people. Between 2000 and 2004, an average of 26 climatic disasters was reported each year. Thus, the immense geological changes will continue their destruction unabated if steps to mitigate global warming are not taken.

People's mental health and related behaviour, is positively or negatively influenced by both external social and climate factors. A rapid change in climate is likely to influence and increase mental health issues. This is especially evident in the case of climate-related natural hazards, where property losses and displacement from residences can cause significant psychological stress, with long-lasting effects on anxiety levels and depression. Social disruptions which results from family and community dislocations due to extreme weather events pose a special stress for children and those of lower socio-economic status.

There is evidence that extreme weather events, such as droughts, floods, cyclones, and hurricanes, can lead to emotional distress, which can trigger such things as depression or post-traumatic stress disorder, in which the body's fear and arousal system kicks into overdrive.

After Hurricane Katrina, rates of severe mental illness - including depression, PTSD, anxiety disorder, panic disorder, and a variety of phobias - doubled, from 6.1 percent to 11.3 percent, among those who lived in affected regions. The Hurricane Katrina Community Advisory Group (2006) found in a study that rates of mild-to-moderate mental illness also doubled, from 9.7 percent to 19.9 percent. After a disaster, people can feel inadequate, like outside forces are taking control of their lives. They can't see a positive future. They tend to lose hope or become depressed. Severe disasters also destroy the infrastructure needed to provide mental health care, and forcibly displace people, severing social connections when people need those most.

Climate change is expected to create about 200 million environmental refugees by 2050, according to the Intergovernmental Panel on Climate Change, the international body established within the United Nations to evaluate causes and consequences of global warming.

Of course, no one can predict the effect of warming on our psyches in future. The link between mental illness and the weather can be tenuous or even downright is contradictory. Suicide is more common, less common, or equally common in hot weather. But even in the face of uncertainty, specialists say the indirect effects of global warming could be substantial. In India and Australia, where severe droughts have already taken a toll on agriculture, researchers have noted an uptick in suicides among farmers. Though much of the anxiety centers on the possibility of extreme weather events, global warming will also transform the natural environment in a more gradual way. These changes could have their own effect on mental health.

Indeed, climate change may eventually deplete natural resources, make it more difficult for people to live off the land, and disrupt the global food supply. This means declining of socioeconomic status and quality of life across the world which in turn gives depression, demoralization, and disillusionment. So, prompt and strong action is clearly wanted. Since climate change is a global problem, the response to it must be international. If we do not take urgent steps to reduce our greenhouse gas emissions, rising mental health issues will be another social cost that our society will need to bear.

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A Comparative Study of CO₂ Emissions in Selected Countries of the World

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Abstract

The accelerating economic growth and improving standard of living all over the world is resulting into increase in per capita energy consumption. Today, in spite of developments in renewable energy resources, fossil and bio-fuel are being used on large scale. This is responsible for the emission of huge quantity of CO₂, a major constituent of GHG,s. The status of country wise as well as per capita CO₂ emission and bio-fuel consumption in road transport studied in this paper reveals that, USA and China emit large amount of CO₂. The consumption of bio-fuel was high in USA and low in Japan. In Australia, Brazil and South Africa the annual CO₂ emission was low i.e. less than one billion tonne per annum. However, there is an urgent need to adapt CO₂ emission reducing measures both in developing and developed countries.

Introduction

Warming of the Climate System is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level' (IPCC, 2007) Greenhouse gases (GHG's) released due to various anthropogenic activities is the main cause of global warming, a looming threat of drastic change in climate in the forthcoming decades.

Climate Change, a result of global warming is the most important challenge that the human civilization has ever faced and has serious implications for future water, food production, health, human wellbeing and ultimately the survival of living organisms. The man- induced activities have led to increased atmospheric concentration of a number of green house gasses, namely carbon dioxide, methane, nitrous oxide, chlorofluro-carbons and tropospheric ozone in the lower atmosphere. Carbon dioxide produced from burning of fossil and bio-fuel is the principle GHG. The World Bank has identified six countries, namely USA, China and the European Union, Russian Federation, India and Japan as emitters of largest quantity of CO₂.

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With this view, an attempt has been made in this paper to compare the CO₂ emissions in selected countries of the world.

Objectives

The main aim of the present study is to compare the CO₂ emissions in different countries of the world. This has been achieved with the help of following objectives.

1. To find the country wise status of CO₂ emission
2. To compare the country wise per capita CO₂ emission.
3. To study the status of bio-fuel consumption in road transport.

The Study Area

In all eight countries, that is USA, India, China, Australia, Japan, Germany, Brazil and South Africa representing different continents of the world have been selected for the present study. USA, Australia, Japan and Germany represent the developed countries, while, India, Brazil, China and South Africa represent the developing world.

Data Base and Methodology

The secondary data of CO₂ emission and percent change in population have been collected from a report of PBL Netherlands Environmental Assessment Agency published in 2012. The data consists of country wise amount of CO₂ emission (1990-2011). Per capita CO₂ emission (1990-2011) and Bio-fuel (bio-ethanol and biodiesel) consumption in road transport (2005-2011). It is because of the unavailability of bio-fuel consumption data for South Africa, the study for bio-fuel consumption have been restricted up to seven countries only.

Changes in CO₂ emissions have been obtained by using following formula.

$$\text{Change in CO}_2 = \frac{\text{Emission in latter year} - \text{Emission in earlier year}}{\text{Emission in earlier year}} \times 100$$

Trends in CO₂ Emission:

In view of knowing the country wise trend of CO₂ emission, the data for eight countries was obtained and presented in table no.1.

Table 1. CO₂ emission/country, 1990-2011 (unit: billion tonnes of CO₂)

Year	USA	India	China	Australia	Japan	Germany	Brazil	South Africa
1990	4.99	0.66	2.51	0.27	1.16	1.02	0.22	0.27
1991	4.96	0.70	2.65	0.28	1.17	0.99	0.23	0.26
1992	5.04	0.74	2.78	0.28	1.18	0.94	0.23	0.27
1993	5.18	0.76	3.02	0.28	1.18	0.93	0.24	0.27
1994	5.26	0.81	3.19	0.29	1.23	0.92	0.25	0.27
1995	5.26	0.87	3.52	0.30	1.25	0.92	0.27	0.29
1996	5.44	0.92	3.62	0.31	1.26	0.94	0.29	0.30
1997	5.58	0.96	3.59	0.33	1.26	0.91	0.31	0.31
1998	5.65	0.97	3.65	0.35	1.22	0.90	0.32	0.32
1999	5.69	1.03	3.57	0.36	1.26	0.87	0.33	0.30
2000	5.87	1.06	3.56	0.36	1.28	0.87	0.35	0.31
2001	5.75	1.08	3.64	0.36	1.26	0.89	0.35	0.29
2002	5.83	1.12	3.90	0.37	1.30	0.87	0.35	0.31
2003	5.87	1.15	4.50	0.38	1.31	0.88	0.34	0.34
2004	5.94	1.24	5.28	0.40	1.31	0.88	0.36	0.36
2005	5.94	1.29	5.85	0.41	1.32	0.85	0.37	0.36
2006	5.84	1.38	6.51	0.42	1.30	0.86	0.37	0.36
2007	5.91	1.48	7.01	0.42	1.33	0.84	0.39	0.37
2008	5.74	1.56	7.79	0.44	1.25	0.86	0.41	0.37
2009	5.33	1.75	8.27	0.44	1.18	0.80	0.39	0.35
2010	5.53	1.86	8.90	0.40	1.26	0.84	0.44	0.36
2011	5.42	1.97	9.70	0.43	1.24	0.81	0.45	0.36

The table reveals that, the highest amount of CO₂ was emitted from china (9.70 billion tonnes) in 2011 while; Brazil records the lowest emission i.e.0.22 billion tonnes in 1990. In Australia, Brazil and South Africa the annual CO₂ emission of CO₂ was less than one billion tonne/annum. The emission from Germany was also less than one billion tonne/annum except in 1990. In case of India also, it was remained less than one billion tonne /annum up to 1998 and further it has exceeded one billion tonne. In case of U.S.A., China and Japan, the emission values were always exceeded one billion tonne per annum.

Per Capita Co₂ Emission

Accelerating economic growth and poverty elimination program undertaken in various countries of the world are resulting into increase in per capita energy consumption in both developed and developing countries. The practice of using fossil fuel like mineral oil, coal and bio-fuel such as bioethanol and biodiesel is highly responsible for the increase in per capita CO₂ mission. The obtained values of per capita CO₂ emission are shown in Table 2.

Table 2: CO₂ emissions in 2011 (million tonnes CO₂) and CO₂ /capita emission 1990-2011 (tonne CO₂ /Person)

Country	Emission	Per capita emissions				Change	Change	Change in Population
		1990	2000	2010	2011			
	2011					1990-2011	1990-2011 in %	2090-2011 in %
USA	5420	19.7	20.8	17.8	17.3	-2.4	-12	19
India	1970	0.8	1.0	1.5	1.6	0.8	100	30
China	9700	2.2	2.8	6.6	7.2	5	227	15
Australia	430	16.0	18.6	17.9	19.0	3	19	24
Japan	1240	9.5	10.1	10	9.8	0.3	3	3
Germany	810	12.9	10.5	10.2	9.9	-3	-23	4
Brazil	450	1.5	2	2.2	2.3	0.8	53	24
South Africa	360	7.3	6.9	7.1	7.2	-0.1	-1	27

The table reveals that, the highest per capita CO₂ (20.8 tonne) was emitted from USA in 2000 while, the lowest (0.8 tonne) per capita CO₂ was emitted from India in 1990. The countries namely India, China and Brazil show continuously increasing trend of CO₂ emission while, in remaining countries, the trend of emission was fluctuating. The rate of change of CO₂ emission was positive in India, China, Australia, Japan and Brazil. However, it was negative in USA, Germany and South Africa. The percent change in CO₂ emission was highest (227%) in China, while, it was at its lowest (-23%) in Germany. The percent change in population varies between 3% (Japan) and 30% (India).

Bio fuel Consumption in Road Transport

In the search for alternative fuels, fuel technologies have looked to bio-sources, By virtue of development, bio-ethanol and biodiesel are being offered as a fuel in most of the countries. Both of these sources emit large amount of CO₂ while burning. An attempt has been made to know the status of bio fuel consumption in road transport of selected countries during the period from 2005 to 2011. The relevant data is depicted in table 3.

Table 3: Bio fuel consumption in road transport (bio-ethanol and biodiesel), 2005-2011 (in Tj)

Country	2005	2006	2007	2008	2009	2010	2011
USA	3,64,700	5,09,800	6,60,700	8,29,600	9,43,100	11,28,500	11,97,500
India	4,600	5,000	5,600	5,500	4,500	5,200	5,200
China	14,800	42,200	46,400	48,500	57,300	57,300	56,300
Australia	---	---	900	2,700	5,500	7,600	10,000
Japan	400	400	500	500	1,100	1,800	1,800

Germany	78,600	1,43,600	1,55,600	1,26,100	1,13,000	1,21,100	1,23,300
Brazil	2,88,900	2,70,500	3,74,900	4,01,100	5,35,500	5,52,600	4,79,400

The table reveals that, the highest emission of CO₂ was from USA (11, 97,500 Tj) in 2011 while, the lowest emission was recorded in Japan i.e.400 Tj in 2004 and 2005. The countries namely USA, China, Australia and Japan shows consistently increasing trend of bio-fuel consumption. In India and Germany, the trend was fluctuating while, in Brazil, the bio-fuel consumption was decreased in 2006 and further it was increased constantly.

Conclusion

USA being most developed country with highest standard of living and China, the most populous country emits large amount of CO₂. Whereas, the emission levels were low in South Africa, which is a developing country. The range of percentage change in per capita CO₂ emission was very high i.e. -12% (USA) to 227% (China). USA because of its recession in recent years might have shown a continuous decline in CO₂ emission. While, China because of its mass production policy adopted in industrial sector have shown the rise in CO₂ emission. The rate of change in population was from 3% (Japan) to 30% (India) i.e. it was low in developed country and high in developing country. The consumption of bio-fuel was high in USA and low in Japan. The low bio-fuel consumption in Japan may be because of the shortage of land resources for growing bio-fuel yielding plants. There is an urgent need to adapt CO₂ emission reducing measures both in developed and developing countries of the world.

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Environment Induced Crop Water Requirement in Ahmednagar District of Maharashtra State

Ashok Salve*

Abstract

Agriculture productivity largely depends upon adjustment of crop growing season with soil moisture adequacy periods. Agriculture planning and scheduling essentially require know how of soil moisture, its fluctuations and moisture magnitudes. Study of rainfall characteristics help in understanding the periodic availability of moisture and its amount for crop growth to evade or to minimize crop losses due to soil moisture variations and to suggest the ways for agriculture planning to increase the crop yields. In this paper attempt has been made to compute top soil and root zone water balance for Ahmednagar district. Based on water balance soil moisture content, start and end of growing season, average length of growing season, soil moisture adequacy and crop moisture availability has been estimated for eight crops for Ahmednagar district, Maharashtra state, India.

Introduction

The soil-water availability is a reflection of soil types and its chemical properties, air moisture and temperature. All these factors together decide the atmospheric water demand. It is the water balance of top soil and root zone soil of the area helps in understanding soil moisture availability, its periodic fluctuations and magnitudes. Quantum of soil moisture demand depends on type and growth stage of crop but availability soil moisture is influenced by type of soil, intensity and duration of wetting events and air temperature. Temperature and rainfall determine the start and end of crop growing season. In this study attempt has been made to identify crop growing season for eight crops namely bajra, jowar, wheat, cotton, Soyabean, sunflower, onion and Tur for Ahmednagar district in Maharashtra state, India.

Key words: Water Balance, Evapotranspiration, Moisture availability index.

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Objectives

To estimate constant, initial and conditional probabilities

To identify the suitable growing period of each selected crop

To compute water balance for 13 rain gauge station of study area for 8 crops

To suggest the best possible growing periods for selected crops in study area

Data and Methodology

In present study, data regarding rainfall and temperature has been obtained from India Meteorological Department, Pune. The crops data have been obtained from socio-economic abstract, Ahmednagar district for 2005-2006. First order Markov Chain Model is used for estimation of initial and conditional probabilities of weekly rainfall. Incomplete Gamma model is used for estimation of expected minimum amount of rainfall at different probability level. For soil water balance for Ahmednagar district WATBAL (Keig and McAlpine, 1974) method and FAO, 1998 has been adopted. WATBAL technique has been used to compute weekly water balance to derive actual evapotranspiration. Two entities reference crop evapotranspiration and actual evapotranspiration are used for estimation of soil moisture availability. Further soil moisture availability index is used to identify growing seasons. Daily water balance technique given in FAO drainage and irrigation paper 56 has been used to find all suitable growing period for each crop at each rain gauge station of study area.

The term “soil water balance” relates to moisture addition through precipitation and irrigation and loss through evapotranspiration, runoff and deep drainage. It is a simple book keeping processes where entries of water debit and credit are entered and deficit or surplus are arrived at. It describes the changes in water content of soil profile. The soil water balance with its surplus or deficit helps to identify growing season for crop cultivation and crop growth. The soil water balance model consists of two components, crop water requirement and its availability to the crop

Rainfall, evapotranspiration and soil moisture are the basic parameters of water balance. The rainfall is the main source of moisture, turns into soil moisture through percolation. With increasing rainfall, soil moisture storage increases resulting into water surplus while continuous uptake of water results into decrease in soil moisture. To compute potential evapotranspiration, actual evapotranspiration, runoff and soil moisture status various methods or models are used. These models range from crude field observation based methods of simple nature to more computationally complex water balance models differing in the range of input data requirements and parameterization. Thornthwaite has used evapotranspiration term to demonstrate the

atmospheric water demand. A few names of water balance models are namely, Thornthwaite and Mather Model (1955), Balney-Criddle method (1950), Palmers Model (1965), Versatile soil moisture budget (Baier and Robertson, 1966), Keig and McAlpine (1974), Modified Penman method (Doornbos and Pruitt, 1977), Frere and Popov FAO Model (1979), WATBAL Model (1974), ICSWAB Model (Reddy 1983), Ritchie's Model (1985)

The range from simple book keeping model of Thornthwaite-Mather model (1956), Keig McAlpine (1959) to More complicated models like Baier and Robertson (1966), Ritchie (1972) Reddy (1983) and other models developed by FAO. Subrahmanyam (1956 and 1972) used Thornthwaite-Mather model for climatic classification of India. George (1973) Chowdhary (1977) Rao and Kalavaty (1983) Hema Malini, Anuja Tigga, Champa Chaudhari has used this model to show water balance in their studies. In 1965 Palmer has presented water balance model to devise drought index. In this model he divided root zone in two soil layers for water budgeting purpose. He has considered these layers as top soil layer and sub layer. Field capacity of top layer was considered 25 mm and field capacity of sub layer was dependant on its inherent properties. The water additions and depletion takes place through top soil layer. This model was used by George and Ramashastry (1973) and Bhalme and Mooley (1979), this model further modified by Frere and Popov (1979), was applied to undertake water balance studies in developing countries. The time interval in this adaptation was reduced from a month to decade and a week to reflect more specific crop water requirement. The parameters used in this model are normal precipitation, weekly average rainfall, number of rainfall days, potential evapotranspiration, crop co-efficient and field capacity. In this model potential evapotranspiration has been calculated by using Penman method whereas crop coefficients are taken from Doorenbos and Pruitt. Baier and Robertson developed the water balance model called versatile soil moisture budget. This is more complex and accurate model. Crop water requirement is fulfilled from root zone of the soil and not from total depth of the soil. Palmer has presented this concept but Baier and Robertson made it more scientific by incorporating systematic zonation of the soil. A book keeping procedure is followed to account for changes in soil moisture due to precipitation and crop water use. Surplus or deficit of water is computed as a measure of stress in the form of an index termed as the Water Requirement Satisfaction Index (WRSI) in a cumulative manner. The input parameters were precipitation, potential evapotranspiration, available soil moisture at start and at the end of the day and water holding

capacity of each zone of soil. Anand Akmagchi used this model for irrigation scheduling in Kolhapur district of Maharashtra state. J Reddy in 1977 presented a model based on experimental data from ICRISAT centre. This model is known as ICSWAB. This model presented a method to estimate soil water balance using easily measurable parameters like rainfall and pan evaporation and estimated actual evapotranspiration is based on atmospheric demand, types of crop and soil characteristics. The growth stage of crop is represented by co-efficient based on least area index and percent light interception. This helps to estimate water availability in soil at different phonological stages of crop growth. Frere and Popov in 1979 have developed a water balance model for Food and Agriculture Organisation. This method incorporated cumulative water balance of weekly values of rainfall, potential evapotranspiration, water holding capacity of soil and crop co-efficients which is a reflection of real situation. This model identifies water availability period and present water requirement. Many scientists have applied this model to quantify the yield of crops under rainfed conditions in vaious parts in India. Deosthali has used Food and Agricultural Organization model to assess the suitability of crops for dry farming tracks of Maharashtra State (1996). The major drawback of above methods is that estimated evapotranspiration as a combined effect of evapotranspiration. Evaporation is basically from soil and transpiration is from plants needs to be estimated separately. In 1998 FAO published guidelines to estimate crop water requirement wherein devised the methods to reference crop evapotranspiration, maximum evapotranspiration, evaporation coefficients, crop coefficients, water stress coefficients and based on that daily water balance can be estimated.

5.2.1 Modified FAO water balance model 1998.

The daily water balance expressed by following formula:

$$D_{r,i} = D_{r,i-1} - (P - RO)_i - I_i - CR_i + ET_{c,i} + DP_i \quad (85)$$

where

$D_{r,i}$ = Root zone depletion at the end of day i [mm],

$D_{r,i-1}$ = Water content in the root zone at the end of the previous day,
i-1[mm],

P_i = Precipitation on day i [mm],

RO_i = Runoff from the soil surface on day i [mm],

I_i = Net irrigation depth on day i that infiltrates the soil [mm],

CR_i = Capillary rise from the groundwater table on day i [mm],

$ET_{c,i}$ = crop evapotranspiration on day i [mm],

DP_i = water loss out of the root zone by deep percolation on day i [mm].

Crop evapotranspiration is calculated by multiplying ET_o by K_c where ET_o is reference crop evapotranspiration and K_c is crop coefficient. The crop coefficients vary at every stage due to change in ground cover, crop height, and leaf area changes. The crop coefficient can be estimated by two approaches, single crop coefficient and dual crop coefficient. In single crop coefficient approach, effects of crop evapotranspiration and soil evaporation are combined in one K_c coefficient. In dual crop coefficient approach, effects of crop evapotranspiration (K_{cb}) and soil evaporation (K_e) are estimated separately. They are called basal crop coefficient (K_{cb}). In present study crop coefficients and basal crop coefficients were taken from FAO Irrigation and Drainage Paper 56 (1998) and then modified because these values require refinement if minimum relative humidity differs from 45 percent or wind speed is larger or smaller than 2.0 meter per second. As relative humidity is 41 percent and wind speed is 2.38 meter per second for Ahmednagar district above mentioned values are refined. In order to calculate crop evapotranspiration for reference crop growth of crop or evapotranspiration.

$$ET_c = (K_{cb} + K_e) ET_o$$

The values measured or calculated by this formula at different locations or different seasons are comparable as it refer to the evapotranspiration from the same reference crop. The growing period is divided into four growth stages: initial stage, namely, vegetative growth stage or crop development stage, flowering and reproductive or mid season stage and ripening stage or late season stage. The initial stage is from planting date to approximately 10 percent ground cover. The crop development stage is from 10 percent coverage to effective full cover i.e. flowering. The mid season stage is from full ground cover to start of maturity. The late season stage of crop is from ripening to harvesting. Robertson has studied the crop growing period based on climate and soil characteristics. He has assumed the amount of water readily available to crops is 50 percent of available water holding capacity at root zone, Kowal and Krabe (1972) have defined the starting of growing period as the first 10 days period with more than 25 mms precipitation provided that rainfall in next 10 days exceeded half of potential evapotranspiration. Roman (1974) was in favour for sowing operation as a spell of 25 millimetres in period of 7 days having least 1 millimetre or more on any five of these seven days. Virmani (1975) defined crop growing period as an event when 20 millimetres of rainfall received in one or two consecutive days in a week having a dependable precipitation probability followed by a week with similar probability. Benoit (1977) has carried out growing season in northern Nigeria. Cocheme and Franquin (1967) have studied growing period at which average rainfall is equal to 1/10, 1/2 and 1.0 of potential evapotranspiration at the beginning, middle and end of the rainy season. In present study growing periods are identified based on following conditions. An amount of precipitation is equal or more than 0.5 potential evapotranspiration has been considered as being sufficient to meet the water requirement of the crops, and,

- The amount of moisture requires to sustain crop germination and emergence is much less than full potential evapotranspiration. During crop emergence in field potential evapotranspiration approximates to about 0.5 (Kowal and Kassan, 1978). In a given crop growing season, many times decisions are relied upon the probability of receiving a certain amount of rainfall during a given week. The beginning of crop growing periods have identified by using following criteria

- ### The growing periods of different crops in the study area

Source: Field Survey, 2009.
Note : Figure indicates number of days.

N	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5									1	1	1	1			
V	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3	4	5	6	7	8	9	0	1	2	3	
B									1	1	2	2	2	2	3	3	3	3	3	3	4	4	4	4																					
J																	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4											
W																													1	1	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4
O																	1	1	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	4									

Source: Computed by Researcher

Note: Crop Growth Stages 1= Initial stage 2= Crop Development Stage 3= Mid Stage 4= Last Stage

Weeks	Ah	Ak	Jam	Kar	Kop	Nev	Par	Pat	Rah	Sang	Shev	Shrig	Shrir
23	0.38	0.21	0.40	0.27	0.21	0.19	0.32	0.25	0.23	0.15	0.27	0.36	0.23
24	0.47	0.35	0.55	0.37	0.32	0.42	0.37	0.37	0.42	0.32	0.42	0.35	0.60
25	0.39	0.37	0.47	0.18	0.37	0.47	0.29	0.63	0.39	0.21	0.58	0.29	0.31
26	0.42	0.48	0.53	0.29	0.45	0.48	0.48	0.40	0.53	0.32	0.56	0.27	0.37
27	0.42	0.89	0.56	0.39	0.45	0.42	0.50	0.47	0.53	0.42	0.61	0.33	0.28
28	0.28	0.78	0.47	0.19	0.41	0.34	0.44	0.38	0.44	0.31	0.41	0.19	0.34
29	0.46	0.92	0.62	0.30	0.46	0.39	0.46	0.43	0.49	0.36	0.43	0.30	0.49
30	0.37	0.91	0.61	0.27	0.41	0.37	0.41	0.44	0.51	0.34	0.34	0.20	0.57
31	0.30	0.86	0.46	0.33	0.39	0.36	0.43	0.30	0.46	0.33	0.39	0.20	0.39
32	0.20	0.64	0.41	0.14	0.24	0.34	0.30	0.14	0.37	0.17	0.17	0.10	0.24
33	0.21	0.56	0.31	0.14	0.28	0.35	0.24	0.35	0.31	0.21	0.24	0.03	0.14
34	0.26	0.39	0.39	0.13	0.23	0.33	0.26	0.23	0.33	0.13	0.46	0.07	0.36
35	0.31	0.41	0.41	0.21	0.27	0.38	0.34	0.38	0.27	0.10	0.48	0.07	0.21
36	0.43	0.26	0.60	0.26	0.23	0.40	0.33	0.63	0.26	0.13	0.63	0.10	0.17
37	0.63	0.23	0.63	0.56	0.40	0.50	0.40	0.66	0.37	0.40	0.56	0.30	0.20
38	1.11	1.01	1.08	0.98	0.81	0.78	0.81	1.11	0.61	0.64	0.88	1.15	0.74
39	0.82	0.92	0.92	0.95	0.65	0.68	0.95	0.95	0.54	0.68	0.65	1.05	0.78
40	0.31	0.42	0.42	0.45	0.31	0.28	0.38	0.17	0.28	0.28	0.28	0.45	0.24

Source : Computed by Researcher.

Note : Ah = Ahmednagar, AK = Akola, Jam = Jamkhed, Kar = Karjat, Kop = Kopergaon, Nev = Nevasa, Par = Parner, Pat= Pathardi, Sang = Sangamner, Shev = Shevgaon, Shrig = Shrigonda, Rah = Rahuri, Shrir = Shrirampur. MW = Monsoon Week

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A Review on Futuristic Impacts of Changing Climate on Crop Production in Maharashtra and Andhra Pradesh State

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Abstract

This study aims to investigate the changing climate and its impact on rural society in India. In Andhra Pradesh ground water depleting rapidly. According to IPCC annual rainfall in Andhra Pradesh is going to increase about 4 to 8 % whereas changes in the spatial rainfall observed, because of anthropogenic emissions which are responsible for global warming. In this context Groundnut yield fall by 28%; Jawar exhibits greater resilience with decline of 4%. On the other side in the Maharashtra state climatic changes will influence the rural classes. IPCC's Integrated Modelling System (IMS) examines increase in precipitation of about 36% across the Godavari river basin in Maharashtra state. Projections show that increase in annual maximum temperature of an average 3.8 °C to 2.4 °C in year 2071 to 2100. This study also reporting that yield of sugar cane is decline so considerably. Looking after the forecast several modifications are adopted in the agriculture. The paper concluded with suggestions and recommendation to make adaptation of climate change.

Introduction

Emergence of global warming due to climate change is not a new but most talked subject of the day and rightly as it being the most threatening issue for very existence of life on the earth. Earth's climate is continuously changes in foreseeable future, regardless of potential mitigation actions, with consequent impacts and implications for development and growth. In India climate change causes for vulnerability of agriculture and livelihoods depend on interconnected factors. These are physical likewise soil conditions, water supplies and infrastructure; economical and institutional.

Key words- Climate change, Temperature increase, Crop yield, Rainfall, Water resource.

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Satish Kumar (2003) edited that mean annual average temperature in India raised by 0.4°C in the last 50 years. The frequency of drought in India has been increasing. Several statements and investigation array to develop recognition on climate change impacts in India and rural classes too. In India the climate change expected to adversely affect its natural resources, forestry, and agriculture, changes in precipitation, temperature, monsoon timing and extreme events (Falkar and Kale, 2010).

It is important to note that on a per-capita basis, India is one of the lowest Greenhouse Gas (GHG) emitters in the world. Its emission of 1.18 tonnes of CO₂ equivalent per capita in 2008 was nearly one-fourth of the corresponding global average of 4.38 tonnes GOI (2011). The per capita emissions of India will be around 2.5 tons of carbon-dioxide equivalents by the 2020 and around 3.5 tones carbon dioxide equivalent by 2030, compared to present emissions. Even in this situation, the per capita emission will be still remaining lower than most major countries as India stands ready to be a part of the solution. India has already announced that it will reduce the emissions intensity of its GDP by 20-25 percent over the 2005 levels by the year 2020, through pursuit of proactive policies. India currently spends over 2.6% of the GDP on adaptation to climate variability with specific areas of concern in agriculture, water resources, forest, health, sanitation, coastal zone infrastructure and extreme events.

Climate change poses particular changes due to its geographical diversity. Climate projections for India suggest that the impacts are likely to be varied and heterogeneous. Some region experiencing intense rainfall and flood risks while others encounter sparser rainfall and prolonged droughts. In India the climate vulnerability of agriculture and livelihoods depends, on a suitable of interconnected physical, economical and policies (World Bank, 2009).

Indian Meteorological Department (IMD) and Indian Institute of Tropical Meteorology (IITM) Pune, showed the same trend for temperature, beats waves, glacier, droughts and floods, and sea level rise as by the results of Intergovernmental Panel on Climate Change (IPCC) varies in some cases. In India, there is no trend in monsoon rainfall during last 100 years, but there are some regional patterns. Areas of increasing trend in monsoon rainfall are found along the west coast, north part Andhra Pradesh and north-west part of India and those of decreasing trend over east Madhya Pradesh and adjoining areas, north-east India and parts of Gujarat and Kerala (-6 to -8%) of normal over 100 years. Surface air temperature for the period 1901 -2000 indicates a significant warming of 0.4 °C for 100 years (Reddy Raghava; 2010). The spatial distribution of

temperature changes indicated a significant warming trend has been observed along the west coast, central Indian and interior Peninsula and over north-east India. Following table shows some warmest years in India.

Year	Temp. anomaly (°C)	Year	Temp. anomaly (°C)
1941	0.448	1958	0.435
1998	0.514	1999	0.445
2001	0.429	2002	0.708
2003	0.560	2004	0.515
2005	0.410	2006	0.600
2007	0.553	2009	0.913

Source: <http://www.imp.gov.in>

The annual mean temperature during the respective year was high compared to 20th century. The increase in trend was higher from late 70's and the magnitude of increase in temperature was 0.4 °C over normal during the first decade of century. Increase in CO₂ has positive effects in photosynthesis and increases the crop growth, free air CO₂ enrichment up-to 550ppm under controlled modeling revealed an enhancement in yield of wheat, chickpea, green gram, pigeon pea, soybean, tomato, potato in between 14-27% (Singh Gyanendra; 2010). Increase in atmospheric temperature may increase the water requirement of the crops, reduce the organic matter of the soil and thus reduce the yield.

According to Rao Govinda *et al* (1994) doubling of CO₂ concentration by 2030 will increase average global temperature by 1-3°C may result to decrease in production of cereals and in contrast increase in tropical cyclonic activities posing serious flood damage. Roesnzweig and Parry (1994) estimated that the net effect of climate change that may lead to reduce global cereals production up-to 5%. Morey and Sadaphal (1981) reported decrease of wheat yield by 400kg/ha at increase in every 1°C temperature. In similar studies, Ramkrishna *et al* (1996) estimated fall in productively of pearl millet in Rajasthan to temperature rise by 2⁰C. Study by Lal *et al* (1998) concluded that acute water shortage conditions combined with thermal stress would adversely affect wheat production.

Likely impacts of climate change on agriculture productivity in India causing a great concern to the scientists and planners as it can binder their attempts for achieving household food security. Food grain requirement in the country would be reach about 300 million tons in 2020. Therefore, the question is great global concern.

Materials and Methods

This study based on the review of secondary data, records and reports published by the several agencies like World Bank, Indian Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM), Intergovernmental Panel on Climate Change (IPCC), Indian Council of Agriculture Research (ICAR) Groundwater Surveys and Development Agency (GSDA) etc. and independent research investigations. For this, two case studies i.e. Maharashtra and Andhra Pradesh state are draw in this work.

Andhra Pradesh

Andhra Pradesh is the 5th largest state in the country, both in terms of geography and population. The World Bank report (2009) projected that average increase in annual perceptual is about 4% to 8%. Uncertainty in the rainfall creates more runoff and frequent drought periods.

Crop responses to climate change: There will be inevitably variations in crop yields i.e. Rice, Groundnut and Jowar which collectively 70% of total arable output in Chittoor and Anantapur districts. World Bank Climate Prediction Model, ie Environmental Policy Integrated Climate model (EPIC) finds that despite slightly higher rainfall, the average yield of all three crops decline. Groundnut yield fall dramatically by 6% to 28%, Jowar exhibits greater resilience with decline up-to 2% to 4% while average Rice yield is decline by 4% to 10%. With declining average yield causes for desindled agricultural profit from 5% to 20% agriculture may not be sufficient to sustain the marginal farmers who comprise a large segment of rural population.

Drought Adaptive Initiative: Putting Adaptation In To Practice: Andhra Government implements pilot level drought adaptation initiative in the selected villages of Mahabubnagar and Anantapur districts by the Society for Elimination of Rural Poverty, Watershed Support Services and Activities Networks. The drought adaptation initiative focuses its resources on four areas of interventions: a) Management of common natural resources, dealing with proper water resource and common land management; b) Production system, focusing on diversification and intensification in agriculture, livestock and horticulture with technology innovation; c) Focus on improved and fast access to markets, credit and insurance; d) Strengthening of villages and village level organizations i.e. Self Help Groups (SHG), watershed committees, credit committees. This pilot experiment is expected to support a wider replication in Andhra Pradesh and provide lesson to other semiarid states.

Weather Index Insurance for Farmer: The insurance company ICICI-Lombard, in collaboration with Hyderabad based microfinance in situation BASIX piloted rainfall indexed insurance to protect farms from drought, especially for Groundnut and Castor crops. This was first weather insurance initiative in the developing world. According to World Bank rise in some technical difficulties to measure weather related phenomenon this has been fails to satisfy for future climate changing scenario.

Maharashtra

About a quarter of Indian's drought prone districts lie in Maharashtra state and its 73% of geographic area classified as semiarid. This state is the second most populated in Indian which have 77% of literacy and an economy contributes 20% of the country's manufacturing output and 13% of its gross domestic product. Industry and services are well developed and the state remains the financial hub of the country. But paradoxically, almost 47 % of its population lives below property line. Poverty has largely related to the rural areas and reflects the low income.

Ground Water Development Problems for Maharashtra State: Directorate of Groundwater Surveys and Development Agency and Department of Water supply and Sanitation, Govt. of Maharashtra stated that in the state most important aquifers are the Deccan basalts, where groundwater occurs within the shadow, weathered and fractured zones extending to depth of 15-20 meters. The average depth of ground water table in the shadow aquifer ranges from 5-10 meters during the post- monsoon period and 15-20 meter below ground level during the pre-monsoon period. Recharge rates are low (8-14% of rainfall). During a poor rainfall, insufficient recharge and over abstraction leads to a progressive decline in water levels. The excessive pumping of ground water leads to decline of water table and consequently wells dried up during the pre-monsoon period (March to April).

Future Prospects under climate change: World Bank's Integrated Modeling System (IMS) finds that the following changes may occurs in the Godavari river basin:

- An increase in precipitation of about 24% to 36% which is approximately 770 mm to 840 mm respectively.
- Increase in annual maximum temperature on average of 2.4°C to 3.8 °C .
- Rainfall is found to become more variable and higher rainfall may expect to increase runoff by 12.5% to 13.5%.

- The monthly rainfall patterns are projected to switch somewhat: while a marginal drop would take place in May and July, an increase would be seen in the already wet months of August and September.
- Crop responses to climate change: Results of the agronomic model find that increase in temperature and rainfall, yield of Bajra increases dramatically in more arid Ahmednagar district. Jowar yield is also increases by 6% to 8% opposite to this Sugarcane display a starkly constricting pattern of responses. Sugarcane yield expected to decline by 30%. The decreased yield is attributed to the increased moisture stress caused by the warmer climate, coupled with the low responsiveness of Sugarcane to carbon dioxide levels.

Looking more closely to the distribution of yields there is a uniform deterioration in outcomes. In particular, climate events that generate low yield are more frequent, whereas higher yield outcome become less common.

Economic Assessment of climate change impacts on crops in Maharashtra state: Under current climate conditions Sugarcane is vastly more profitable than either Bajara or Jowar. The per hectare profit of sugar cane are approximately ₹ 19,000 (Word Bank, 2009), while those from Bajara are ₹ 1,300 to ₹ 2,300. This clearly gives the estimates of economical loss of the farmers in the study region.

Projected consequences of climate change:

If higher the yield of Bajra and Jowar translate into moderately higher profits of 8% to 15% per hectare receptivity. In this regards the profitability of Sugarcane is 25% to 30% per hectare where Sugarcane still remains consider more profitable, so there is little incentive to switch cropping pattern from Sugarcane to either Bajara or Jawar

Sugarcane yield and Climate Change in Ahmednagar district in EPIC Model Projection:

The response of Sugarcane yield to climate change is rather complex, the impact take place through the several channels, including temperature, water, stress and level and distribution of rainfall. With testing by the EPIC model predicts that increasing CO₂ concentration from 420 ppm to 550 ppm will drop 13% crop yield. It is estimated that Sugarcane yield responds negatively to hotter conditions and Sugarcane yield drops by 6% with 1°C rise in temperature. The damage is even greater when the warming intensify Sugarcane farm will experience 22% yield loss with temperature rise by 2°C and as much as 40% loss with rise of 3°C. EPIC model

predicts that this is more than offset by other for overall cause. A yield loss for Sugarcane is demarcated in the study.

Findings

Climate change impact on food productivity: Study by Agarwal and Mall (2002), stated the impact of various climate scenario has been assessed from grain yield of irrigated Rice with popular crop stimulations model i.e ORYZAIN at different level of management. Output of this study showed that Rice yield increased by 1-16.8% in southern and western part. The direct and indirect effects are seen on agricultural system will not only responding to climate change but through fluctuating yield have negative impacts on production and distribution. On the contrary most site-specific simulations indicate that a small increase in temperature without considering the CO₂ fertilization effect will produce decline in yield, but that combined effects of increases in the level of CO₂ and temperature will increase yield (e.g. Saseendran et al. 2000, Krishnan et al. 2007, and Yao et al. 2007).

In Wheat it was projected that Wheat yield would be around 58 million tons by 2070 as against the 76 million tons during the year 2000 due to increase in temperature (Reddy Raghava, 2010). World Bank in the study stated that raise in 2°C temperature losses the 3 to 9 % current agriculture income.

Conclusion and Recommendations

Accelerating the productivity and sustainability of the agricultural sector is the prerequisite for properly eradication. Because of climate change there will be continue to affect the lives and agricultural production.

- Requirement of policy actions after deeply studying possible impacts of climate change in context with agriculture produce. Establish a climate information management system at central level for developing climate diagnostic and risk assessment tools with feedback mechanisms to end users.
- Promote agricultural and extension services towards system and cultivators better suit to the local climate and its variability.
- Water conservation measures like cost effective rain water harvesting for villages, watershed practices and promote storage of rain water.
- Develop and design community based agriculture credit and climate change risk financing system.

➤ Develop multi level benefits of the insurance for the crops.

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Water Quality Status of Groundwater in Nira River Basin Area for Agricultural Purpose

R. P. Dhok*

Abstract

Groundwater quality of Nira river basin area experienced degradation due to unlimited use of canal water for irrigation purpose. This area is under irrigation by Nira River left canal. The hydrochemical investigation in the present study is restricted to the major ions concentrations, distributions, their relative abundance, and the pattern of the variability in groundwater. An investigation was carried out by collecting thirty groundwater samples for Post – monsoon season (POM) (November 2012 to February 2013) to decipher hydrochemistry and groundwater quality for determining its suitability for agriculture purposes. The groundwater is neutral to alkaline in nature with pH ranging from 6.36 to 9.53 with an average of 7.85. Higher electrical conductivity was noted in Kalamb, Khorochi, Nimsakhar. Residual sodium carbonate value indicates 19 samples out of 30 are not suitable for irrigation purpose. 40% samples are hard water and 37% are very hard water. High salinity of groundwater is recorded by 27 % samples and such saline water affect on the quality and total production of agriculture.

Introduction

Water is the precious gift of nature to the human being. It is essential for the growth and maintenance of our bodies, as it is involved in a number of biological processes (WHO 2008). In India, groundwater constitutes about 53% of the total irrigation potential of the country (FAO 2003) and about 50% of the total irrigated area is dependent on groundwater irrigation (Central water commission 2006). Sixty percent of irrigated food production is from groundwater wells (Shah et al 2000). Groundwater quality is a major concern in many parts of the country.

Key Words: Groundwater, Electrical Conductivity, SAR, Soluble Sodium Percentage, RSC.

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Groundwater quality data gives important clues to the geologic history of rocks and indications of groundwater recharge, movement and storage (Walton 1970). Assessment of groundwater quality is necessary and immediate task for present and future groundwater quality management. Groundwater quality, in turn, depends on a number of factors, such as general geology, degree of chemical weathering of the various rock types, quality of recharge water and input from sources other than water- rock interaction (Domenico 1972); (Schuh et al 1997); (Todd et al 1980). Such factor and their interaction results in a complex groundwater quality (Hussein 2004). Various publications have concentrated on groundwater quality monitoring and evaluation for domestic and industrial activities (Jalali 2005; Pritchard et al 2008) reported high salinity and nitrate in groundwater from Wuwei basin, northwest China. (Mohan et al 2000) reported geochemical facies and demarcation of locations unfit for human consumption in Uttar Pradesh state of India. Total dissolved solids (TDS) values are also considered as an important parameter in determining the usage of water and groundwater with high TDS values are not suitable (Dhok et al 2011). The objective of the present paper was to assess groundwater quality and its suitability for agriculture purpose in the Nira river basin area.

Study Area

The Nira River originates from Bhore in pune district. The study area lies between 18.11 to 18.16 latitudes and 73.85 to 75.03 longitudes. It is located at an altitude of 526 meters above means sea level at Indapur and 587 meters above means sea level at Bhore. Ground water samples from different thirty sampling sites are selected randomly and by considering the topography of the study area (APHA 1995) (Fig. 1).

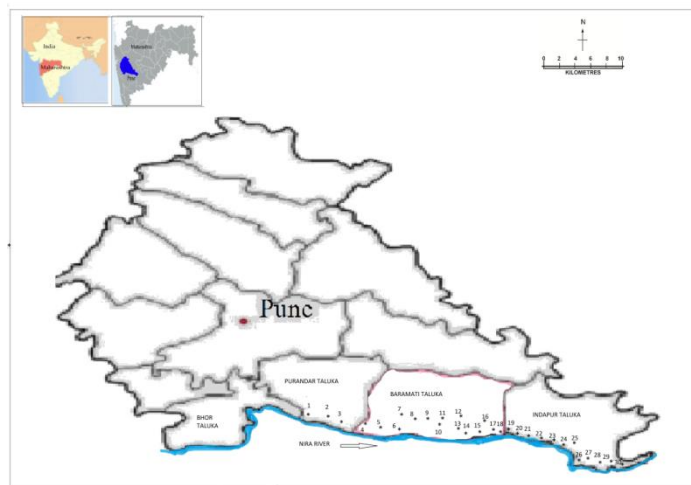


Fig 1 Location map of the study area

Material and Methods

Sample Collection: groundwater samples were collected from the selected sites for Post monsoon season (November 2012 to February 2013). Each sample was collected in a good quality polyethylene bottle of one-liter capacity.

Laboratory Measurements:

Samples were analyzed in the laboratory in the major ions chemistry employing standard method (APHA 1995). Calcium (Ca^{2+}) and magnesium (Mg^{2+}) were determined titrimetrically using standard EDTA. Carbonates, bicarbonate (HCO_3) by titration with HCl, Sodium (Na^+) and Potassium (K^+) by flame photometry. EC, pH and TDS were measured at the sampling sites with the help of handy meters. The results are tabulated in Table 1.

Table - 1 Water Analysis data of Post - Monsoon (Winter 2012)

Sr No.	Sampling Sites	PH	EC	TDS	Sodium	RSC	SAR	Ca	Mg	TH
			$\mu\text{S/cm}$	mg/l	%	meq/l		mg/l	mg/l	mg/l
1	Vir	7.52	510	326	24.50	2.60	0.86	15.00	33.00	173
2	Mandki	7.80	560	358	23.80	2.50	0.75	27.20	18.20	143
3	Jeur	7.25	1750	1120	54.60	0.30	3.09	32.00	20.00	162
4	Nimbut	8.14	290	186	50.81	7.80	2.54	32.06	17.02	150
5	Wanewadi	9.53	150	96	25.23	2.80	0.80	36.07	21.88	180
6	Murum	8.11	1060	678	36.72	0.70	1.43	36.07	17.02	160
7	Soratewadi	7.78	2600	1664	22.25		1.25	104.20	52.28	475
8	Hol	7.28	880	563	38.67		2.22	36.07	53.50	310
9	Wadgaon	7.72	1140	730	56.21	8.30	2.89	30.06	12.16	125
10	Korhale	8.29	1480	947	20.16	7.20	0.72	14.02	37.38	189
11	Malwadi	7.98	2470	1581	35.19	2.30	1.61	28.05	36.48	220
12	Pandhare	7.91	1090	698	52.04	5.60	3.38	14.02	49.85	240
13	Kambleswar	7.14	800	512	44.20	2.30	2.27	30.85	32.83	212
14	Sangvi	8.19	520	54	46.74	3.10	2.04	24.04	18.24	135
15	Khandaj	8.10	4250	2720	50.92		4.40	54.10	76.60	450
16	Dorlewadi	8.07	880	563	64.68	4.20	3.87	42.02	1.22	110
17	Mekhali	7.87	2040	1306	28.37	4.80	1.58	22.04	83.90	401
18	Songaon	7.43	820	525	21.21	1.70	0.75	22.04	34.04	195
19	Tawashi	8.16	860	550	41.17	3.10	1.75	34.06	17.02	155
20	Jambh	7.85	600	384	17.71		1.03	64.12	96.06	556
21	Chikli	8.21	1880	1203	18.67	2.70	0.84	64.12	38.91	320
22	Kalamb	8.06	4760	3046	37.35		3.39	200.40	74.17	806
23	Nimsakhar	7.54	3700	2368	28.68	2.00	1.75	56.11	72.96	440
24	Khorochi	8.03	4170	2669	40.62		2.43	28.05	17.02	140

25	Boratwadi	8.02	2390	1530	31.20		2.13	54.10	32.83	270
26	Nirningaon	7.32	1440	922	20.06		1.07	24.04	14.59	120
27	Sarati	7.62	1030	659	62.29	4.50	3.72	36.07	8.51	125
28	Pimpri Bk	7.94	1860	1190	22.69		1.36	16.03	121.60	541
29	Tannu	6.36	1300	832	58.06	2.00	3.15	26.05	15.80	130
30	Narsinghpur	8.14	1790	1146	15.27	0.50	4.71	82.16	121.60	706
	Min	6.36	150	54	15.27	0.30	0.72	14.02	1.22	110
	Max	9.53	4760	3046	64.68	8.30	4.71	200.40	121.60	806
	Avg	7.85	1636	1038	36.34	3.38	2.13	42.84	41.56	278

Source: Field Survey

Results and Discussion

Physico-Chemical Parameters of Groundwater

The physicochemical composition of the groundwater samples were analyzed and the results such as maximum, minimum and average parameters are given in table 1. The pH ranges from 6.36 to 9.53 with an average 7.85 during POM which indicated the alkaline nature of groundwater. During POM, Calcium is found to be higher (200.40 mg/l) due to dissolution of CaCO_3 during recharge (Datta et al 1996).

Spatio-Temporal Variation

Electrical Conductivity

EC is the most important parameter to indicate salinity hazard and suitability of water for irrigation purpose (Dhok et al 2011). The EC varies from 150 to 4760 $\mu\text{S}/\text{cm}$ during POM. The spatial variation of EC is shown in Fig. 2. Very high (>3000) EC concentration is found in 13.33 % samples.

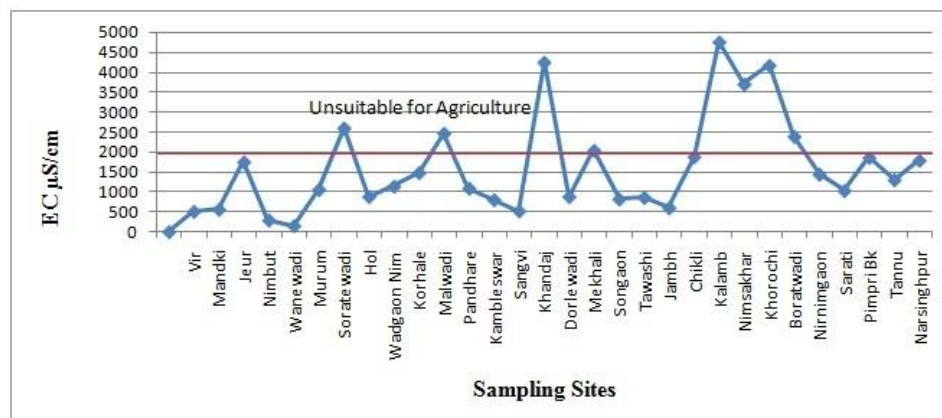


Fig: 2 Spatial variations in EC

Total Hardness

Water hardness has no known adverse effects; however, some evidence indicates its role in heart disease (WHO 2008). The TH is calculated by using the formula

$$TH = (\text{ppm of Ca} \times 2.496) + (\text{ppm of Mg} \times 4.118)$$

Hard water is unsuitable for domestic use and it is a measure of the Ca^{2+} and Mg^{2+} content expressed in equivalent of calcium carbonate (Dhok et al 2013).

During POM, Total Hardness ranges between 110 to 806 mg/l with an average of 278 mg/l representing (77 %) of the water samples are hard to very hard.

Residual Sodium Carbonate

RSC is calculated to determine the hazardous effect of carbonate and bicarbonate on the quality of water used for agricultural activities (Janardhana Raju 2007) RSC is calculated by using the formula

$$RSC \text{ (meq/l)} = (\text{CO}_3 + \text{HCO}_3) - (\text{Ca} + \text{mg})$$

RSC ranges from 0.30 to 8.30 meq/l with an average of 3.38 during POM. From the observed values 63 % samples are not suitable for irrigation purposes (> 1.25). Hence, continuous use of high RSC waters will affect the yields of crop.

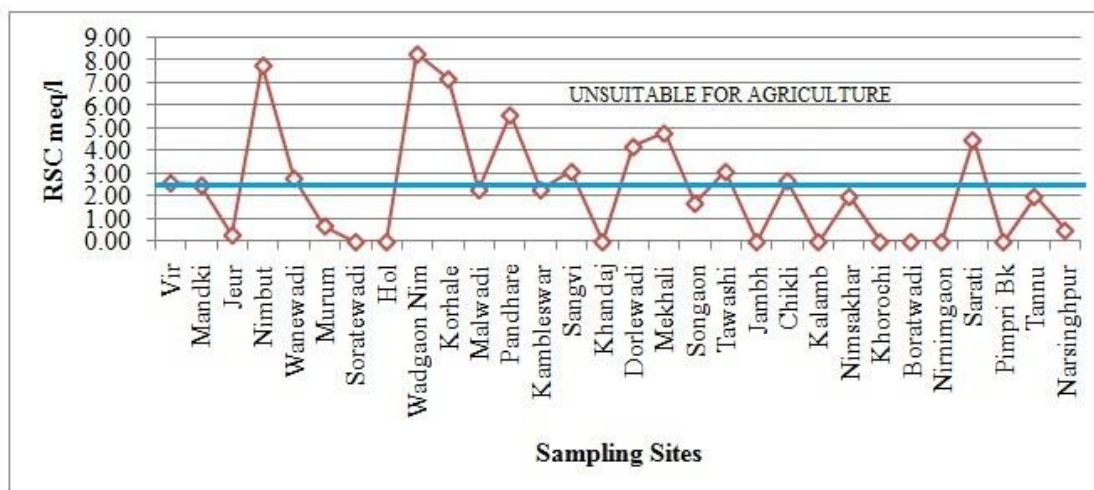


Fig: 2 Spatial variations in RSC

Sodium Percentage

Sodium is an important ion used for the classification of irrigation water due to its reaction with soil, reduces its permeability. Sodium is usually expressed in terms of percent sodium or soluble-

sodium percentage (%Na). Percentage of Na^+ is widely used for assessing the suitability of water for irrigation purposes (Wilcox 1955).

Table 2 Classification of groundwater quality based on suitability for irrigation purposes

Parameters	Range	Class	No of Samples	Percentage of the samples
EC	<250	Excellent	1	3.33
	250-750	Good	5	16.66
	750-2000	Permissible	16	53.33
	2000-3000	Doughtful	4	13.33
	>3000	Unsuitable	4	13.33
SSP	0-40	Good	18	60
	40-65	Good to permissible	12	40
	60-90	Doughtful	0	0
	>92	Bad (Unsuitable)	0	0
TH	<75	soft	0	0
	75-150	Moderately	7	23.34
	150-300	Hard	12	40
	>300	Very hard	11	36.66
RSC	<1.25	Safe	11	36.67
	1.25-2.5	Marginally suitable	6	20
	>2.5	Not suitable	13	43.33

The Na % is computed with respect to relative proportion of cations present in water as

$$\text{Sodium \%} = \frac{\text{Na}}{(\text{Ca} + \text{Mg} + \text{K} + \text{Na})} \times 100 \text{ meq/l}$$

Where, all ionic concentrations are expressed in meq/l. The classification of samples is shown in Table 2. It is observed that maximum samples contains less amount of soluble sodium percentage.

Sodium Adsorption Ratio

Total salt concentration and probable sodium hazard of the irrigation water are the two major constituents for determining SAR. Salinity hazard is based on EC measurements. If water used for irrigation is high in Na^+ and low in Ca^{2+} the ion-exchange complex may become saturated with Na^+ which destroys the soil structure, due to the dispersion of clay particles (Todd 1980) and reduces the plant growth. Excess salinity reduces the osmotic activity of plants (Subramani et al. 2005). The SAR is computed, using the formula

$$\text{SAR} = \frac{\text{Na} +}{\sqrt{\frac{(\text{Ca} + 2 + \text{Mg} + 2)}{2}}}$$

Concentrations of ions are expressed in meq/l. There is a close relationship between SAR values in irrigation water and the extent to which Na^+ is absorbed (Subba Rao 2006). The computed SAR values ranges from 0.72 to 4.71, which indicates that SAR is in the permissible level.

Conclusion

The groundwater quality in Nira river basin area has been evaluated for their chemical composition and suitability for agricultural purpose. Higher EC values are Confined along up stream, central and downstream indicating the dominance of natural and agricultural activities. Higher TH is noted in various parts of the study area like Jambh, Kalamb, Narsinghpur places. 77 % water samples are under hard to very hard categories and not suitable for agricultural purposes. Sodium percentage and SAR is found to be in permissible level. Overall hydro geochemical analytical study reveals 67 % samples shows RSC unsuitable for irrigation purposes.

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Climatic Water Budget – A Case Study of Rahata Tahsil in Ahmednagar District of Maharashtra

B. K. Wani*

Abstract

The present paper attempts to analyse the climatic water budget. This research is based on Thornthwaite and Mather (1955) modified water balance technique. An analysis is based on weekly rainfall data. The average rainfall is about 515.53mm receives during monsoon season. The climatologically water demand for potential evapotranspiration is estimated about 1391.2mm. There is water deficit for annual mean or less than mean rainfall. The distribution of weekly rainfall shows that only 38th to 39th week have rainfall greater than PE and rest of the weeks have water deficit. The total amount of rainwater is estimated about 3318Mh for mean rainfall, 4396 Mh for mean + STD and 5474 Mh for mean + 2STD. For greater than mean rainfall, coarse shallow soils located in western part of the tahsil have comparatively more water surplus after AE than the deep black soil located in the central part and along with rivers. Study area is located in drought prone zone of Maharashtra so water management is prime object for sustainable agricultural development.

Introduction

Agriculture is the backbone of Indian economy because of largest share in national income and workforce employed (Naidu and Venkata 2007). In India, overall economy is depends on the performance of agriculture. Agriculture is the source of livelihood and food security for rural population. However, the erratic nature of monsoon rainfall increases the elements of risk in agricultural production. In the last century there were many severe droughts as in 1918, 1972, 1979, and 2002 affects about 45% of total cultivable area. These droughts were reduced food grain production and income of the farmer (Mir 2006).

Key Words: Agriculture, Soil, Precipitation, Evapotranspiration, Deficit, Surplus,

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The drought-prone areas are facing several socio-economic problems like poor standard of living, malnutrition, migration for employment etc. The water is the key in socio-economic development (Durabude *et al* 2001). India has about 16% of total world population and water resource about only 4% (Bansil 2004). The nature of ecosystem has been defined according to rainfall distribution (Briji 2003). It is also primary elements of biome production (Rao and Krishnamurthy 2006). Water deficit areas are poorer than the water surplus areas for biomass production and diversity (Warner *et al* 2006).

The maximum water holding capacity of soil, rainfall and potential evapotranspiration are the basic controlling elements of water balance. The distribution of these elements have decides droughts or water surplus condition. Therefore rainfall, potential evapotranspiration, aridity, humidity and soil moisture are become primary controlling factors of agriculture (Saikia 1994). In rain fed agriculture, soil moisture is the prime source of water to agriculture and atmosphere. In study area rainfall is only source to water recharge. In the present study water balance technique is used to estimate the availability of rainwater resource in the study area. It will be basic information for agriculture planning for sustainable development.

Objectives

The objectives of the study are as follows.

1. To compute and understand the distribution of weekly water balance.
2. To estimate the climatic water resource available in the study area.

Hypothesis

Rahata tahsil is located drought-prone zone of the Maharashtra and facing water scarcity. The available rainwater is less than atmospheric requirement (PE). Therefore it may be hypothesised that the study area have water deficit for mean or less than mean rainfall and have surplus water after AE if rainfall exceeds from the mean.

Study Area

For the present study Rahata tahsil of the Ahmednagar district in Maharashtra has been selected as a study area. It lies between 19° 31' N to 19° 51' N latitude and 74° 23' E to 74° 37' E longitude. It is situated rain shadow zone of western ghat and facing severe droughts. This is the warping land between Godavari and Pravara river. The average elevation of the area is 530 m from mean sea level (S.O.I.). Tahsil occupies 696.31km² geographical areas within 58 villages and 2 towns. In study region 84.32% of total population living in rural area, out of these

population 42.37% is classified as working population and 57.62% is dependent. Agriculture is the major claimant of workforce and source of income. In this tahsil, 47% area is irrigated and 53% is rain feed. The present study will help to understand water related problems in this area and same time analysis provide basic information for irrigation planning and selection of crops.

Methodology

Data Base: The weekly rainfall data for 30 years (1976-2005) for seven rain-gauge stations situated in and near by Rahata tahsil have been used for present analysis. This data has been procured from the department of irrigation Govt. of Maharashtra. The climatological data have been collected from I.M.D. Pune. Soil map of study area is obtained from the department of agriculture Govt. of Maharashtra.

Data Analysis: The required values of PE have been estimated using formula (1) given by Thornthwaite (1955).

$$e = 1.7 (10 T / I)^a \quad (1)$$

Numerical values of water surplus and deficit are computed by the application of simple book keeping method (2).

$$RF = AE + (Rn + I) + \Delta s \quad (2)$$

The spatial estimations of water resource are based on statistical and GIS techniques. Linear regression has been used for estimations of water resource according different soil types and probability limits. The total volume of water resource is estimated using GIS technique. i.e. Ilwis-3.4 academic (ITC, RSG/GSD, Jan 2004).

Result and Discussion

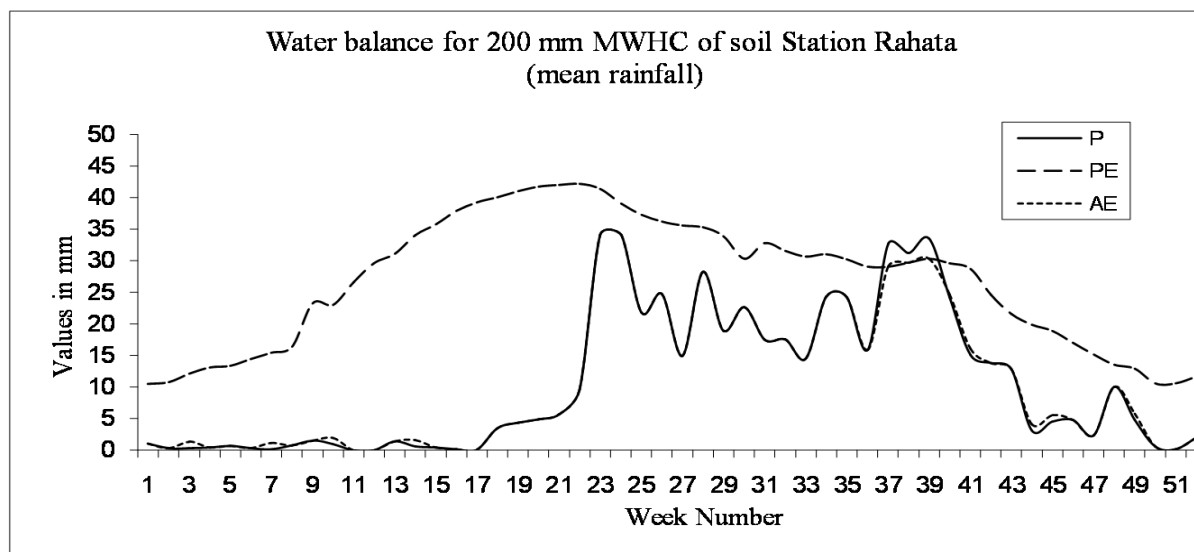
Table.1. Result of Water Balance Analysis

Rain-Gauge station	MWHC	Mean Rainfall				Maximum Rainfall			
		P	AE	WD	WS	P	AE	WD	WS
Rahata	100	546.17	546.17	845.03	0.00	881.4	637.9	753.9	243.5
	200	546.17	546.17	845.03	0.00	881.4	727	664.18	154.38
	300	546.17	546.17	845.03	0.00	881.4	793	598.18	88.38
Ranjangaon	100	518.58	518.58	872.62	0.00	898.2	539.3	851.88	358.88
	200	518.58	518.58	872.62	0.00	898.2	627	764.23	271.23
	300	518.58	518.58	872.62	0.00	898.2	695	696.23	203.23
Chitali	100	518.7	518.7	872.5	0.00	908	595.6	795.61	312.41
	200	518.7	518.7	872.5	0.00	908	731.2	659.97	176.77
	300	518.7	518.7	872.5	0.00	908	812.6	578.58	95.38

Loni	100	478.7	478.7	912.5	0.00	768	588.6	802.61	179.41
	200	478.7	478.7	912.5	0.00	768	665.6	725.65	102.45
	300	478.7	478.7	912.5	0.00	768	734.6	656.65	33.45

Source: District Annual Rainfall Report Various Years

For calculation of water balance MWHC of soil is most essential.



Maximum Water Holding Capacity of Soil (MWHC)

The field capacity is defined as the amounts of water that can be hold in the capillaries of soil agents the pull of gravity. Texture, inorganic and organic contents in soils have counters the MWHC. It has significant role in the water exchange between land – atmosphere and inter region. Study area has three-type of soils i.g. coarse shallow, medium black and deep black. The coarse shallow soil observed in western part (39.71%) of the tahsil with about MWHC 100 mm. Medium black soils found in the middle part covers 44.16% area, having about 200mm MWHC. Deep black soil covers 16.33% of the total area, located along with the rivers. It has about 300mm MWHC.

Water Balance Analysis for Mean Rainfall

The average annual rainfall in the tahsil is about 515.53mm, where as potential evapotranspiration (PE) 1391.2 mm. The water balance calculation is show (Table.1) Positive average actual Evapotranspiration (AE) is about 515.53mm. The value of AE and water deficit (WD) have showing slight difference at various stations and MWHC of the soil located in the tahsil at mean rainfall. Water balance analysis shows there is no surplus water (WS) after AE. It means that MWHC of the soil have not significant role in water balance at mean rainfall.

Water Balance Analysis for Maximum Rainfall

The maximum annual rainfall in the tahsil has been observed up to 908 mm at Chitali station. This is 406 mm more than average. Rainfall above mean is become significant for WS after AE. For this rainfall the value of AE, WD and WS (Table.1) have varied according to soil types. For maximum rainfall coarse shallow soil have show maximum WS after AE than the deep black soil. The deep black soil saturated during high rainfall. Both *kharif* and *Rubbi* season have shows WS. It means that year having high rainfall have good condition for agriculture, with high security in deep soil. All these results gives the idea about nature of rainfall. However, for proper agricultural and irrigation planning the value of water resource volume in Mh with different parameter is more helpful. With considering limitations of water balance the study is offered water budgeting for climatic water resource i.g. rainfall for obtaining the volume of water resource availability and its distribution according to climatic elements viz. AE, WD, and WS.

Available Rainwater Resource

The amount of rainwater resource (Meter hectors) in study area is estimated using interpolation technique in GIS. (3).

$$RW = \sum_{i=1}^n \frac{X_i}{1000} \quad (3)$$

RW = Rainwater resource

n = Number of groups of pixels according rainfall in values histogram (GIS)

Xi = area in the groups of pixels according rainfall values in histogram (GIS)

Total rainwater resource available for mean rainfall in the tahsil is estimated about 3318 Mh. It increases by 32% for rainfall Mean +STD and 64% for mean+2STD.

Estimation of Surplus Water

Surplus water after AE is the main source of soil moisture recharge and runoff. In study area there is no SW for mean or less than mean rainfall. Therefore water balance has been calculated for the years of maximum rainfall. The amount of SW after AE have been estimated for mean + STD and mean + 2STD rainfall. In another study it is found that there is close relationship between WS and the value of rainfall minus MWHC of soil (Bhagat 2002). Here with considering this relationship rainfall minus MWHC is considered independent variable and WS estimated in water balance analysis is considered as dependent variable. For estimation of WS regression technique is use at different rain gauge stations and MWHC of soil. The R² value

(0.82) indicating suitability of regression equation. Estimation of surplus water (equation 4) by using interpolation technique total WS based on MWHC of soils have been estimated. It means that for mean rainfall (P) is equal to AE. However, if rainfall is exceeds mean + STD, WS is estimated about 14% and mean+2STD about 21%. Western part of the tahsil where are coarse shallow soil have high WS than the deep black soil located along with the river for both mean + STD and mean + 2STD rainfall. It means that WS after AE is depends on soil types if rainfall is more than mean.

$$WS = \sum_{i=1}^n \frac{A_i S_j}{1000} \quad (4)$$

WS = water surplus after AE

n = Number of groups of pixels in histogram (GIS).

AiSj = area in the ith groups of pixels with values of WS in the jth groups according to MWHC (GIS).

Soil Water Resource

In this study soil moisture has considered equivalent to AE (Tornthwaite1955). The estimation of these values is based on value of WS after AE from total water resource by using following equation (5) in GIS.

$$AE = \text{rainwater resource} - WS \quad (5)$$

The volume of soil moisture have been estimated by using following equation (6) based on histogram generated for the maps prepared according to STD limits of rainfall in GIS.

$$SWR = \sum_{i=1}^n \frac{A_i SR_j}{1000} \quad (6)$$

SWR = Soil Water Resource

n = number of groups of pixels in histogram.

AiSRj = area in the ith groups of pixels with values of AE in the jth groups of soils according to MWHC.

In the study area soil water resource is equivalent to rainfall if rainfall is less than mean. However, these values are decreases by 14% for mean + STD and 21% for mean+2STD. It is about 3318 Mh for mean, 3792 Mh for mean + STD and 4286 Mh for mean+2STD.

The distribution pattern of the soil moisture is observed similarity for the rainfall above the mean. Deep soils are providing more soil moisture for crops if rainfall exceeds from mean. However, coarse shallow soils have limited scope of soil water resource even in high rainfall condition.

Total Water Resource

At the end of the study the availability of climatic water resource according to soil moisture and WS have been estimated and tabulated. The values shows that the amount of total rainwater available in the tahsil for mean rainfall is about 3318 Mh. This is equivalent to available soil moisture. There is no WS for mean and less than mean rainfall. There is WS estimated about 604 Mh (14%) if rainfall exceeds up to mean + STD and 1188 Mh (21%) for mean +2STD it means that WS is increases from mean. Where soil moisture is also increases by 3792 Mh for mean +STD and 4286 Mh for mean + 2STD. However, total share of soil moisture from total rainwater availability decrease by 14 % and 21 % accordingly.

The variability in rainfall has shows about 30%. It means that the incidence of rainfall more than average is low. It indicates that availability of rainwater in different forms is confined to mean rainfall number of years with water surplus is low. It suggested that the need of water resource management and cropping planning based on availability and variability of climatic water resource.

Conclusion

The water balance analysis and climatic water budgeting have proved that the tahsil have rainwater resource less than the atmospheric water need (PE). The availability of rainwater is increase by rainfall exceeding from the mean. Therefore, hypothesis stated for the present study is accept. The water scarcity has suggesting urgent need of water resource management for sustainable development.

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Spatio-Temporal Analysis of Rainfall Variability in Identifying the Climate Change in Ahmednagar District

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Abstract

Rainfall Variability Index is helpful for farmers and climate change analyzers as it is the most important single factor which determines the cropping pattern of an area. It refers as the degree to which rainfall amounts vary across an area or through the time. Therefore, the present study deals with the rainfall variability of the Ahmednagar District, which includes the spatio-temporal distribution of rainfall variability. This study is based on 30 years of the annual rainfall data for 14 rain gauge stations. The rainfall is highly variable over the entire district and shows the complexity of the rainfall occurrence over the district. Impact of climate changes on spatio-temporal pattern over smaller is clearly noticed in this analysis. There is steady decrease of rainfall from west to east, resulting increase in rainfall variability from west to east in the North Ahmednagar. It also indicates that south tahsils have high rainfall variability as compared to north during last decade. It is warning bell for the agriculture sector in the Parner, Shrigonda, Nagar, Pathardi, Shevgaon, Karjat and Jamkhed tahsils.

Introduction

Climate Change has become a one of the burning issue at present, threats to food production, water availability, forest, biodiversity and livelihoods. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. "Rainfall Variability" refers as the degree to which rainfall amounts vary across an area or through the time. There are two types of rainfall variability, the variation of rainfall amounts at various locations across a region for a specific time interval is called "spatial rainfall variability and the variation of rainfall amounts at a given location across a time interval is refers as a temporal rainfall variability.

Key words: Annual rainfall, Climate Change, Rainfall Variability, Spatio-Temporal

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Both *spatial* and *temporal* variability of rainfall may be measured in various ways. The resulting numerical value can be used to identifying the climate change in the region.

In Ahmednagar district rainfall is one of the most important climatic parameter on which the economy depends because about 9, 26,500 ha. (73.73 %) area is rain fed and out of total workforce 75. 42% are engaged in agriculture therefore, variability in SW monsoon affect life of people and economy of the Ahmednagar district. The understanding of spatio-temporal variability of rainfall is most essential for socio-economic development. Many scientific investigations have been carried out for the spatial analysis of the rainfall over India, including the Maharashtra state by Bussieres and Hogg (1989); Mitra et al. (1997); Sinha et al. (2006). But previous studies have mainly focused on variability of rainfall over Maharashtra in terms of annual and seasonal mean. However, there is no in-depth study for district rainfall variability and the changing pattern of rainfall using a long period of data. The present paper tries to analyze the spatio-temporal variability in annual rainfall of all the 14 tahsil of the Ahmednagar districts for the period 1981- 2010.

Objective

To analyze Spatio-Temporal Rainfall Variability in identifying the Climate Changes in the Ahmednagar District during 1981 to 2010.

Study Area

Ahmednagar is the largest district of Maharashtra State with geographical area of 17, 418 sq. km. (17. 41 lakh ha.) which is 5.66% of area of Maharashtra State. It lies between 18° 2' to 19° 9' N latitude and 73° 9' to 75° 5' E longitude with covering 14 tahsils. The population of district is 45, 43,083 (Provisional Census, 2011) and Out of total workers 75. 42% are engaged in agriculture. The district has 12, 56,500 ha. Net Cropped Area (NCA) out of 3, 30,000 ha. area (26.27 %) is under canal and well irrigation and remaining about 9, 26,500 ha. (73.73 %) area is rain fed. Therefore agricultural operations are mainly depends on SW Monsoon, but rainfall in district is highly erratic. The average annual rainfall in the district is 568.7 mm. The district is mostly in rain shadow region to the east of Western Ghats. From the western border of the district the rainfall decreases rapidly towards east. About 77% of the annual rainfall in the district is received during the SW monsoon season, September being the rainiest month and remaining months receiving unevenly with showing monthly as well as annual rainfall variability.

Database and Methodology

The present study is relies on the secondary data. Annual rainfall data of 14 raingauge stations of the Ahmednagar district for the period 1981 to 2010 are obtained from the Agricultural Department of Maharashtra State (<http://www.mahaagri.gov.in>)

Decadal annual rainfall series of all the 14 tahsils of Ahmednagar district are developed then computed arithmetic mean (X), Standard Deviation (SD) and Rainfall Variability for the each station applying Coefficient of Variation (C.V.) which is expressed as percentage is defined as:

$$\text{Coefficient of Variation (C.V.)} = \frac{SD}{X} \times 100 \quad \text{Where,}$$

C.V. = Rainfall Variability, SD = Standard Deviation of rainfall during 30 year

X = Mean of Rainfall during 30 year

Maps were prepared for express decadal change rainfall variability using Arc GIS software.

Result and Discussion

For the analysis of Rainfall Variability over the Ahmednagar District, CV has been calculated. The table depicts that the spatio-temporal distribution of rainfall is highly variable over entire district, with running CV values from 15.89 to 46.39 % during 1981 to 2010.

Decadal Rainfall Variability in Ahmednagar District

Sr. No.	Tahsil	Rainfall (mm.)								
		1981-1990			1991-2000			2001-2010		
		X	SD	CV (%)	X	SD	CV (%)	X	SD	CV (%)
1	Akoe	402.4	185.25	46.03	533.21	136.86	25.66	768	276.59	36.01
2	Sangamner	356.5	124.62	34.95	426.66	86.23	20.21	449.63	113.32	25.20
3	Shrirampur	546.3	136.92	25.06	480.59	155.87	32.43	445.72	110.47	24.78
4	Kopergaon	460.5	114.13	24.78	410.42	96.03	23.39	525.45	172.03	32.73
5	Rahuri	527.8	199.72	37.840	517.1	94.15	18.20	547.54	185.62	33.90
6	Nevasa	478.6	158.73	33.16	501.03	125.21	24.99	474.90	177.46	37.36
7	Rahata	N.A	N.A	N.A	N.A	N.A	N.A	479.00	165.17	34.48
8	Shevgaom	510.9	198.51	38.85	491.16	184.53	37.57	556.45	171.88	30.88
9	Pathardi	618.7	170.30	27.52	605.01	238.66	39.44	580.54	161.75	27.86
10	Parner	618.6	155.35	25.11	485.49	167.31	34.46	480.54	178.91	37.23
11	Shrigonda	514.06	88.23	17.16	487.56	77.48	15.89	449.72	173.47	38.57
12	Karjat	608.0	145.50	23.93	495.2	176.89	35.72	558.63	165.32	29.59
13	Jamkhed	804.1	207.62	25.82	654.85	218.56	33.37	627.63	153.42	24.44
14	Nagar	729.9	338.60	46.39	592.61	179.67	30.31	526.09	184.81	35.12
	District Average	1025.19	235.80	23.00	957.23	219.07	22.88	995.98	264.05	26.51

Source: Author Computed

Rainfall Variability (1981 to 1990)

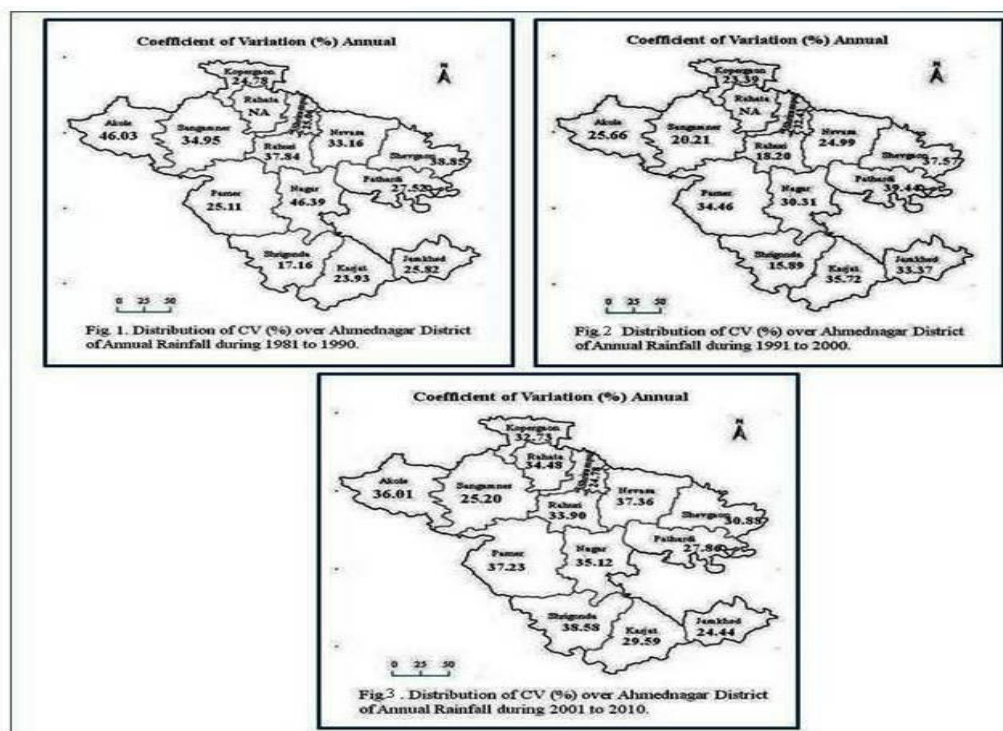
Fig.1 show that during the 1981-1990 decade, lowest rainfall variability has been observed in Shrigonda (17.16 %) while highest in Nagar tahsil (46.39 %), reaming tahsils have moderate to quite high variability. But over all district show 23 % of variability in rainfall.

Rainfall Variability (1991 to 2000)

Decade 1991 to 2000 indicated lowest rainfall variability in Shrigonda (15.89 %) while highest has been observed in Pathardi tahsil (39.44 %). As compared to last decade Akole, Sangamner, Rahuri, Nevasa and Nagar have low rainfall variability while Shrirampur, Pathardi, Parner, Karjat and Jamkhed has been observed high variability in rainfall. But Kopergaon, Shevgaon and Shrigonda also all over the district (22.88 %) show the almost constant variability in Fig. 2.

Rainfall Variability (1991 to 2000)

During the period 2000 to 2010 recorded lowest variability in Jamkhed (24.44%) and highest in Shrigonda (38.57%). As far as Shrigonda is concerned, high increase in rainfall variability is observed as compared to last two decades. Most of the remaining tahsils has been indicates high increase in variability but over entire district it was slightly increase (26.51 %).



Conclusion

The present study analyzed rainfall data during 1981 to 2010 to find out spatio-temporal variability in rainfall over entire Ahmednagar district for identifying climate change. The rainfall is highly variable over the entire district and shows the complexity of the rainfall occurrence over the district. Impact of climate change on spatio-temporal pattern over smaller is clearly noticed in study region. This indicates that the Western Ghat influence the spatial and temporal variability of rainfall patterns. There is steady decrease of rainfall from west to east, resulting increase in rainfall variability from west to east in the North Ahmednagar. It also indicates that south tahsils have high rainfall variability as compared to north during last decade. It is warning bell for the agriculture sector in the Parner, Shrigonda, Nagar, Pathardi, Shevgaon, Karjat and Jamkhed tahsils.

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Climate Change Impacts on Wildlife and Wildlife Habitat

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Abstract

The main purpose of research here are effects of climate change on wildlife habitat. Important policy considerations involving any mitigation actions include effects on other ecosystem services, such as wildlife habitat, and determining baselines and additionality. Stacking of ecosystem services payments or credits with carbon offset payments may be crucial in improving the participation of private forest owners. Potential social impacts of climate change are discussed in terms of health effects on rural communities and climate change sensitivity of indigenous communities. Potential economic impacts on rural communities are discussed for agriculture, forestry, recreation and tourism, fisheries, water resources, and energy. Salient findings from the effects of climate change on wildlife and wildlife habitat at a broad scale. Because climate change is such a far-reaching topic, research opportunities focusing on climate change impacts on wildlife and wildlife habitat are likely to be most informative for policymakers if formulated using an integrated and multidisciplinary systems analysis approach and adaptive management.

Introduction

Climate change is arguably one of the most pressing issues facing our planet and its inhabitants. Climate change is affecting environmental conditions for people and wildlife. As a result of changing environmental conditions, climate change affects wildlife species both directly and indirectly. Current policies influence the area and distribution of potential wildlife habitat. In response to climate change, policies adopted to influence the management of ecosystems are expected also to affect the wildlife habitat and populations that depend on these ecosystems. Many researchers have explored potential impacts of climate change on wildlife populations and habitats, as well as shifts in vegetation communities resulting from projected climate change.

Keywords: Climate change, wildlife habitat, ecosystem services

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The focus of this paper is to provide a broad-scale review and synthesis of existing knowledge about potential direct and indirect impacts of climate change on terrestrial wildlife and wildlife habitat within a systems analysis context. To do this, we rely on existing research that has suggested climate-influenced impacts on particular species and their habitats. We use examples from around the world to illustrate phenomena that have potential to be relevant to wildlife. For our purposes, we define land cover as the observed biophysical cover of the Earth's surface (e.g., forest, grassland). In contrast, land use is the means by which land is used by humans (e.g., protected areas, timberland, and agriculture). Research focused on the impacts of climate change on wildlife, such as those discussed in this paper, expand on earlier studies focused on land cover and land use change to illustrate and project how organisms that depend on particular attributes of land cover and land use may respond to changes. Wildlife species depend on vegetation characteristics for cover (e.g., shelter from predators), reproduction (e.g., trees for dining and nesting), and food (e.g., pollen, seeds, and fruits). We describe direct ecological and behavioral responses of wildlife to climate change, such as geographical range shifts by species.

Objectives

- Assess climate change impacts on wildlife and wildlife habitat.
- Assessment of multiple stressors such as direct and additive impacts of concurrent land use and climate change and potential climate-related effects on landscape characteristics such as habitat connectivity.
- Assessment of vulnerability of species in habitats in proximity to development, and evaluation of adaptation strategies for and adaptive management of climate change impacts on wildlife and wildlife habitat.

Data used

The data used in this study is obtained from primary as well as secondary sources.

Results and Discussions

Ecological and Behavioral Responses of Wildlife to Climate Change

Adjusting to climate-influenced variation in resources they depend on is a challenge for wildlife. This variation may include changes in spatial distribution in food resources, timing of food resource availability, and differences in cover, ground moisture, and water requirements. Many abiotic and biotic factors individually, and in combination, affect the geographic distribution of

species (Gaston 2003). Researchers are observing variation over space and time in species distributions that appear to be range shifts in response to climate change.

Wildlife also may be affected by the interaction of spatial and temporal characteristics of environmental processes. Discussion of climate change often focuses on impacts on ecological systems. However, the interaction between ecological and abiotic systems characteristics may hinder a species' ability to adapt to ecological changes. Deviation of concurrent timing of abiotic and biotic environmental events may result in species vulnerability. Annual photoperiod (i.e., sunlight per 24 hours) cycles are relatively constant, and not related to climatic shifts. In other words, the same date each year has approximately the same amount of sunlight regardless of climatic events. Thus, innate behaviors triggered by length of daylight period (Gwinner, 1996) may not be affected by climate change. Migratory birds often depend on changes in photoperiod, temperature, and wind to determine timing of spring and fall migrations (Gwinner 1996, Price and Glick 2002). Similarly, migratory butterflies use sensors in their antennae to determine timing for migration based on photoperiod (Kyriacou, 2010). In short, particular ecological and behavioral events have become synchronized with photoperiod characteristics. Consequentially, species that migrate based on photoperiod characteristics have become adapted to using resources in winter and summer ranges that are available when a particular species arrives in the respective range. As ecological communities adapt to climate change, species behavior based on photoperiod likely will become out of synch with ecosystem processes in different parts of an organism's range. It is unknown whether wildlife will be able to adapt to asynchrony between photoperiod and ecosystem processes.

Impacts of Climate Change on Wildlife Habitat

However, climate change impacts to wildlife also may include disturbances that drive changes in wildlife habitat. Examples of climate-influenced changes that may indirectly affect wildlife are variation in vegetation community composition or other ecosystem components, as well as pest outbreaks and other disturbances such as wildfire. Some species may be relatively more sensitive to overall habitat change than other species. For example, amphibians have received a large amount of recent attention in that the presence of additive habitat-related elements has had potentially major impacts on their populations. Other factors that may affect habitat, such as the interaction between land use and climate change, are only now becoming a focus of research.

Vegetation type, often identified as a main characteristic of land cover (e.g., evergreen forest), is an important predictor of species occurrence. Temperature and interaction between position and temperature (Körner and Paulsen, 2004) often are considered primary drivers of plant species distribution, although other factors also may be influential, such as precipitation, disturbance, and community interactions. Globally, many researchers have suggested that plant communities are shifting toward the poles, upward in elevation, and blooming earlier in the season, any of which likely will affect the wildlife that depend on them. Research has identified relationships between tree line range shifts and climate variables. In a meta-analysis, Harsch et al. (2009) evaluated a global data set of 166 sites across more than 100 studies for which tree line dynamics since 1900 could be classified; most sites were in North America or Europe. The authors observed recruitment of tree lines at increasingly higher altitudes or latitudinal advancement of tree lines at 87 out of 166 sites, which corresponded with sites that also exhibited warming during the winter months. Tree lines with diffuse form (gradual merge between tree communities or to treeless areas) were strongly associated with changes in annual and winter temperatures. In contrast, shift of abrupt and krummholz (stunted) tree lines were more associated with winter warming and were potentially affected by other constraints on tree survival (e.g., wind, ice) (Harsch, 2009). At a regional level, 78 percent of 542 leafing, flowering, and fruiting records across 21 European countries were observed to have advanced in latitude since 1971 (Menzel et al. 2006). Along with trees, herbs, and shrubs, even symbiotic organism groups such as lichens are susceptible to range shifts that would be projected by climate change (Parmesan and Yohe 2003). Vegetation range shifts that may affect the distribution of habitat also may be influenced by interactions between climatic variables and disturbance. In New Mexico, Allen and Breshears (1998) reported a ≥ 2 -km shift in ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and piñon-juniper woodland over a 5-year period, a result of several interrelated climate-influenced events. In the same study, a combination of drought, fire suppression, and a bark beetle outbreak may have been factors in a concurrent expansion of the piñon-juniper community. Piñonjuniper eventually may have competed with the ponderosa pines for limited water, which resulted in enhanced susceptibility of the ponderosa pines to bark beetle attack and related mortality (Allen and Breshears 1998). Ultimately, climate change impacts on plant communities could affect temporal aspects of resource use and consumption by dependent wildlife species, and survivorship of dependent wildlife populations. Integration of climate model simulations with

bioclimatic variables suggest shifts in vegetation taxa to continue with anticipated changes in climate. Shafer et al. (2001) suggested range changes for particular tree and other species may be multidirectional, and could result in range fragmentation, both of which may affect associated wildlife. In an analysis by Iverson et al. (2008), a simulation modeling approach was used to project suitable habitat for 134 tree species across the Eastern United States. Results suggest that approximately 66 species would gain suitable habitat (e.g., southern oaks and pines), whereas 54 species would lose at least 10 percent of their current suitable habitat (e.g., spruce-fir). Range shifts were predicted to move up to several hundred miles in a generally northeastern direction. It is expected that climate change will affect the frequency, extent, duration, and severity of disturbances, but a challenge exists in projecting specific outcomes (Dale et al. 2000).

Impacts of Climate Change Mitigation on Wildlife Habitat

As landscape conditions respond to climate change, resource managers will be forced to respond to the new landscape conditions as well as any related climate change policy. Mitigation for climate change, defined as policies or actions that seek to decrease the impact of climate change. Policies supporting afforestation may affect amount of habitat available for wildlife, as well as habitat quality. Increased area and quality of wildlife habitat, particularly for forest species, is a possible co-benefit of conversion of land use from row-crop agriculture to forest land. Matthews et al. (2002) used econometric models of land use to simulate the response of landowners to planting trees on land currently used for agriculture in South Carolina, Maine, and southern Wisconsin. These models then were used in combination with breeding bird survey data to evaluate responses of forest and farmland bird populations. For a scenario of 10-percent conversion of agriculture for carbon sequestration, projected land conversion between agriculture and forest differed in amount from state to state. Following these projected changes in land use, results from Matthews et al. (2002) also suggested overall losses of farmland birds, and only small increases in forest bird species. However, from the same study, overall total bird populations were projected to decrease between 1 and 3 percent across all three states. The authors suspected that these differences were effects of overlaps between econometric predictions of locations converted and spatial patterns of bird species richness. Ultimately, tradeoffs between biodiversity and economic benefits will need to be evaluated by policymakers and landowners. Other research has evaluated the potential benefits for afforestation, such as conservation of wildlife habitat, which may be derived from carbon sequestration programs in

the upper Midwestern United States (Feng et al. 2007, Plantinga and Wu 2003). Decreased soil erosion, nitrogen pollution, and atrazine pollution were among additional benefits that could be derived from the afforestation program, in addition to improvement of wildlife habitat (Plantinga and Wu 2003). From the same study, the authors suggested that overall benefits derived from the program would be the same order of magnitude as the costs associated with the carbon sequestration program. Feng et al. (2007) expanded earlier work by suggesting that particular benefits and transfers of them may vary geographically. Although afforestation may offer a means to provide additional habitat for wildlife, particularly forest species, unintended consequences that affect other ecosystem components are possible. In Ireland, policy was initiated to double the percentage of forest land by 2035 (Allen and Chapman 2001). From the same study, thus far, afforestation efforts and resulting uptake and storage (by trees and soil) of water have led to a reduction in precipitation runoff by as much as 20 percent. However, new forestry operations have the potential to enhance risk of flooding within the area. In addition, a slower rate of groundwater recharge occurred, along with concerns about water quality (Allen and Chapman 2001). As another example, Thompson et al. (2009) suggested that afforestation efforts may be a factor in absorption of more solar radiation by forests and result in local warming temperatures. This local warming may neutralize or counter efforts to offset climate change by afforestation (Thompson et al. 2009). As such, the authors suggested a geographically targeted approach that seeks to increase forest land in locations naturally occupied by forests.

There are many means by which private landowners may derive benefits from their land while managing land for wildlife habitat. For example, hunting leases may provide forest-land owners extra income while also promoting biodiversity (Johnson 1995). Researchers also have assessed economic benefits of landowners adopting “green” practices, such as conservation tillage (Kurkalova et al. 2006). More broadly and formally, incentive programs may serve as a vehicle to entice private landowners to manage land in ways that are beneficial for habitat of particular wildlife species. For example, incentives created by the U.S. Department of Agriculture Conservation Reserve Program (CRP) have influenced availability of wildlife habitat. Establishment of more than 985,000 acres (398 615 ha) of grasslands coincided with a large increase in Henslow’s sparrow (*Ammodramus henslowii*) populations in Illinois (Herkert 2007). Similarly, Niemuth et al. (2007) projected that loss of CRP lands would result in large declines in

grassland bird populations among the prairie pothole region of North and South Dakota. It is suspected that private lands will play an important role in future biodiversity conservation.

Conclusion

Climate change is a complex and far-reaching issue, both spatially and temporally, and involves a relatively large amount of uncertainty even beyond the typical human inability to predict the future. Both adaptation and mitigation actions in the future are unknown, as is their interaction over time and space. An adaptive process will facilitate incorporation of research results into management, as well as ongoing consideration of land-use changes, forest management, wildlife management, mitigation alternatives, and society's willingness to undertake actions to formulate policy alternatives and confront other components of the global climate issue. Climate change is a complex and uncertain issue. It affects and is affected by both natural and social systems at multiple scales ranging from global to local. In one perspective, more weight may be warranted for short-term research that may support and inform management and policy decisions regarding both adaptation and mitigation. For the case of wildlife, for which potential ability to adapt to changing conditions may be limited, there may not be time to pursue long-term research while avoiding varying levels of extinction. Rather, research results may be valuable as information to use within broader and immediate adaptive management processes dealing with climate change, while also maintaining natural resource management and societal objectives.

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Environmental Education

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Abstract

Environmental education can be defined as an integral process which deals with man's interrelationship with his natural and man-made surroundings, including the rate of population growth, pollution, resource allocation and depletion, conservation technology and urban and rural planning. It is the study of the factors influencing ecosystems, mental and physical health, living and working conditions, decaying cities and population pressures. Environmental education is intended to promote among citizens the awareness and understanding of the environmental and the concern to improve the quality of life. The importance of environment has been recognized in India since long. According to National policy of Education, "There is paramount need to create a consciousness of environment. It must permeate all ages and all section of society, beginning with the child, environmental consciousness should inform teaching in schools and colleges. This aspect be integrated in entire educational process. The objectives of environmental education include providing opportunities to acquire the knowledge, values, skills, attitudes and commitment, improving the environment and creating new patterns of behaviour of individual, group and society as a whole.

Introduction

Education for sustainable development (ESD) is different from environmental education as there is a shift from awareness and understanding to involvement, participation and problem solving. Education as an instrument to environmental sustainability, United Nations in December 2002 in its general assembly has proclaimed 2005-14 as the Decade of Education for Sustainable Development (DESD) in order to help everyone consider and learn the values, behaviour and lifestyle required for a sustainable future and societal transformation. In this context teacher training college should promote community based education by forming partnership to meet the community need.

Keynotes: Environmental Education, Education for sustainable development Role of teacher training Institute.

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Student-teachers though partnership can create a product or process or solve some local problems for the community that result in learning experience . As such there is urgent need for pre as well as in – service training for teachers in community linked environmental issues / problems to sustainable lining.

Today, people all over the world face grave environmental problems. The continuing depletion of natural resources, deforestation, extinction of plant and animal species, rise in global temperature, environmental pollution, thinking of life saving ozone layer etc. are few examples of environmental degradation. These problems are further being compounded with population explosion, food crisis, hunger, malnutrition, poverty insanitation, and unbridled consumerism which together has caused serious strains on the essential life-support systems of our planet. For example unsafe water kills three million people each year many of which are children. Nearly two billion people cope daily with the problem of finding enough water, and as many as 3.5 billion-almost half the world's projected population-could face water shortage by 2025 (Satapathy,2007) Every year 15.2 million hectares of forest in tropical countries are cut down and converted into other uses. Green house gases notably carbon dioxide coming out from power plants, automobiles, and burning forest, acting as agents of climate change are contributing to warming climate that cause shifting precipitation pattern, melting glaciers, and rising sea levels. These environmental threats now facing us could have so much momentum that unless steps are taken to reserve them, they may soon overwhelm our ability to respond even threatening all living beings including man himself with disaster or extinction (Parashar, 1996)

The concept of sustainable development, which became well- known though the famous, Brundtland report, entitled 'Our common Future' published in 1987 recognized that natural resources are not inexhaustible, and the current trends of economic development and the accompanying environmental degradation are unsustainable. There is urgent need to look in to the health of the global environmental for the future of everyone.

Sustainable Development and its Principles

The notion of sustainable development was considerably old. The dictionary meaning of sustainability is the amount or degree to which the earth's resources may be exploited without degree to which the earth's resources may be exploited without deleterious effect (The Chambers Dictionary) The term itself was introduced to the international community in 1980 by the world conservation union (IUCN, 1980). Subsequently the term was introduced in the International

Diplomatic Community in 1987 by the world commission on Environment and development (WCED, 1987) headed by Gro Harlem Brundtland, the then prime Minister of Norway in its report “Our Common Future” The concept of sustainable development does not see environmental protection and economic growth as mutually exclusive and conflicting objectives.

The Major Principles of Sustainable Development

- to integrate development programmes and conservation strategies
- through ecological and economic integration
- to ensure socio-economic security
- to consult public in development programmes
- to respect for the carrying capacity of nature and conserve bio-diversity.
- to enable communities to protect local environment
- to respect culture and religious diversity
- to promote tolerance, peace , and democracy; and
- to foster global alliance and networking

From Environmental Education (EE) to Education for Sustainable Development (ESD)

There is mention of environment and its importance in many ancient literatures. However the beginning of Environmental education (EE) can be traced back to educational thinkers such as froebel, Montessori, Steiner and Dewey who had put emphasis on the learner and learning environment, on learning by doing and participation and on differential learning need and styles. With increase in the knowledge of science and technology and initiation of industrial activities, in the last part the nineteenth century, there has increasing awareness to protect air, water, land forests and aquatic resources. Environmental education has two intimately linked goals – education towards protection and improvement of the environmental of the environment and education as an instrument of development for improving the quality of human communities.

Role of Colleges and Teacher Training Institutions

Education provides the instrument for liberation from ignorance and oppression. Besides sharpening the eye of knowledge, it develops awareness (Alam,1998)and makes mind logical. Further it is a very importance input in human resource development (UNDP,1993). The relationship between environment and development can be established as a part of education. The concern for environment and its conservation has been reflected in the National Policy on Education-1986 document (MHRD,1986) which notes:

There is paramount need to create a consciousness in the environment. It must permeate all ages and all section of the society beginning with the child. Environmental consciousness should inform teaching in schools and colleges. This aspect will be integrated in the entire educational process.

The new concept of Education of Environmentally Sustainable Development (EESD) could be introduced (Parashar,1996) in the education system, which paves the way for the protection of the environment keeping in view the developmental needs of the society through science and technology considering the long-term future of economy, ecology and equity of all communities. This would mean educating people to awareness, decision-making and at a later stage implementing. Building the capacity for such future oriented thinking is a key task of education. It is observed that educational institutions have to take the lead in stimulating and guiding the sustainable use of natural resources. Environmental education for sustainable development need to be introduces at all levels of education, school, college, university as well as in all forms of informal education. It is suggested that environmental education curriculum for sustainable should include skills, concepts and facts as already exists in the school curriculum but in the context of local specific environment.

Teachers are the most critical agents of change responsible for growth, development and progress of societies and communities (Mangle,2002) Enlightened, emancipated and empowered teachers lead communities and nations in their march towards better and higher quality of life (NCTE,1998). As such their role of teachers is very crucial to achieve the objectives of sustainable development. Since teachers play major role in the education of children, their own education on these sensitive issues must therefore create necessary understanding among teachers about their new roles and responsibilities. Recently following the Supreme Court's directive, NCTE has observed that environmental education as a compulsory curriculum for Teacher's education will be implemented to stress development of critical awareness about pressing problem of life especially environmental degradation, its consequences and methods to curtail it. The Courses of teacher education need to be enriched to eatable teachers to understanding the attributes of modernity and sustainable development so that play active role in the developmental activities responding to progress of community and improvement in the quality of life. To realize this, the curriculum of teacher education needs to provide the basic knowledge and conceptual understanding of ESD in order to develop relevant skills and attitudes

in student teachers and the existing cadre of teachers. As such developing adequate teaching approaches are thus an immediate challenge. This calls for proper development of skills for competency based teaching, continuous and comprehensive evaluation, organizing and conducting projects and activities related to local specific conditions and the daily of learners.

Conclusion

Education for sustainable Development (ESD) is complex interaction of economic, social, political, cultural and ecological force. In addition global policy statements and principal have placed a heavy responsibility on environmental education to facilitate the transformation needed for sustainable living. In the context of teacher training, it stresses on action oriented approach with emphasis on active, hands-on discovery method with emphasis on learning by doing, exploring, problems solving etc. While preparing a prospective teacher, socio- economic and cultural background of community constituting the catchments area is to be realized. For effective orientation of teachers in the area of sustainable development it is necessary to have coordination among university departments, department of science and technology, pollution control board, departments of environmental and forest etc. Ministry of Environment and Forest (MoEF,1998) observes that for in-service training support from centre for environmental education.

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Environmental Degradation and Biodiversity

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One of the greatest challenges facing humanity is environmental degradation, including deforestation, desertification, pollution, and climate change- an issue of increasing concern for the international community. Environmental degradation increases the vulnerability of the societies it affects and contributes to the scarcity of resources.

Climate change will lead increases in the intensity and frequency of weather extremes, such as heat waves, floods, droughts and tropical cyclones. The people hardest hit by climate change and environmental degradation are those living in the most vulnerable areas, including coastal communities, small island nations, Sub-Saharan Africa and Asian delta regions. It is the poorest of the poor, who lack the resources to prepare, adapt and rebuild, that are most affected.

Environmental degradation can lead to a scarcity of resources, such as water and farmable.

Extreme weather events, such as severe flooding, increase the spread of waterborne diseases, such as malaria and diarrhea. The effects of the major environmental problems on both health and productivity are:

- a. **Water pollution and water scarcity:** As per the estimation of UN, more than two million deaths and billions of illnesses a year are attributable to water pollution. Water scarcity compounds these health problems. Productivity is affected by the costs of providing safe water, by constraints on economic activity caused by water shortages, and by the adverse effects pollution and shortages on other environmental resources such as, declining fisheries and aquifer depletion leading to irreversible compaction.
- b. **Air pollution:** As per the estimation of Un, urban air pollution is responsible for 300,000 - 700,000 deaths annually and creates chronic health problems for many more people. Restrictions on vehicles and industrial activity during critical periods affect productivity, as does the effect of acid rain on forests and water bodies.
- c. **Solid and hazardous wastes:** Disease are spread by uncollected garbage and blocked drains; the health risks from hazardous wastes are typically more localized, but often acute. Wastes affect productivity through the pollution of groundwater resource.

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- d. Soil degradation:** Depleted soils increase the risks of malnutrition for farmers. Productivity losses on tropical soils are estimated to be in the range of 0.5 – 1.5 per cent of GNP, while secondary productivity losses are due to siltation of reservoirs, transportation channels and other hydrologic investments.
- e. Deforestation:** Death and disease can result from the localized flooding caused by deforestation. Loss of sustainable logging potential and of erosion prevention, watershed stability and carbon sequestration provided by forests are among the productivity impacts of deforestation.
- f. Loss of biodiversity:** The extinction of plant and animal will potentially affect the development of new drugs; it will reduce ecosystem adaptability and lead to the loss of genetic resources.
- g. Atmospheric changes:** Ozone depletion is responsible for perhaps 300,000 additional cases of skin cancer a year and 1.7 million cases of cataracts. Global warming may lead to increase in the risk of climatic natural disasters, Productivity impacts may include sea level damage to coastal investments, regional changes in agricultural productivity and disruption of the marine food chain.

Conclusion

The impacts of environmental disasters can be devastating on the social economic, and environmental system of a country or region as well as the global ecosystem. Environmental disasters do not recognize man-made borders, and threaten the legacy left to future generations of a clean and supportive environment. Because of the interdependency of earth ecosystem international co-operation is paramount to prevent, and when disaster strikes, respond to relieve quickly and effectively the effects of environmental disasters. Thus, Governments, International organizations and communities must work together- at all levels – to lessen the risks associated with environmental degradation and its contributing factors, such as climate change, and ensure that vulnerable people are prepared to survive and adapt. At the same time, environmental friendly and sustainable.

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Biomedical Waste: A Hazard to Health and Environment

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Abstract

Biomedical waste carries a higher potential for infection and injury than any other type of waste. Inadequate and improper handling of health care waste has serious public health consequences and a significant impact on the environment. Exposure to hazardous biomedical waste can result in disease or injury. Individuals exposed to such hazardous waste are potentially at risk. Biomedical waste pollutes air, soil and waterways. It should be properly categorized, segregated, treated and disposed to protect our health and environment.

Introduction

Biomedical waste means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto or in the production or testing of biologicals. Biomedical waste carries a higher potential for infection and injury than any other type of waste. Inadequate and improper handling of health care waste has serious public health consequences and a significant impact on the environment.

Biomedical wastes consists of:

- Infectious waste like waste from isolation wards, laboratory cultures, materials that have been in contact with infected patients etc.
- Pathological waste which includes human tissues or fluids like blood.
- Sharp waste e.g. needles, infusion sets, scalpels, blades.
- Pharmaceutical waste like expired medicines or bottles or boxes containing drugs.
- Genotoxic waste like drugs used for cancer therapy or genotoxic chemicals.
- Chemical waste containing expired disinfectants, laboratory reagent, solvents, etc.
- Heavy metal waste like batteries, broken thermometers or blood pressure apparatus.
- Pressurized containers like gas cylinders, gas catridges and aerosol cans.
- Radioactive waste from unused liquids from radiotherapy or laboratory research or from urine of patients tested with a radionucleides.

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These are further divided into ten categories for proper segregation, treatment and disposal. The institutions involved in generation of biomedical waste are hospital, nursing homes, physician's clinics, dentist's clinics, dispensaries, primary health centers, medical research and training establishment, mortuaries, blood banks, animal house, slaughter house, laboratories, research organizations, vaccination centers and bio-technology institutions. In developing country like India, 80% of general health care waste is like that of house hold domestic waste, 15% is pathological and infectious waste, 3% chemical and pharmacological waste, 1% is sharp waste and less than 1% consists of radioactive and genotoxic waste³. Table shows average composition of hospital waste in India.

Material	Percentage
Paper	15
Plastic	10
Rags	15
Metals	01
Infectious waste	1.5
Glass	4.0
General waste	53.5

Health Hazards of Biomedical Waste

Exposure to hazardous biomedical waste can result in disease or injury. All individuals exposed to such hazardous waste are potentially at risk. This includes those personnel who generate waste, like doctors, nurses, patients or those who handle such waste, like workers in waste disposal facilities.

Pathogens in infectious waste may enter the human body through a puncture, abrasion or cut in the skin, through mucous membrane by inhalation or ingestion. Major concern is with HiV, Hepatitis B and C virus for which there is a strong evidence of transmission via biomedical waste. Many chemicals and drugs used in hospitals are toxic, genotoxic, corrosive, flammable or explosive. They may cause intoxication by acute or chronic exposure and injuries including burns. Severity of hazard from exposure to genotoxic waste depends upon the substance toxicity and extend and duration of exposure. Exposure may occur by inhalation of dust or aerosols, absorption through skin, ingestion of food accidentally contaminated with cytotoxic drugs or

chemicals. The type of disease caused by radioactive waste is determined by the type and extends of exposure. It can range from headache, dizziness and vomiting to much more serious diseases like leukemia. Also, as it is genotoxic, it may affect genetic material. Apart from health hazards, the general public is very sensitive to visual impact of biomedical waste particularly anatomical waste.

Environmental Hazards of Biomedical Waste

Biomedical waste pollutes air, soil and waterways. Air gets polluted by release of toxic gases like methane, carbon dioxide, sulphur dioxide and dirty odor when biomedical waste is thrown on open land or by incineration. Water gets polluted by deposition of heavy metals and hazardous substances on surface water. There can be accidental spillage of waste in drinking water during transportation. There can be accumulation of hazardous substances in soil. Finally our ecosystem may get disturbed by contamination and accumulation of toxic substances in the food chain.

Conclusion

Biomedical waste is potentially toxic and hazardous. It should be properly categorized, segregated, treated and disposed to protect our health and environment. Every individual who is directly or indirectly involved with generation or disposal of biomedical waste, must behave responsibly to avoid the health and environmental hazards. There is strong need for creating awareness among different categories of personnel regarding this issue.

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Disposal of Kitchen Waste by Composting at Home

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Introduction

Environmental degradation has become a major threat confronting the world. Due to improper waste management facilities and treatment, disposal of organic waste has caused acute environmental problems. Domestic waste poses a serious threat they ferment creating condition favorable to the survival and growth of microbial pathogen incineration of kitchen waste problematic due to its high moisture, salt content if treated by land filling the unpleasant odors generated by kitchen waste.

Kitchen waste, which include leftover food, vegetable leave, fruit peeling and scraped food. Food waste leads to wasteful use of chemical such as pesticide. More fuel use for transportation and more rotting food, creating methane one of the most harmful greenhouse gases that contribute to climate change. The vast amount of food going to landfills makes a significant contribute on to global warming. Composting at home can save global warming gases equivalent to the CO₂

When kitchen waste is sent to landfill air cannot get to the organic waste. Therefore the waste break down it creates harmful greenhouses gas, methane which damage the Earth atmosphere. Nearly all this food waste thrown in the bin kitchen waste and plate scraping should be collected and to disposal it by composting .When this kitchen waste is composted above ground at home oxygen helps to waste to decompose aerobically which means hardly any methane is produce, which is good news for the planet.

What is Compost?

Compost is dark, crumbly, earthy smelling from of decomposed organic matter that can be easily made at home. Composting is the most practical and convenient way to handle food waste .Composting is an inexpensive,natural process that transforms kitchen waste into valuable and nutrient rich food for garden.

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Advantages of Composting

1. Compost increase yield of fruits vegetable flower and herb.
2. Composting can help garden and potted plant.
3. Compost reduce reliance on the use of toxic chemical and pesticide
4. Compost provide a free soil conditioner it helps soil to retain moisture reducing water consumption
5. Compost improves soil structure maintain moisture level and keep soil PH balance

Composting is a natural process which converts organic waste in to earth like mass by means of bacteria and micro organism .The compost process is supported by larvae wood like beetle worm and other such creature moisture and oxygen are the important factors in the composting process. Heat is generated during composting process. In the landfill rotting food decomposes to make methane any other gases in addition to the smell these are really bad greenhouse gases.

Composting is rich in nutrient and fertilizes the soil as composting becoming more popular.

Essential of Composting

1. Biology

The compost pile is teeming microbial farm bacteria start the process of decaying organic matter. They are the first break down plant tissue and also the effective composters.

2. Material

Food waste in home is potential food for tiny decomposer carbon and nitrogen torn the cell of dead plant and dead microbes fuel their activity. The micro-organism use the carbon in leaves of woodier waste as an energy source nitrogen provide the microbes with the raw element of protein to build their bodies.

3. Surface Area

The surface area the microorganism have to work on the faster the material are decomposed.

4. Volume

A large compost pile insulate itself and hold the heat of microbial activity. Its center will be warmer than its edge pile smaller than fact cubed.

5. Moisture and Aeration:

All life of earth needs a certain amount of water and air to sustain itself. The microbes in the compost pile are no different. They function best when the compost material are about as moist

and are provided with many air passage extremes of sun or rain can adversely affect this moisture balance of pile.

6. Time and Temperature:

The faster the composting, the hotter the pile. Use material with proper. C: N (Carbon nitrogen ratio) provides a large amount of surface area and big enough volume and moisture and aeration are adequate.

Composting Kitchen Waste by

1) Backyard composting

Select dry shady spot near a water source for compost pile or bin, add kitchen waste. Moisten dry materials they collected. When compost pile established mix grass clipping and green waste into pile and bury fruit and vegetable waste under ten inches of compost material. Cover top of compost with a trap to keep it moist. When the material at the bottom is dark and rich in colour, compost is ready to use.

2) Soil Incorporation:

Burying kitchen waste is the simplest method of composting. Kitchen waste should be buried at least eight inches below the surface, this is simplest method, but because of the absence of air, some nutrient will be lost.

3) Earthworm Compost:

Feeding earthworm in wooden bin is a good way to make high quality compost from food scrap. Fill a bin with moistened bedding such as pit mass for the worms. Rotate the burying of food waste throughout the worm bin every 3-6 months the worm population should be divided and moved to fresh bedding. Earthworm composting is an efficient way to convert food waste into high quality soil for houseplant seedling transplant or general garden use. The worms themselves are a useful product for fishing. Worm composting is more expensive and complicated than soil incorporation for dealing with food waste.

Conclusion

A fundamental change in attitude is needed in the way wastes are managed. Due to improper waste management facilities and treatment, disposal of kitchen waste from domestic source has caused acute environmental problems. It is necessary for the environmentalism and women to save the environment for better tomorrow for the next generation. In future need for clean and safe

environment will be among the most serious problems that need to be trickled. Sensitization and mass awareness can contribute toward proper and safe disposal of waste.

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why compost?<http://www.recyclenow.com>

Studies on Isolation of Genomic DNA and Synthesis of Primers from Cotton Species

Ashok Rodge*, Girish Machewad**, Ashish Kumar Verma*** and Pravin Ghatge****

Abstract

The seeds of *G. hirsutum* cultivars (variety LRK-516 (Anjali) and LRA-5166) were selected for genomic isolation from selected cultivars. Further, the DNA was purified and quantified at 260 nm and it was revealed that the DNA samples invariably showed around 50 µg/mL concentration of DNA. The quality of DNA was checked by 1 per cent agarose gel electrophoresis and it was observed intact bands in total genomic DNA without contamination of proteins. The primers were synthesized (Qiagen) and used for amplification of protease inhibitor genes in cotton. Finally it can be concluded that the pure and more quantity of DNA were isolated and primers were synthesized which can be used for amplification of protease inhibitor genes in cotton.

Introduction

The food, clothing and shelter are the three primary needs for human and cotton (white gold) provides cloth to human beings. Therefore it enjoys the predominant among all cash crops. Cotton plays a key role in the national economy in terms of both employment generation and foreign exchange earnings (30%) of the total foreign earning of the country (Khadi *et al.*, 2007). The world cotton production was 26.879 million tons in 2011-12 which is higher than the previous year 2010-11 (24.879 million tons) because of increase in the area, productivity and better price (ICAC 2011). India continued to maintain the second largest producer of cotton next to China with 22% of world production. China, India, USA and Pakistan are the major cotton producing countries in the world with share of 75% and 71% of the world cotton production and area respectively. The major cotton states in India are Maharashtra, Gujarat and Andhra Pradesh.

Keywords: Cotton, DNA, agarose gel, genes, protease inhibitor, primers.

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The cotton plant is deciduous, indeterminate perennial plant of family Malvaceae and genus *Gossypium* is native to subtropical climate. The American cotton or new world cotton and two diploid viz *G. hirsutum* and *G. barbadense* have been domesticated independently throughout the world. The world wide crop losses without the use of pesticides and other non-chemical control strategies is estimated to be about 70% of crop production, amounting to US \$ 400 billion. The world wide pre-harvest losses due to insect pests, despite the use of insecticides are 15% of total production representing over US \$ 100 billion (Krattiger 1997). The annual cost of insect control itself amounts to US \$ 8 billion thus warranting urgent economical control measures. Many of the crop varieties developed in the past 30 years were high yielders, but had poor storage characteristics (Kerin 1994). Insect pests are capable of evolving to biotypes that can adapt to new situations, for instance they overcome the effect of toxic materials or bypass natural or artificial plant resistance which further confounds the problem (Roush and McKenzie 1987). Under these circumstances, provision of food to the rapidly expanding population has always been a challenge facing mankind. This problem is more acute in the tropics and subtropics where the climate provides a highly conducive environment for a wide range of insects and necessitates massive efforts to suppress the population densities of different pests in order to achieve an adequate supply of food. In developing countries, the problem of competition from insect pests is further complicated with a rapid annual increase in the human population (2.5-3.0 percentage) in comparison to a 1 per cent increase in food production. In order to feed the ever expanding population, crop protection plays a vital and integral role in the modern day agricultural production to minimize yield losses. Currently, the crop protection practice in such agricultural systems relies exclusively on the use of agrochemicals, although a few specific cases do exist where inherent varietal resistance and biological control have been successfully employed. The cotton is a commercial important crop and affected by number of insect pest and diseases which not only cause large damage to cotton fiber quality but also to the production. The seedling diseases can be caused by several fungi commonly *pythium* and *rhizoctonia*. Further the leaf spot in cotton is caused by *alternaria macrospora*. It is a major disease in cotton growing area. There are many insect which damages to cotton by variety of ways by damaging leaf and boll of cotton. The minimum loss was caused by sucking pest (4.6%) whereas bollworm causes loss about 51.6% (Gujar *et al.*, 2000). Globally 4.5% crop production lost due to lepidopteron insect (ISAAA, 2003). The average yield loss in cotton due to insect pest ranges from 50-60%

(Dhaliwal et al., 2004). The important aspects of use of pesticides are non specificity and broad range effect on insects. The cost of these pesticides is so high that majority of farmers cannot afford. The main drawback of these pesticides is the development of resistance in insects against these chemicals. Further the resistance strain can arise rapidly, killing susceptible populations and resistance populations being raised next year. The use of pesticides affects other biota's e.g. birds and mammals. The exclusive use of these pesticides not only result in rapid build up of resistance to such compounds but there non-selectivity affect the balance between the natural predator and is generally in favour of pests (Metcalf 1986). Therefore an integrated pest management (IPM) programme, comprising a combination of practices including the judicious use of pesticides, crop rotation, field sanitation and above all exploitation of inherently resistant plant varieties would provide the best option (Meiners and Elden 1978). Several non-homologous families of proteinase inhibitors are recognized among the animal, microorganisms and plant kingdom. The majority of proteinase inhibitors studied in the plant kingdom originates from three main families namely *leguminosae*, *solanaceae* and *gramineae* (Richardson 1991). The diverse endogenous function of these proteins have already been proposed and are ranging from regulators of endogenous proteinase to storage proteins but evidence for many of these roles are partial or confined to isolated examples (Lawrence and Koundal 2002). The pesticide proteins involved in host plant defense and effective pest control by this strategy will presumably result from the co-expression of numerous determinants each of could be custom engineered by directed molecular evolution to maximize its effectiveness against specific pest.

The protease inhibitor genes accumulate on attack by herbivorous and pathogens. These defensive genes are found in constitutive component in various plant tissues (Rhodes 1979, Mauricio *et al.*, 1997) or synthesized in response to attack by pest and pathogen (Fossum 1970, Green and Ryan 1972, Carroll and Hoffman 1980). The term protease refers to both endopeptidase and exopeptidase. The exopeptidase cleaves the peptide bond proximal to amino or carboxyl termini of the substrate while endopeptidase cleaves peptide bond distance from termini. The property of plant defensive gene is their attack on different sites. The possible role of protease inhibitor gene in plant protection was first investigated in 1947 by Mickel and Standish revealed that the larvae were unable to develop normally on soybean products. The development of transgenic crop has come long way from the first transgenic development i.e. by transferring trypsin inhibitor gene from *Vigna unguiculata* to tobacco which conferred resistance

to wide range of lepidopteron insect such as *Heliothis* and *Spodoptera*, coleopterans such as *Diabrotica*, *Anthonomous* and orthoptera such as *Locusts*. Further there is no evidence that it had toxic or deleterious effects on mammals (Hilder *et al.*, 1987). Many of these protease inhibitors are rich in cysteine and lysine contributing to better and enhanced nutritive quality (Ryan 1989).

Among different types of inhibitor, serine inhibitors PIs are exclusively studied because they are ubiquitous in plant and most lepidopteron pest like *H. armigera* and *S. exigna* depend upon serine protease for food digestion. Many insect possess serine proteases to digest their food. Serine including trypsin chymotrypsin is the main intestinal digestive enzyme responsible for hydrolysis of food protein. They hydrolysis peptide bond in which the carboxyl group is contributed by lysine and arginine residue (Brown and Dziegielewska 1997). The most concerned plant protease inhibitor is serine type of potato, soybean and tomato. The potato and tomato inhibitor are most widely used and well characterized inhibitor and exhibit broad spectrum activity potato inhibitor-II family has been shown to inhibit serine proteases such as chymotrypsin, trypsin, subtilisin, oryzin and elastase (Pearce *et al.*, 1991). Further the protease inhibitor affect insect by reducing their capacity to assimilate plant protein and reduce insect feeding and lead them to starvation.

The modern plant genetic engineering involves different technologies to transfer these genes to any crop. The plant biotechnology helps to identify gene for genetically modifying and enhancing traits in cotton plant. The production of transgenic crops has seen rapid advances during the last decade with the commercial introduction of *Bt* transgenics, but the major concern with these crops has been the development of resistance by pest and public acceptability. Hence, there has been a need to discover new effective plant genes which would offer resistance/protection against these pests. Protease inhibitors (PIs) are one of the prime candidates with highly proven inhibitory activity against insect pests and also known to improve the nutritional quality of food. The objective is to isolate the proteinase inhibitor genes and attaching a constitutive promoter to the gene which in turn produces throughout the plant parts during its life cycle and control the bollworms at neonate larval stage.

Materials and Methods

The plant materials of *G. hirsutum* (variety *LRK-516 (Anjali)* and *LRA-5166*) were selected for genomic isolation from selected cultivars from Crop Improvement Division, Central Institute for Cotton Research, Nagpur.

Isolation of plant DNA

The seed were soaked in water for period (24-36 h), seed coat was removed and seeds (2-3) were ground. Further the extraction buffer (2 ml) in small aliquots were added and ground thoroughly. Add suspension buffer (1 ml) to suspend the material. The homogenate is transferred to a centrifuge tube, 80 µl of SDS (20%) and PVP (20%) were added and mix thoroughly. The tubes were kept in water bath at temperature (65⁰C) for period (30 min). Then add 7.5 M ammonium acetate (3 ml) and kept in ice for period (1 h). The content was centrifuge at 15000 rpm, temperature (4⁰C) for period (15 min). Add isopropyl alcohol (6/10 volume) to the aqueous layer and kept at temperature (-20⁰C) over night for complete precipitation of DNA. The spinning (15000 rpm) for period (15 min) will pellet the DNA. The pellet was dissolved in TE buffer (25 µl) and RNase (100 µg) was added. Then incubate at temperature (37⁰C) for period (15 min). Again spinning (15000 rpm) for period (15 min) to pellet DNA. The DNA was dissolved with TE buffer (100 µl) and added equal volume of phenol, chloroform and isoamyl alcohol mixture and mixed properly by inverting the tube 4-5 times. Then centrifuge at 15000 rpm for period (15 min). Later carefully pulled out the aqueous layer in a fresh tube leaving the inter phase. Added equal volume of ice cooled ethanol and pelleted DNA by centrifugation. The pellet was dissolved in suitable volume of TE buffer. Further re-precipitate the DNA with ethanol. It is spinned, vacuum dried and the pellet is dissolved in suitable volume of TE buffer. The DNA content was estimated and checked the purity by UV spectrophotometer. Finally the DNA is checked by gel electrophoresis by resolving the sample on 0.8 or 1.0 agarose gel (Dellaporta *et al.*, 1983).

Quantification of DNA

The isolated DNA was quantified by using UV-spectrophotometer at 260 nm for DNA and 280 nm for protein. The extinction coefficient of DNA is 200 or DNA at a concentration of 50 µg/ml shown as absorbance of 1 at 260 nm. The 260/280 ratios should be less than 0.5 for good quality DNA.

Agarose gel electrophoresis

The quality of DNA was checked by agarose electrophoresis. Agarose gels separate and resolve DNA fragments from 0.1-25 Kb.

Preparation of agarose gel

The quality of DNA of the plasmid and cotton genome was checked using agarose gel (0.8%). Further percentage of gel depends on the size of the DNA molecule to be separated. The ends of the gel casting plate were sealed with cello tape and kept on perfectly horizontal platform. The agar was melted in 1 X TBE buffer and allowed to cool to lukewarm temperature. Later the agarose was poured into gel casting plate, the comb was fixed on one end of plate and gel was allowed to solidify. Then comb was carefully removed from the gel plate without disturbing the well. The casted gel was placed on the electrophoresis unit (Bangalore Genei Pvt. Ltd) and submerged with 1 X TBE. The DNA samples were mixed with the loading dye and carefully loaded into the wells. The cathode and anode were connected to the power pack and current was adjusted to 20 mA. The negatively charged DNA molecule moves towards the anode and separate according to their molecular weight. The power was turned off when the tracking dye reach at about 2 cm from the anode end.

Viewing gel

The gel was viewed on UV transilluminator. The nucleic acid (DNA) on the gel appeared orange owing to fluorescence of bound ethidium bromide. The DNA was photographed and the gel has been checked for the presence of bands. The photograph was used for further interpretation of band patterns.

Primers

The primers were designed to obtain the PI genes (Table 1). The inhibition of spore germination and mycelium growth of *Alternaria alternata* by buckwheat trypsin/chymotrypsin (Dunaevskii *et al.*, 1997) and cysteine PIs from pearl millet inhibit growth of many pathogenic fungi including *Trichoderma reesei* (Joshi *et al.*, 1998). These advantages make protease inhibitors an ideal choice to be used in developing transgenic crops resistant to insect pests. Further, the transformation of plant genomes with PI encoding cDNA clone appears attractive not only for the control of plant pests and pathogens but also as a means to produce PIs useful in alternative systems and the use of plant as a factories for the production of heterogonous proteins (Sardana *et al.*, 1998). These inhibitor families that have been found are specific for each of the four

mechanistic classes of proteolytic enzymes, and based on the active amino acid in their “reaction center” (Koiwa *et al.*, 1997).

Results and Discussion

DNA isolation

The total genomic DNA from seeds was isolated in all selected cultivars (Table 2). The DNA was purified and intact DNA was subjected to quantitative and qualitative analysis.

Quantification of DNA

The DNA was quantified with BIO-RAD Smart Spec. Plus UV- spectrophotometer at 260 nm.

Qualitative check

The quality of DNA was checked by agarose gel (1%) electrophoresis (Figure 1). The intact bands were observed in total genomic DNA. The result revealed that the genomic DNA was isolated without contamination of proteins.

Isolation of protease inhibitor gene

The cotton protease inhibitor genes (cystein protease inhibitor) from *G. hirsutum* cultivars like *LRK-516 (Anjali)* and *LRA-516* using forward and reverse primers. Further DNA was amplified by PCR approximately a product of the size 600bp in each cultivar (Figure 2). The cysteine proteinase is important enzymes for digestion in many coleopterans, while vertebrates generally use proteinase from other classes for digestion. Therefore the incorporation of genes encoding cysteine proteinase inhibitors into transgenic grain has been proposed as a method to prevent seed damage from coleopteran pests while posing little or no side effects on vertebrates. The transgenic plants developed especially using proteinase inhibitors of insect digestive enzymes with the view to control pest or designed to retard their growth and development but not to kill the insects. These are the fundamental differences between proteinase inhibitor strategy with the chemical pest control or Bt-toxins which aims to kill the insect's community. This will provide an efficient regulation mechanism of insect population at low profile instead of developing high resistant biotype of insects against the toxic proteins or chemicals. Further the results revealed that the proteinase inhibitor genes present in commercially cultivated cotton varieties of *G. hirsutum*. Although the genes are present in cotton plants but they are induced by insect attack or wounding. Therefore the isolation and characterization traits more specifically genes responsible producing protease inhibitor in plant were studied. This defensive protein in plants systems helps to understand the biophysical and biochemical rules that govern the activity of proteins with

advent of recombinant DNA technology and enable to achieve efficient defensive mechanism in plant systems using proteinase inhibitors in biotechnology.

The further work on sequencing the amplified gene in *G. hirsutum* would provide the complete knowledge of presence of various PI genes present in the cotton plants. The gene expression is found satisfactory then the genes will be cloned for transformation into any crops. The plant derived genes such as proteinase inhibitors will have advantage of efficient expression than bacterial genes especially Bt. The development of proteinase inhibitors genes construct would be relatively easy because modification of coding sequence is not necessary whereas if bacterial genes are used for the plant system which need modification of the cloning sequence without modification of amino acid sequence of the protein. The development of new types of proteinase inhibitors by protein engineering with altered affinity for different proteinase and incorporating multi-domain proteinase inhibitors in a single gene are attractive strategies for developing insect resistant transgenic plant in near future.

Conclusions

A part of gene was isolated from cotton that gave a way to move to target full-length DNA sequence. This gene would be designed with constitutive promoter and transfer into other crop plant. Although some data on expression of this gene in plant show that it is not effective as Bt genes, its utility as supplementary gene to enhance the effect of insecticidal gene overlooked. Such approach is desirable to restrict developments of resistance by insect pests towards products of transgene. Further the PI genes are present in cotton plants that need to be engineered for efficient expression to make viable transgenic cotton resistant against insect pest. Although plant PIs have been isolated and characterised from large number of sources and the natural inhibitors are made by gene therapy and through transgenic plants over expressing specific inhibitors with therapeutic significance. The potential for the natural inhibitors in medicine and agriculture is enormous and waiting full scale explorations.

The availability of diverse genes from different plant species makes possible to use one or more gene in combination, whose products are targeted at different biochemical and physiological processes within the insect. These packages will not only contain protease inhibitor genes but also lectins, alpha amylase inhibitors or other plant genes encoding insecticidal proteins. This technology may not replace the use of chemical pesticides in near future but effectively complement it. The use of recombinant PIs may also be attractive way to protect plant from

fungus, bacterial and viral pathogens. Now-a-day two principal strategies are proposed to engineer effective pest control in plants i.e. ectopic expression of pesticidal proteins and induction of plant natural defensive response. At present screening gene pools without taxonomic constraint can help to identify novel insecticidal determinants but in future this approach will be augmented by directed *in vitro* molecular evolution. The number of pesticidal proteins which are involved in host plant defence are known and presumed that effective pest control by this strategy will result from the co-expression of numerous determinants which could be custom engineered by directed molecular evolution to maximize its effectiveness against specific pests. However in future non-scientific issue such as regulatory approval, propriety rights and public perception will be decisive in releasing crop plants produced by genetic engineering using recombinant DNA technology.

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Water Pollution: Causes, Effects and Remedies

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Abstract

Environment pollution is a wide-reaching problem and it is likely to influence the health of human populations is great. It means adding impurity to environment .The environment consist of earth .water, air, plants and animals. If we pollute them then the existence of living beings and nature will be hampered. Water pollution is a major problem .In recent years due to industrialization and urbanization in India , this problem has become gigantic. This paper provides the insight view about the causes, effects of water pollution on living beings by diseases and problems. Study finds that water pollutions is seriously affecting the living beings by diseases and problems living beings

Introduction

The significance of environmental factors to the health and well-being of human populations' is increasingly apparent .(World Health Organization [WHO], 2010bThe World Health Report – Health System financing: The path to Universal Coverage.) Environment pollution is a worldwide problem and its potential to influence the health of human being is great .Pollution reaches its most serious proportions in the densely settled urban-industrial centers of the more developed countries. Polluted water is the main cause of a number of diseases. Polluted water not only affects the life of present generation but it also affects the life of upcoming generations because its effects remain for long. (Dr Mukesh Garg June2012) In underdeveloped countries of the world more than 80% polluted water has been used for agriculture. (Mara & Cairncross , 1989) Industry clustered in urban and semi-urban areas surrounded by densely populated, low-income localities, continues to pollute the environment with impurity. Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution .Human exposure to pollution is believed to be more intense now than at any other time in human existence. Pollution can be made by human activity and by natural forces as well. (Fereidoun et al, 2007; The Encyclopedia of the Atmospheric Environment, n.d)

Keywords: Water Pollution causes effects remedies

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Causes of Water Pollution

The water we drink is essential ingredients for our wellbeing and a healthy life. (Ries et al European Public Health Alliance ,(2009) Air Pollution and Health Effects) Unfortunately polluted water and air are common throughout the world. The WHO states that one sixth of the world's population, approximately 1.1 billion people do not have access to safe water and 2.4 billion lack basic sanitation.(Ries et al, European Public Health Alliance (2009) :Air Pollution and Health Effects)Polluted water consists of Industrial discharged effluents, sewage water, rain water and agriculture or households which cause damage to human health or environment.(Ries et al European Public Health Alliance ,(2009): Air Pollution and Health Effects)

Sewage from domestic households, factories and commercial buildings is treated in water treatment plants is often disposed into the sea. Sewage can be more problematic when people flush chemicals and pharmaceutical substances down the toilet. Dumping solid wastes and littering by humans in rivers, lakes and oceans. Industrial waste from factories which use fresh water to carry waste from the plant into rivers, contaminates waters with pollutants such as asbestos, lead, mercury and petrochemicals. Oil pollution caused by oil spills from tankers and oil from ship travel. Burning fossil fuels into the air causes the formation of acidic particles in the atmosphere. When these particles mix with water vapor, it gives acid rain. Due to Global Warming and thermal plants water temperature increases that use lakes and rivers to cool down mechanical equipment.

Effects of Water Pollution

Living beings across the globe, moreover, water pollution affects our oceans, lakes, rivers, and drinking water. Swimming in and drinking contaminated water can cause skin rashes, cancer , reproductive problems, typhoid fever and stomach sickness in human. Ground water contamination from pesticides causes reproductive damage within wildlife in ecosystems. The drainage water contains heavy metals in addition to biological contaminations. This water pollution infected our food in addition to groundwater contamination when used to irrigate crops. Sewage, fertilizer and agricultural run –off contain organic materials when discharged into waters, increase the growth of algae, which causes the depletion of oxygen. Industrial chemicals and agricultural pesticides that end up in aquatic environments can accumulate in fish that are also later consumed by humans. Ecosystems are vanished by the rising temperature in water Human –produced litter of items such as plastic bags and 6-pack rings can get aquatic animals

caught and killed from suffocation. Water pollution flood due to the accumulation of solid waste and soil erosion in streams and rivers. Oil spills in the water causes animal to die when they inject it or encounter it. Oil does not dissolve in water so it causes suffocation in fish and birds.

Concluding Remarks

There are several remedies to help prevent water pollution from getting worse. Many of the chemical substances are toxic which cause waterborne diseases in either human or animal host. If you use toxic chemicals such as paints, stains or cleaning supplies, dispose them properly. Do not dispose them near the sources of water. We can teach people to properly dispose of fluids to prevent it from leaching into water supplies. Proper maintenance of vehicles is important to prevent fluid leak so keep your machinery in good working order. Oil is one of the largest polluters of water in the world. Therefore clean up the residue and dispose of the used oils properly. Pick up the waste litter wherever it is spotted at long distance from the water. It helps Clean up Beaches and Waterways. Plastic bags in the ocean are a well documented water pollutant. Keep this problem from getting worse by changing to reusable grocery bags whenever possible. Avoid plastics whenever possible. Erosion is one of the biggest causes of water today. If decide to conserve soil, you are also conserving water and water life. For this implement beneficial farming methods to soil conservation. Do not throw industrial or other waste and sewage into rivers. Trees should be planted along the rivers.

If you do your part to prevent pollution in your area, then you'll be helping to protect aquatic life. Awareness should be created among the people. If we take care of above there may be decrease in water pollution in some extent.

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Impact of Climate Change on Human Health

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Abstract

The present paper reviews the issue of climate change and health in the Indian context. Climate change has become a major global concern in the recent years mainly because of accumulating greenhouse gases, particularly carbon dioxide. The increased pressure of carbon dioxide has led to an alarming increase in the global temperatures. In fact the available records over the last 100 years showed an increasing trend in surface temperature by 0.6 C resulting in extreme fluctuations in the spatial patterns of rainfall, local weather patterns and besides causing floods, droughts and cyclones. Further, there has been a growing concern about the changing pattern of diseases over the years throughout India in view of the climate change effects. To a large extent, public health depends on safe drinking water, sufficient food, secure shelter, and good social conditions. A changing climate is likely to affect all of these conditions. Main focus of this paper is to understand the likely influence of climate change i.e. Climate change is related to change in mean temperature & change in rainfall which is responsible for vector born disease.& respiratory diseases(Air),diarrheal diseases(water) & malnutrition(food) . Extreme weather events are responsible for vector born disease (flood), Death, injuries (cyclone),heat stokes(thermal stress). Sea level rise responsible for health consequences of population displacement.

Introduction

When sunlight reaches Earth's surface, it can either be reflected back into space or absorbed by Earth. Once absorbed, the planet releases some of the energy back into the atmosphere as heat (also called infrared radiation). Greenhouse gases (GHGs) like water vapor (H₂O), carbon dioxide (CO₂), and methane (CH₄) absorb energy, slowing or preventing the loss of heat to space. In this way, GHGs act like a blanket, making Earth warmer than it would otherwise be. This process is commonly known as the "greenhouse effect". The Role of Greenhouse effect in the past : In the distant past (prior to about 10,000 years ago), CO₂ levels tended to track the glacial cycles. During warm 'interglacial' periods, CO₂ levels have been higher. During cool 'glacial' periods, CO₂ levels have been lower. This is because the heating or cooling of Earth's

surface can cause changes in greenhouse gas concentrations. These changes often act as a positive feedback amplifying existing temperature changes.

The Recent Role of the Greenhouse Effect : Since the Industrial Revolution began around 1750, human activities have contributed substantially to climate change by adding CO₂ and other heat-trapping gases . These greenhouse gas emissions have increased the greenhouse effect and caused Earth's surface temperature to rise. The primary human activity affecting the amount and rate of climate change is greenhouse gas emissions from the burning of fossil fuels.

At the global scale, the key greenhouse gases emitted by human activities are

Carbon dioxide (CO₂) - Fossil fuel use is the primary source of CO₂. The way in which people use land is also an important source of CO₂, especially when it involves deforestation.

Methane (CH₄) - Agricultural activities, waste management, and energy use all contribute to CH₄ emissions.

Nitrous oxide (N₂O) - Agricultural activities, such as fertilizer use, are the primary source of N₂O emissions.

Fluorinated gases (F-gases) - Industrial processes, refrigeration, and the use of a variety of consumer products contribute to emissions of F-gases, which include hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

Humans are largely responsible for recent climate change

Over the past century, human activities have released large amounts of carbon dioxide and other greenhouse gases. The majority of greenhouse gases come from burning fossil fuels to produce energy, although deforestation, industrial processes, and some agricultural practices also emit gases into the atmosphere. The effect of rising temperature across the earth surface will lead to change average temperatures, rainfall pattern and monsoon timings. .Indeed the climate has begin to change. The Earth's climate is changing in significant ways and scientific evidence strongly supports this too. These changes are affecting human being, animals, insects and plants. The entire living world is feeling the effect of a changing climate. As per Indian Network of Climate Change Assessment (INCCA)6INCCA6 projected rise in temperature by the year 2030 is 1.7 to 2°C. Overall rainfall shows little rise but the numbers of rainy days are likely to reduce in the Western Ghats, coastal areas and northeastern states. Frequency of cyclones is likely to reduce but the intensity may be severe. Rise in sea level has been projected at the rate of 1.3 + 0.7 mm/year. There is consensus that climate change has set in, but it is not only a rise in

temperature; rather decrease in temperature has also been projected. Lancet, one of the most reputed medical journals, has warned that climate change could be the biggest health threat of the twenty-first century.

Thermal Stress

Several researchers have asserted that global climate change is likely to be accompanied by an increase in the frequency and intensity of heat waves and cold waves. It is interesting to note that mortalities due to both heat waves and cold waves were highest in India in 2003 as compared to other years. Global climate change with extreme heat wave conditions has been seen not only in India but also in other countries like France. In the national context, a number of studies in India show that the country has been experiencing extreme weather events for the past few decades, particularly after the 1990s. Heat wave and cold wave conditions and consequent deaths have been increasing in India. In 1998, major parts of North India and the northern parts of peninsular India experienced severe heat wave. During the second half of May, the heat wave was one of the severest ones seen in the last 50 years and led to the deaths of more than 2600 people. The large number of deaths in Orissa was perhaps due to the lack of adaptability to such extreme conditions. Cold wave events and consequent deaths have also been increasing in India. From 10 events and 22 deaths in 1994, it increased to 30 events and 425 deaths in 2000, and 42 events and 1156 deaths were officially reported by the India Meteorological Department in 2003 (source IMD & NCC). Heat waves can lead to heat stroke and dehydration, and are the most common cause of weather-related deaths. Excessive heat is more likely to impact populations in northern latitudes where people are less prepared to cope with excessive temperatures. Young children, older adults, people with medical conditions, and the poor are more vulnerable than others to heat-related illness. Eighteen heat waves were reported in India between 1980 and 1998, with a heat wave in 1988 affecting ten states and causing 1,300 deaths (De and Mukhopadhyay, 1998; Mohanty and Panda, 2003; De et al., 2004). Heat waves in Orissa, India, in 1998, 1999 and 2000 caused an estimated 2,000, 91 and 29 deaths, respectively (Mohanty and Panda, 2003) and heat waves in 2003 in Andhra Pradesh, India, caused more than 3000 deaths (Government of Andhra Pradesh, 2004). Heat waves in South Asia are associated with high mortality in rural populations, and among the elderly and outdoor workers (Chaudhury et al., 2000). The mortality figures probably refer to reported deaths from heat stroke and are therefore an underestimate of the total impact of

these events. In India, loss of life due to excessive heat occurs every year. Recently, the mortality due to heat wave in India and found that heat waves occur in the month of March to June. Maximum deaths (1658) occurred in the year 1998. Andhra Pradesh, Orissa, Punjab, Uttar Pradesh, Rajasthan, Bihar and Madhya Pradesh were the most affected states. With projected rise in temperatures, mortality is expected to rise due to heat waves. The National Physical Laboratory, New Delhi is working on assessment of heat stress on human health in view of climate change and showed high occurrence of maximum temperature for three consecutive days in the range of 45–50°C in April to June in the years of 2030, 2050, and 2080 in some districts of Andhra Pradesh, Bihar, Gujarat, Orissa Rajasthan, Uttar Pradesh, and West Bengal. Increased temperatures are also likely to cause increase in eye diseases like cataract, dry eyes, pterygium, and skin diseases.

Sea Level Rise

Coastal regions offer several climatic and trade advantages, which result in a concentration of Population and economic activities along the coasts. Coastal zones are also vulnerable to climate change as these are affected directly by climatic extremes. In light of climate change, extreme coastal events and accelerated sea level rise (SLR) can threaten human safety and shoreline development. Potential effects of SLR on health are; Effects on nutrition due to loss of agricultural land or decline in fish catch, Reduced freshwater availability by saltwater intrusion into groundwater aquifers, Changes in distribution of disease agents, Psychological trauma and stress, Death and injury due to flooding & cyclones and Health impacts associated with population displacement.

Malnutrition

India is home to major nutritional problems, both in terms of numbers and the proportion of population vulnerable. Climate change has major impact on the progression of nutritional problems, and the future trends will be dictated by our adaptation to the epidemiologic shift brought about by climate change. Climate change affects access to food, health, and environment of the population—the critical determinants for health and nutrition of communities. This will particularly be so for children, women, and families from the worst off and vulnerable segments of the population. In such populations, in addition to decreased access to food, the increased morbidity and absenteeism as a result of environmental factors such as severe weather conditions, together with migration, seriously affect their nutritional

status .Poor families tend to lose their ability to earn enough, and decreased incomes result in coping mechanism with either shifts in dietary patterns or migrating to newer locations with corresponding adaptations. Often such shifts result in these families settling for either unhealthy or costly foods and progressively reduce the food intake resulting in malnutrition. Drought diminishes dietary diversity and reduces overall food consumption, and may therefore lead to micronutrient deficiencies. In Gujarat, during a drought in the year 2000, diets were found to be deficient in energy and several vitamins. In this population, serious effects of drought on anthropometric indices may have been prevented by public-health measures (Hari Kumar et al., 2005)

Vector-Borne Diseases

With climate change, geographical ranges and survival of species bearing diseases will vary. Warmer, wetter climes, particularly breeding season, could enable malarial mosquitoes to spread their range and survive longer, leading to increased rates of dengue, fever and schistosmiasis (Battacharya et.al.2006) Changes in the climate may affect vector-borne diseases in several ways, namely, their survival and reproduction rates, the intensity and temporal pattern of vector activity and the rates of development, survival and reproduction of pathogens within vectors. Applying the same criteria as under the climate change conditions in the 2050s, it is projected that Malaria is likely to persist in Orissa, West Bengal and Southern parts of Assam, bordering North of West Bengal. However, it may shift from the central Indian region to the South Western coastal states of Maharashtra, Karnataka and Kerala. Also the Northern states, including Himachal Pradesh, may become Malaria prone in the future climate change regime. The duration of the transmission window is likely to widen in Northern and Western states and shorten in the Southern states. Changes in climate may alter the distribution of important vector species like malarial mosquitoes and may increase the spread of such diseases to new area. If there is an increase of 3.8 c in temperature and 7% increase in relative humidity the transmission windows i.e. the months during which mosquitoes are active, will be open for all the twelve months in 9 states in India. The transmission windows in J & K.and Rajasthan may increase by 3-5 months. However in Orissa and southern states a further increase in temp. is likely to shorten the transmission windows by 2-3 months.

India is afflicted with six major vector borne diseases (VBDs), namely malaria, dengue, chikungunya, filariasis, Japanese encephalitis and leishmaniasis of which malaria ranks at number one with about 1.48 million cases and 1173 deaths. As per NVBDCP, in 2011, cases and deaths due to Japanese encephalitis, dengue were 1214/181, 18860/169 .respectively. Around 60,000 suspected cases of chikungunya were also reported in 2007. In addition to mortality, vector borne diseases cause morbidity of millions of persons resulting in loss of man-days causing economic loss. As per NVBDCP, in 2010,2011, cases and deaths due to malaria were 1599986/1018, 1310656/754 respectively

The Logic of Impact of Climate Change on VBDs

The role of climatic factors has been studied extensively in the epidemiology of malaria due to its global public health importance. The minimum temperature required for development of *P. vivax* parasite in anopheline mosquitoes is 14.5–16.5°C while for *P. falciparum* it is 16.5–18°C. At 16°C it will take 55 days for completion of sporogony of *P. vivax* while at 28°C, the process can be completed in seven days and at 18°C it will take 29 days. The duration of sporogony in *Anopheles* mosquitoes decreases with increase in temperature from 20 to 25°C. From 32 to 39°C temperature, there is high mortality in mosquitoes and at 40°C, their daily survival becomes zero. At increased temperatures, the rate of digestion of blood meal increases which in turn accelerates the ovarian development, egg laying, reduction in duration of the gonotrophic cycle and more frequency of feeding on hosts, thus, increasing the probability of transmission. Thus, climatic conditions play important role in the distribution, degree of endemicity and epidemicity of diseases in an area. Some areas, which have most favourable conditions of temperature and rainfall, experience transmission of disease throughout the year, while in areas experiencing colder months, transmission is seasonal and does not take place throughout the year.

Major issue of concern is urbanization in the context of VBD, particularly dengue and chikungunya. Impact of climate change on dengue also reveals increase in transmission with 2°C rise in temperature in northern India as reviewed in 2010. The thresholds of temperature and relative humidity for indigenous transmission of dengue need to be redefined. Risk factors in terms of water availability, storage practices and life style also need to determine.

India has approximately 2 million confirmed cases of malaria per year (Kumar et.al.2007). Although WHO concludes that approximately 15,000 individuals die from malaria each year in India (WHO 2008), a recent study by (Dhingra et.al.2010) estimates approximately 200,000

malaria deaths per year in India before 70 years of age and 55,000 in early childhood. As suggest, accurate estimation of malaria mortality in India is difficult because correctly diagnosed episodes are successfully treated and do not result in death; in fatal cases without medical intervention, malaria is easily mistaken for some other life-threatening fever; and in most rural areas where death from malaria is common, proper medical attention at the time of death is uncommon. These challenges, which hold true in many developing countries, make it difficult to use hospital-based data to assess the association between climate variability and malaria, because disease burden may be vastly underestimated. In India, 65% of malaria cases are reported from six regions (Orissa, Jharkhand, Madhya Pradesh, Chhattisgarh, West Bengal, and the North East). In Orissa, the disease has much more serious proportions than even in sub-Saharan Africa (Narain2008). A 2001 WHO report estimated the disability-adjusted life years lost because of all vector-borne diseases in the country to be 4.2 million, and malaria is believed to account for nearly half of this (Dash et al.2008).

Diarrheal Diseases

Excessive floods contaminate drinking water creating conditions for transmission of diarrheal diseases like cholera. In India, the figures for estimated Disability Adjusted Life Years (DALY) lost due to diarrhoeal diseases were 23,801,447 in 2006 and by 2016, 21,486,636 DALYs are projected. The Energy and Resources Institute, New Delhi (<http://www.teriin.org/>) and National Institute of Cholera and Enteric Diseases (NICED), Kolkata undertook a research project to examine the potential relationship between climate change and diarrhoeal diseases, assess the vulnerability and adaptability and evaluate the economic impact.

Respiratory Diseases

Humans affect the environment and vice versa. Burning of fossil fuels leads to the accumulation of greenhouse gases, which have very likely (>90% probability) warmed earth's climate. This "global warming" has likely (>66% probability) changed physical and biological systems. There is emerging evidence and considerable speculation that this man-made or "anthropogenic" climate change affects respiratory health. Climate change has been associated with increased respiratory morbidity and mortality in essentially three ways: first, "extreme weather events" like heat waves, cold waves, extreme precipitation and forest fires; second, indirect mechanisms mediated via changes in "physical and biological systems"; and third, direct damage through "air pollution". The quality of air likely to decrease as surface ozone concentrations begin to rise with

increasing temperatures. This will lead to an increasing incidence of asthma and other cardiovascular and respiratory diseases. (Liggins 2008) Warmer air temperatures can influence the concentration of regional air pollutants and aeroallergens. Allergenic pollens grow more profusely in a warmer climate leading to respiratory disorders such as asthma, emphysema and chronic bronchitis, and allergy problems. Vehicular pollution, particularly in metropolitan cities experience heavy smog and haze resulting in asthmatic attacks. When combined with smog and other atmospheric pollutants, illness from allergic respiratory diseases, particularly asthma, could increase. Changes in the climate also affect diseases like chronic obstructive pulmonary disease, pneumothorax, and respiratory infections in children. There are also indications of relationship between air pollution and tuberculosis. Further, there is some evidence that dust storm in deserts as well as high altitude areas can lead to respiratory problems. There is ample scope of establishing a relationship between climate change and exacerbation in respiratory diseases in India. The quality of air is likely to decrease as surface ozone concentrations begin to rise with increasing temperatures. This will lead to an increasing incidence of asthma and other cardiovascular and respiratory diseases.

Conclusion

It is a response to actual climate stimuli or their effects, which moderate harm or exploits beneficial opportunities. In human systems, adaptation can be both anticipatory and reactive and can be implemented by public or private actors. Adaptation measures recommended for India include awareness; capacity building of individuals, communities, and institutions; disease and vector surveillance; preparedness for disaster management, development of early warning systems as well as strengthening of primary and secondary health-care facilities.

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E-Waste Management

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Abstract

"E-waste" is a popular name for electronic products. "E-wastes" are considered dangerous, as certain components of some electronic products contain materials that are hazardous, depending on their condition and density. The hazardous content of these materials pose a threat to human health and environment. Discarded computers, televisions, VCRs, stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem. This paper highlights the hazards of e-wastes, the need for its appropriate management and options that can be implemented.

Introduction

Industrial revolution followed by the advances in information technology during the last century has radically changed people's life & lifestyle. Although this development has helped the human race, mismanagement has led to new problems of contamination and pollution. The technical prowess acquired during the last century has posed a new challenge in the management of wastes. For example, personal computers (PCs) contain certain components, which are highly toxic, such as chlorinated and brominate substances, toxic gases, toxic metals, biologically active materials, acids, plastics and plastic additives. The hazardous content of these materials pose an environmental and health threat. Thus proper management is necessary while disposing or recycling e-wastes.

These days computer has become most common and widely used gadget in all kinds of activities ranging from schools, residences, offices to manufacturing industries. E-toxic components in computers could be summarized as circuit boards containing heavy metals like lead & cadmium; batteries containing cadmium; cathode ray tubes with lead oxide & barium; brominates flame retardants used on printed circuit boards, cables and plastic casing; poly vinyl chloride (PVC)

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coated copper cables and plastic computer casings that release highly toxic dioxins & furans when burnt to recover valuable metals; mercury switches; mercury in flat screens; polychlorinated biphenyls (PCB's) present in older capacitors; transformers; etc. Basel Action Network (BAN) estimates that the 500 million computers in the world contain 2.87 billion kgs of plastics, 716.7 million kgs of lead and 286,700 kgs of mercury.

The average 14-inch monitor uses a tube that contains an estimated 2.5 to 4 kgs of lead. The lead can seep into the ground water from landfills thereby contaminating it. If the tube is crushed and burned, it emits toxic fumes into the air.

Effects on Environment and Human Health

Disposal of e-wastes is a particular problem faced in many regions across the globe. Computer wastes that are land filled produces contaminated leachates which eventually pollute the groundwater. Acids and sludge obtained from melting computer chips, if disposed on the ground causes acidification of soil. For example, Guiyu, Hong Kong a thriving area of illegal e-waste recycling is facing acute water shortages due to the contamination of water resources.

This is due to disposal of recycling wastes such as acids, sludges etc. in rivers. Now water is being transported from faraway towns to cater to the demands of the population. Incineration of e-wastes can emit toxic fumes and gases, thereby polluting the surrounding air. Improperly monitored landfills can cause environmental hazards. Mercury will leach when certain electronic devices, such as circuit breakers are destroyed. The same is true for polychlorinated biphenyls (PCBs) from condensers. When brominated flame retardant plastic or cadmium containing plastics are land filled, both polybrominated diphenyl ethers (PBDE) and cadmium may leach into the soil and groundwater. It has been found that significant amounts of lead ion are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, gets mixed with acid waters and are a common occurrence in landfills.

Not only does the leaching of mercury poses specific problems, the vaporization of metallic mercury and dimethylene mercury, both part of Waste Electrical and Electronic Equipment (WEEE) is also of concern. In addition, uncontrolled fires may arise at landfills and this could be a frequent occurrence in many countries. When exposed to fire, metals and other chemical substances, such as the extremely toxic dioxins and furans (TCDD tetrachloro dibenzo-dioxin, PCDDs-polychlorinated dibenzo-dioxins. PBDDs-polybrominated dibenzo-dioxin and PCDFs polychlorinated dibenzo furans) from halogenated flame retardant products and PCB

containing condensers can be emitted. The most dangerous form of burning e-waste is the open-air burning of plastics in order to recover copper and other metals. The toxic fall-out from open air burning affects both the local environment and broader global air currents, depositing highly toxic byproducts in many places throughout the world. (Ramachandra T.V., Saira Varghese K.,2004)

In view of the ill-effects of hazardous wastes to both environment and health, several countries exhorted the need for a global agreement to address the problems and challenges posed by hazardous waste. Also, in the late 1980s, a tightening of environmental regulations in industrialized countries led to a dramatic rise in the cost of hazardous waste disposal. Searching for cheaper ways to get rid of the wastes, "toxic traders" began shipping hazardous waste to developing countries. International outrage following these irresponsible activities led to the drafting and adoption of strategic plans and regulations at the Basel Convention. The Convention secretariat, in Geneva, Switzerland, facilitates and implementation of the Convention and related agreements. It also provides assistance and guidelines on legal and technical issues, gathers statistical data, and conducts training on the proper management of hazardous waste.

Table: Effects of E-Waste constituent on health

Source of e-wastes	Constituent	Health effects
Solder in printed circuit boards, glass panels and gaskets in computer monitors	Lead (Pb) Damage to central and peripheral nervous systems, blood systems and kidney damage.	Affects brain development of children.
Chip resistors and semiconductors	Cadmium (Cd) Toxic irreversible effects on human health.	-Accumulates in kidney and liver. -Toxic irreversible effects on human health. -Teratogenic -Causes neural damage.
Relays and switches, printed circuit boards	Mercury (Hg) Chronic damage to the brain.	-Chronic damage to the brain. -Respiratory and skin disorders due to bioaccumulation in fishes.
Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings	Hexavalent chromium (Cr) VI Asthmatic bronchitis.	-DNA damage. -Asthmatic bronchitis.
Cabling and computer housing	Plastics including PVC	Burning produces dioxin. It causes -Reproductive and

		developmental problems -Immune system damage -Interfere with regulatory hormones
Plastic housing of electronic equipments and circuit boards.	Brominated flame retardants (BFR)	Disrupts endocrine system functions
Front panel of CRTs	Barium (Ba)	Short term exposure causes: - Muscle weakness - Damage to heart, liver and spleen.
Motherboard	Beryllium (Be)	-Carcinogenic (lung cancer) - Inhalation of fumes and dust. Causes chronic beryllium disease or berylliosis. - Skin diseases such as warts.

Management of E-wastes

It is estimated that 75% of electronic items are stored due to uncertainty of how to manage it. These electronic junks lie unattended in houses, offices, warehouses etc. and normally mixed with household wastes, which are finally disposed off at landfills. This necessitates implementable management measures.

In industries management of e-waste should begin at the point of generation. This can be done by waste minimization techniques and by sustainable product design. Waste minimization in industries involves adopting:

- inventory management,
- production-process modification,
- volume reduction,
- Recovery and reuse.

Inventory management

Proper control over the materials used in the manufacturing process is an important way to reduce waste generation (Freeman, 1989). By reducing both the quantity of hazardous materials used in the process and the amount of excess raw materials in stock, the quantity of waste generated can be reduced. This can be done in two ways i.e. establishing material-purchase review and control procedures and inventory tracking system.

Developing review procedures for all material purchased is the first step in establishing an inventory management program. Procedures should require that all materials be approved prior

to purchase. In the approval process all production materials are evaluated to examine if they contain hazardous constituents and whether alternative non-hazardous materials are available.

Another inventory management procedure for waste reduction is to ensure that only the needed quantity of a material is ordered. This will require the establishment of a strict inventory tracking system. Purchase procedures must be implemented which ensure that materials are ordered only on an as-needed basis and that only the amount needed for a specific period of time is ordered.

Production-process modification

Changes can be made in the production process, which will reduce waste generation. This reduction can be accomplished by changing the materials used to make the product or by the more efficient use of input materials in the production process or both. Potential waste minimization techniques can be broken down into three categories:

- i) Improved operating and maintenance procedures,
- ii) Material change and
- iii) Process-equipment modification.

Improvements in the operation and maintenance of process equipment can result in significant waste reduction. This can be accomplished by reviewing current operational procedures or lack of procedures and examination of the production process for ways to improve its efficiency. Instituting standard operation procedures can optimize the use of raw materials in the production process and reduce the potential for materials to be lost through leaks and spills. A strict maintenance program, which stresses corrective maintenance, can reduce waste generation caused by equipment failure. An employee-training program is a key element of any waste reduction program. Training should include correct operating and handling procedures, proper equipment use, recommended maintenance and inspection schedules, correct process control specifications and proper management of waste materials.

Hazardous materials used in either a product formulation or a production process may be replaced with a less hazardous or non-hazardous material. This is a very widely used technique and is applicable to most manufacturing processes. Implementation of this waste reduction technique may require only some minor process adjustments or it may require extensive new process equipment. For example, a circuit board manufacturer can replace solvent-based product with water-based flux and simultaneously replace solvent vapor degreaser with detergent parts washer. Installing more efficient process equipment or modifying existing equipment to take

advantage of better production techniques can significantly reduce waste generation. New or updated equipment can use process materials more efficiently producing less waste. Additionally such efficiency reduces the number of rejected or off-specification products, thereby reducing the amount of material which has to be reworked or disposed of. Modifying existing process equipment can be a very cost-effective method of reducing waste generation. In many cases the modification can just be relatively simple changes in the way the materials are handled within the process to ensure that they are not wasted. For example, in many electronic manufacturing operations, which involve coating a product, such as electroplating or painting, chemicals are used to strip off coating from rejected products so that they can be recoated. These chemicals, which can include acids, caustics, cyanides etc are often a hazardous waste and must be properly managed. By reducing the number of parts that have to be reworked, the quantity of waste can be significantly reduced.

Volume reduction

Volume reduction includes those techniques that remove the hazardous portion of a waste from a non-hazardous portion. These techniques are usually to reduce the volume, and thus the cost of disposing of a waste material. The techniques that can be used to reduce waste-stream volume can be divided into 2 general categories: source segregation and waste concentration. Segregation of wastes is in many cases a simple and economical technique for waste reduction. Wastes containing different types of metals can be treated separately so that the metal value in the sludge can be recovered. Concentration of a waste stream may increase the likelihood that the material can be recycled or reused. Methods include gravity and vacuum filtration, ultra filtration, reverse osmosis, freeze vaporization etc.

For example, an electronic component manufacturer can use compaction equipments to reduce volume of waste cathode ray-tube.

Recovery and reuse

This technique could eliminate waste disposal costs, reduce raw material costs and provide income from a salable waste. Waste can be recovered on-site, or at an off-site recovery facility, or through inter industry exchange. A number of physical and chemical techniques are available to reclaim a waste material such as reverse osmosis, electrolysis, condensation, electrolytic recovery, filtration, centrifugation etc. For example, a printed-circuit board manufacturer can use electrolytic recovery to reclaim metals from copper and tin-lead plating bath.

However recycling of hazardous products has little environmental benefit if it simply moves the hazards into secondary products that eventually have to be disposed of. Unless the goal is to redesign the product to use nonhazardous materials, such recycling is a false solution.

Sustainable product design

Minimization of hazardous wastes should be at product design stage itself keeping in mind the following factors

- **Rethink the product design:** Efforts should be made to design a product with fewer amounts of hazardous materials. For example, the efforts to reduce material use are reflected in some new computer designs that are flatter, lighter and more integrated. Other companies propose centralized networks similar to the telephone system.
- **Use of renewable materials and energy:** Bio-based plastics are plastics made with plant-based chemicals or plant-produced polymers rather than from petro-chemicals. Bio-based toners, glues and inks are used more frequently. Solar computers also exist but they are currently very expensive.
- **Use of non-renewable materials that are safer:** Because many of the materials used are non-renewable, designers could ensure the product is built for re-use, repair and/or upgradeability. Some computer manufacturers such as Dell and Gateway lease out their products thereby ensuring they get them back to further upgrade and lease out again.

Occupational and environmental hazards

Lead : A neurotoxin that affects the kidneys and the reproductive system. High quantities can be fatal. It affects mental development in children. Mechanical breaking of CRTs (Cathode Ray Tubes) and removing solder from microchips release lead as powder and fumes

Plastics : Found in circuit boards, cabinets and cables, they contain carcinogens. BFRs or brominated flames retardants give out carcinogenic brominated dioxins and furans. Dioxins can harm reproductive and immune systems. Burning PVC, a component of plastics, also produces dioxins. BFR can leach into landfills. Even the dust on the computer cabinets contains BFR

Chromium: Used to protect metal housing and plates in a computer from corrosion. Inhaling hexavalent chromium or chromium 6 can damage liver and kidneys and cause bronchial maladies including asthmatics bronchitis and lung cancer

Mercury: Damages brain and kidneys, impairs foetus growth and harms infants through mother's milk. It is released while breaking and burning of circuit boards and switches. Mercury

in water bodies can form methylated mercury through microbial activity. Methylated mercury is toxic and can enter the human food chain through aquatic life forms

Beryllium: Found in switch boards and printed circuit boards. It is a carcinogen and causes lung diseases

Cadmium: A carcinogen. Long term exposure causes Itai- itai, which affects kidneys and softens bones. Cadmium is released into the environment as powder while crushing and milling of plastics, CRTs and circuit boards. Cadmium may be released with dust, entering surface water and groundwater

Acid: Sulphuric and hydrochloric acids are used to separate metals from circuit boards. Fumes contain chlorine and sulphur dioxide, which cause respiratory problems. They are corrosive to the eye and skin.(Down To Earth,2010)

The Indian Scenario

While the world is marveling at the technological revolution, countries like India are facing an imminent danger. E-waste of developed countries, such as the US, dispose their wastes to India and other Asian countries. A recent investigation revealed that much of the electronics turned over for recycling in the United States ends up in Asia, where they are either disposed of or recycled with little or no regard for environmental or worker health and safety. Major reasons for exports are cheap labour and lack of environmental and occupational standards in Asia and in this way the toxic effluent of the developed nations 'would flood towards the world's poorest nations. The magnitude of these problems is yet to be documented. However, groups like Toxic Links India are already working on collating data that could be a step towards controlling this hazardous trade.

In India, the Union Ministry of Environment and Forests decides on what hazardous waste can be imported and exported. It is imperative that developing countries and India in particular wake up to the monopoly of the developed countries and set up appropriate management measures to prevent the hazards and mishaps due to mismanagement of e-wastes.

Management Options

Considering the severity of the problem, it is imperative that certain management options be adopted to handle the bulk e-wastes. Following are some of the management options suggested for the government, industries and the public.

Responsibilities of the Government

- (i) Governments should set up regulatory agencies in each district, which are vested with the responsibility of co-ordinating and consolidating the regulatory functions of the various government authorities regarding hazardous substances.
- (ii) Governments must encourage research into the development and standard of hazardous waste management, environmental monitoring and the regulation of hazardous waste-disposal.
- (iii) Governments should enforce strict regulations against dumping e-waste in the country by Outsiders, where the laws are flouted, stringent penalties must be imposed.
- (iv) Governments should enforce strict regulations and heavy fines levied on industries, which do not practice waste prevention and recovery in the production facilities.
- (v) Polluter pays principle and extended producer responsibility should be adopted.
- (vi) Governments should encourage and support NGOs and other organizations to involve actively in solving the nation's e-waste problems.
- (vii) Uncontrolled dumping is an unsatisfactory method for disposal of hazardous waste and should be phased out.
- (viii) Governments should explore opportunities to partner with manufacturers and retailers to provide recycling services.

Responsibility and Role of industries

1. Generators of wastes should take responsibility to determine the output characteristics of wastes and if hazardous, should provide management options.
2. All personnel involved in handling e-waste in industries including those at the policy, management, control and operational levels, should be properly qualified and trained. Companies can ad-opt their own policies while handling e-wastes. Some are given below:
 - Use label materials to assist in recycling (particularly plastics).
 - Standardize components for easy disassembly.
 - Re-evaluate 'cheap products' use, make product cycle 'cheap' and so that it
 - Has no inherent value that would encourage a recycling infrastructure.
 - Create computer components and peripherals of biodegradable materials.
 - Utilize technology sharing particularly for manufacturing and de manufacturing.
 - Encourage / promote / require green procurement for corporate buyers.

- Look at green packaging options.
3. Companies can and should adopt waste minimization techniques, which will make a significant reduction in the quantity of e-waste generated and thereby lessening the impact on the environment. It is a "reverse production" system that designs infrastructure to recover and reuse every material contained within e-wastes metals such as lead, copper, aluminum and gold, and various plastics, glass and wire. Such a "closed loop" manufacturing and recovery system offers a win-win situation for everyone, less of the Earth will be mined for raw materials, and groundwater will be protected, researchers explain.
 4. Manufacturers, distributors, and retailers should undertake the responsibility of recycling/disposal of their own products.
 5. Manufacturers of computer monitors, television sets and other electronic devices containing hazardous materials must be responsible for educating consumers and the general public regarding the potential threat to public health and the environment posed by their products. At minimum, all computer monitors, television sets and other electronic devices containing hazardous materials must be clearly labeled to identify environmental hazards and proper materials management.

Responsibilities of the Citizen

Waste prevention is perhaps more preferred to any other waste management option including recycling. Donating electronics for reuse extends the lives of valuable products and keeps them out of the waste management system for a longer time. But care should be taken while donating such items i.e. the items should be in working condition.

Reuse, in addition to being an environmentally preferable alternative, also benefits society. By donating used electronics, schools, non-profit organizations, and lower-income families can afford to use equipment that they otherwise could not afford.

E-wastes should never be disposed with garbage and other household wastes. This should be segregated at the site and sold or donated to various organizations.

While buying electronic products opt for those that:

- are made with fewer toxic constituents
- use recycled content
- are energy efficient
- are designed for easy upgrading or disassembly

- utilize minimal packaging
- offer leasing or take back options
- Have been certified by regulatory authorities. Customers should
- opt for upgrading their computers or other electronic items to the
- Latest versions rather than buying new equipments. NGOs should adopt a participatory approach in management of e-wastes.

Conclusion

Recycling of hazardous products has little environmental and health benefit. Recycling raw materials from end of life electronics is the most effective solution to the growing e-waste problem. By dismantling and providing reuse possibilities, intact natural resources are conserved and air and water pollution caused by hazardous disposal is avoided. Additionally, recycling reduces the amount of greenhouse gas emissions caused by the manufacturing of the new products. Responsible recycling ensures best management practices of electronics being recycled, people health and safety, and consideration for the environment.

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Environmental Ergonomic

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Introduction

Ergonomics has been defined as the study of the anatomical, psychological aspects of man in his working environment, with the object of optimising human safety, health, and comfort efficiency. Thus it is concerned with the study of man and women in his or her daily work. The intent is to ensure that the work, the working equipment and the working environment are also designed or modified as to fit the job of the man rather than the man to the job. Man in his working environment has certain assets and liabilities, certain capacities and limitations.

The birth date of the discipline ergonomics can be pinpointed fairly accurately to 12th July 1949. A meeting was held at the admiralty at which an interdisciplinary group was formed for those interested in human work problems. The word ergonomics was coined from the Greek: ergon – work; nomos – natural laws. Today the most common definition of ergonomics is that “It is a scientific study of a relationship between the man, the machine and the environment.”

The final outcome of anything man made article for human use with definite form, shape and size to perform a particular purpose may be termed as product. The range may be from a small individual pin, household equipment, to a group of articles assembled together e.g. machine, tools, toys, a computer, electronics articles to a vehicle.

The scope of Ergonomics

As reason it can be said, whatever products we use through various innovations may have all the best scientific principles in them for functioning. If these are not comfortable for human uses, it serves no good, because man is ultimately going to use the product. Human incapability design defects should be taken care during the process of product development.

The effect of temperature, light and noise and humidity on production quality levels and psychological functioning of human being is considerable. It is therefore necessary to provide the environmental facilities to workers before measuring effectiveness of the job design. Human factors and ergonomics (HF&E) is a multidisciplinary field incorporating contributions from

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psychology, engineering, biomechanics, mechanobiology, industrial design, graphic design, statistics, operations, research and anthropometry. In essence it is the study of designing equipment and devices that fit the human body and its cognitive abilities. Ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

HF&E is employed to fulfill the goals of health and productivity. It is relevant in the design of such things as safe furniture and easy-to-use interfaces to mechanisms and equipment. Proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over time can lead to long-term disability.

Human factors and ergonomics is concerned with the “fit” between the user, equipment and their environments. It takes account of the user’s capabilities and limitations in seeking to ensure that tasks, functions, information and the environment suit each user.

To assess the fit between a person and the used technology, human factors specialists or ergonomists consider the job (activity) being done and the demands on the user; the equipment used (its size, shape, and how appropriate it is for the task), and the information used (how it is presented, accessed, and changed). Ergonomics draws on many disciplines in its study of humans and their environments, including anthropometry, biomechanics, mechanical engineering, industrial engineering, industrial design, information design, kinesiology, and psychology.

Review of Literature

It is difficult to imagine life without any machine. Every human being uses machine. It could be a household equipment, tool, cell phone, laptop, computer, printer, scanner etc. That machine could be an electric or nonelectric depending on the requirement.

Recently, a Jawaharlal Nehru University pilot study found that 20 rat subjected to mobile phone radiation had damaged DNA and low sperm count. The Union Health Ministry Commission carried out the first large-scale study of the effect of radio frequency radiation from mobile phone on humans with 250 million mobile phone subscribers. Currently in India, there are many people using appliances like television, Computer, Vacuum Cleaner, Microwave, household equipment or tools etc. The fear is that these “essentials” of life may actually be posing a big health risk because of their electromagnetic fields (EMFs). Almost all electronic equipments have EMFs and we are constantly bombarded by the radiation from these fields. But then, not all

EMFs have an impact. Only those with high frequencies-2 mG (milligauss) and above- causes the maximum harm. These frequencies are usually found in appliances that we use on a daily basis- microwaves, cordless phone, Computer, Monitors, Fax machines, Cell phones, Cell phone tower, hair dryers, and so on.

Similarly, 'Ergonomic study on computer operator', A study by Dewgekar Sonal (2003), found that health problems related to neck- shoulder-wrist aches existed among most of operators. Eyestrain, headaches and dry/irritated eyes were also found. Feeling of tiredness or fatigue was reported by almost all operators. These problems were attributed to abnormal working posture and faulty work station.

'Cell phone towers are a cause of Concern'- 2005 study by Gursatej Gandhi, found that " exposure to radio frequency (RF) signals generated by use of Cellular phone has increased dramatically and is reported to effect physiological, neurological, cognitive and behavioral changes and to induce, initiate and promote carcinogenesis. Oberai K.(2003) developed Ergonomically planned kitchen for standing posture. He found that kitchen design developed on the basis of anthropometrics and reach measurements of the women, proved to be very effective in reducing the ergonomic cost work i.e. up to 55-60 % and with the organized layout of the kitchen the ergonomic cost of work further reduced up to 15% based on the study.

Environmental Ergonomics

The physical environment is characterized by climate, temperature, Pressure, vibration, light ect. The studies have shown that poor working conditions such as poor ventilation, low illumination, high or low tem, unbearable noise and pollution such as dust, dirt, smoke, poisonous gases in loss of efficiency, create discontent and results in increased rate of accidents or sickness.

Facts

- * The average person working at a keyboard can perform 50,000 to 200,000 keystrokes a day.
- * Overexertion and falls are the most common cause of work place injury.
- * An average of 125,000 back injuries due to improper lifting each year.

Recommendation

- Product must be durable, repairable and must have multipurpose use facility.
- Use the largest joints and muscles to do the job.
- Warm up and stretch before activities that are repetitive, static or prolonged.
- Take frequent breaks from any sustained posture every 20-30 minutes.

- Stop painful activity.
- Use two hands to lift rather than one, even with light objects and tasks.
- Carry objects close to body at waist level.
- Considering human-physical structural and biomechanical nature, male-female and age variations, machine must be designed.
- Temperature, light, noise, vibration, illumination, ventilation, cold production quality level effect physiological functioning of human beings.
- Hence to reduce disease and increase well being of people men and machines should maintain a healthful balance.
- Buy green and eco friendly products.
- Ergonomics help to reduce job related injuries, illness, stresses and to increase job satisfaction which leads to improve productivity.

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Social, Physiological & Psychological Consequences of Drought in Beed District

Chetana. V. Donglikar*

Abstract

Climate change has a potential to undermine human development across many countries, including India, and many even lead to a reversal of current developmental progress. Actions taken or indeed not taken, in the years will have a huge impact on the future course of human development. Freshwater resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. The survival, development, protection and participation of human beings are all implicated in a climate-changing world. This alone makes a compelling case for bringing children and women into the focus when examining the impacts of climate change on their communities. In such unfavorable conditions women and children had to suffer a lot socially, physically, mentally and economically. To overcome these primary needs of people Government have to work on some root level implementations on malnutrition in woman and children, child labor, unemployment and sex trafficking of girls in such drought prone areas.

Introduction:

Nearly 50% of population from Shirur (Ka) taluka has migrated to neighboring districts because of water scarcity and daily earnings. Water tankers visit various villages even today once in every 8 days. Billobasti Jhapewada in Shirur taluka of Beed district is left only with 200 people out of nearly 500. The villagers do not have means to store enough water to last for more than a week. Most of them have moved to brick kilns sugar-cane cutting and other labor work in the neighboring Nagar district that provide slightly better water facilities and also cash for work. Water collected from polluted water sources like drains and drying wells seems clean but carry many germs making the villagers get cough, cold, fever, diarrhea and number of other diseases.

Keywords: Drought in Marathwada, Food Security & drought, Consequences of drought.

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In such unfavorable conditions we can hardly think of Health and Nutritional Status of people living there. Women and children are the most affected by climate change and natural disasters because of their social roles, vulnerability, discrimination and poverty. Limited mobility, lower resistance to disease and inadequate access to health care, the burden of household and agricultural work, substandard housing and infrastructure contribute to aggravating the multiple burdens of climate change. India is a net agricultural exporter but food availability is threatened by the effects of climate change and declining water resources on agriculture output. Economic access to food by about a fourth of the population living below the poverty line is problematic. The level of malnutrition, especially among women and children, remains unacceptably high. Government efforts alone and a business-as-usual stance are inadequate to tackle food and nutrition security in India. Today there is a alarming need to improve the status of food and nutrition security in India.

Heavy Drought in Maharashtra & Marathwada

Maharashtra, an Indian state, is facing one of the worst droughts in the past 40 years. Newspapers have reported that dams in Marathwada district are left with only 8% water as compared to 18% last year and 46% year before at this period of the year. Reports say severe droughts have prompted people to migrate to Mumbai and neighboring states of Gujarat, Karnataka and Andhra Pradesh from 3,905 villages in 12 districts of the state. Districts of Ahmednagar, Aurangabad, Jalna, Beed and Osmanabad are reported to have only enough drinking water reserves. Impending summer have worsen the situation and even today the state is transporting water from neighboring districts and even by trains from other states.

In Beed district, the conditions are very harsh. The climate of Beed district is hot and dry. Summers are very long ranging almost five months from mid February to June. Natural water sources get dry by the end of November-December. Rains are scarce and occur only during the monsoons from June to September. Humidity is low and winters are dry. Soil is coarse and rocky with low vegetations and forests. In recent times there are frequent droughts, shrinking water reservations and extreme shortages of drinking water especially in rural areas like Shirur (ka). The present crisis worse than that of 1972 and other than shortage of rain, recorded at an unprecedented low of 55 mm against ideal 750 mm in Jalna and Beed.

Impact of Climate Change

Climate change has a potential to undermine human development across many countries, including India, and many even lead to a reversal of current developmental progress. Actions taken or indeed not taken, in the years will have a huge impact on the future course of human development. In India more than 56% of workers are allied in agricultural work and allied sectors. India is a net agricultural exporter but food availability is threatened by the effects of climate change and declining water resources on agriculture output. Economic access to food by about a fourth of the population living below the poverty line is problematic. The dry areas are also challenged by rapid population growth, frequent droughts, high climatic variability, land degradation and desertification, and widespread poverty.

Poverty and other social problems are leading to unsustainable agriculture, degradation of natural resources and increased migration. Another major challenge is the impact of globalization, due to the changes in the world trade system and potential competition. This instability is further exacerbated by unrest in the financial markets. Food insecurity, poverty, and poor access to natural resources also manifest themselves in conflicts. Conflicts have been concentrated in regions heavily dependent on agriculture destroying food and water supply sources, biodiversity and seed systems, and resulting in long-term negative effects on the environment.

Effects of Drought in Beed District

In Beed district of Marathwada, Shirur Kasar and Ashti talukas were the worst hit, with just 24 and 25 days of rainfall, or 248mm and 259mm rain, respectively because of which the farmers had to bring their cattle to camps that provided shelter to villagers as well as fodder and water to cattle living behind their homes. During investigation it was found that there were more than 200 families in one camp to feed their cattle.

In unfavorable conditions women and children had to suffer a lot socially, physically, mentally and economically. Socially a woman is stressed in various areas like home, children, her spouse, her cattle and day to day problems of family, physically she have to travel 5-6 km daily for water, she hardly gets a full meal to eat as she has to fulfill the needs of family, even she don't have enough time, knowledge, awareness and money to take care of her health. Economically to share the needs of family she had to work on farms, brick factories, sugar cane cutting and cotton collection. Whereas children have to drop out from their schools and help their parents in providing daily needs of family by working on others fields, in hotels and dhabas being

irresponsible for their health, childhood and studies. Water woes in drought hit areas so much that the school gives relaxations to students for collecting water for families when the water tanker arrives in the village. The vulnerable position of families from drought prone areas force them to perform child marriage, a fraudulent marriage of his ward, forced labor of child, bonded labor and migration. Migration is a broad general concept and trafficking is a sub-set or category of migration.

Trafficking of Women and Children

Maharashtra is increasingly known as a source, destination and route for trafficking in women and children. Trafficking of women and children is a deeply entrenched and growing phenomenon in drought-prone districts of Marathwada such as Latur, Osmanabad, Beed and Nanded. These four districts are high trafficking zones in India. Main causes are mixture of environmental and social factors as mentioned above. Poor rainfall and irrigation facilities in Beed limit the scope for agriculture, landless farmers, *dalits* and other minority groups have had to survive here under tremendous pressure. Social injustice and exploitation, both cultural and economic, is common. Recurrent droughts as experienced in the region have resulted in depletion of economic livelihoods creating great pressure for rural masses to migrate in search of economic sustenance. With the erosion of livelihoods in the rural areas, the promise of better livelihood in the big cities becomes for the rural masses an inducement to migrate. The prevailing state of distress in the region combined with poverty and illiteracy makes most migrant persons dependent on agents who show them illusions of all kinds including job, marriage with an end to their misery and deprivation. In such circumstances, women of marginalized communities easily become commodities. Rendered option-less by the situation and with the challenge of ensuring the survival of the family, women become more and more gullible to be deceived or forced to look at other options for sustenance. Particularly women who are separated from their families are vulnerable.

In many cases, close family members such as the father, husband, in-laws, uncles, cousins, stepfathers and family friends or relatives act as trafficking agents. There is growing community acceptance for the fast-growing commercial sex sector. In some cases, the victims themselves or their families took the initiative of contacting traffickers in the hope of gaining a better livelihood. As people in drought-hit parts of Maharashtra face livelihood challenges, concerns have been raised over the possibility of girls from these areas being allegedly trafficked to Goa

for flesh trade, according to a prominent NGO here. Past experiences have shown how girls and women were trafficked and pushed into sex trade, when calamities like natural disaster or conflicts happen, leaving people helpless and indulge in sex trade to fulfill their family needs. NGO ARZ (Anyay Rahit Zindagi) director Arun Pandey said.

Health Problems and Drought in Beed

Because of harsh circumstances occurred by severe drought, people living in rural areas of Beed district face various health and sanitation problems related to water. During the study we collected some data of various water born diseases in taluka shirur (Ka) from Primary Health Care Center. While collecting the data specially the data belonging to period of February to July was collected to know about health problems in this area, which is most effected by drought.

Heat disorders are a group of related illnesses caused by prolonged exposure to hot temperatures, restricted fluid intake, or failure of the body's temperature regulation mechanisms. Disorders related to heat exposure include heat cramps, heat exhaustion, and heat stroke (also called sunstroke).

As per the results, direct and indirect human costs of this are enormous and include extensive health problems, high labor costs, particularly women (primarily) are forced to travel long distances each day to haul water to meet even the most minimal needs, and severe limits on the extent and form of economic development. As a result of the lack of clean water and sanitation services, there are thousands of cases of water-related diseases and sanitation problems every year. Researchers have found that there is a close relation between local climate and occurrence of severity of some diseases and other threats to human health. It is estimated that climate change contributes to 150,000 deaths and 5 million illnesses each year, and the world health Organization estimates that a quarter of the World's diseases burden is due to the contamination of soil, air, water, and food. Changing temperatures and precipitation patterns linked to climate change will further affect health by changing the ecology of various vector-borne diseases, such as malaria, dengue, chikungunya, Japanese encephalitis, kala-azar, and filariasis. Vulnerable populations include the elderly, children, urban populations, and the poor. Heat stress and air pollution, waterborne disease, and vector-borne disease are the different categories of occurrence of diseases; Climate change poses an overwhelming stressor that will magnify existing health threat.

Conclusion

The gender aspects of social security assume significance as it is widely recognized that, the position of women is particularly vulnerable to continued poverty because of frequent droughts, unemployment, migration and destitution when they attain old age and/or are widowed or divorced. As mentioned above, Marathawada is one of the most backward region of India and four districts in the discussion are high supply zones of trafficking, it is important that not only STCI but all the stakeholders- Government, NGOs, Corporate, and academic institutions forge an effective alliance and provide viable and sustainable livelihood options for the people so that the causative factors are directly addressed which make women and children highly vulnerable to trafficking. Economic aspects like poverty, lack of opportunities, and breakdown of livelihood options are factors, which make people easily fall prey to the exploitation. It is also important to deal with issues of gender, age, class and caste dimensions, which have very clear roles to play in defining vulnerabilities. To enhance awareness and to influence lifestyle, behavior, and individual choices to protect and improve climate, environment and health; Government, Non-Government, social and educational institutions should come forward.

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Global Warming and Human Health

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Introduction

Global Warming is big problem all over the World. All countries should come forward to perfect Earth. Global Warming is all about adverse climate change, cause by the trapping of greenhouse gases in the Earth's atmosphere that affect biodiversity and poses a serious health hazard. Global Warming is term used to describe the average temperature of the Earth is increasing. it is believe that pollution has caused a hole in ozone layer that is allowing more sun rays in than before. It is belived that the increase in the temperature will eventually melt the polar ice caps. The rate of warming is increasing the 20th century, s last two decades during the past two centuries carbon dioxide in the atmosphere has increased dramatically. Global Warming has brought alarming changes in many aspects of the earth and its biosphere. this includes the effects on global climate, agriculture economy, sea level, biodiversity and Human heath. The world is spinning in a vicious cycle of demand and supply that is both the cause and effect of global warming. If the situation continues health hazards will increase.

Causes of Global Warming

The main reasons pointed out by scientist which are causes of global warming is greenhouse effect, ozone depletion, and many other reasons.

Greenhouse Effect

Greenhouse effect is the most prominent reason observed as the cause for global rise in temperature. The earth surface including the land and water is exposed to the sun and the heat radiations from the sun are heating up the earth surface. The land as it cools re radiates this heat back into the atmosphere and further to the space from there but not whole of this heat energy can leave the earth surface called greenhouse gases and these gases block the radiation from escaping into the outer space.

Effects of Carbon Dioxide:

Carbon dioxide which is essentially factor for all life forms to exist, is presently criticized as the main reason for global warming and in fact it is the main sources of Carbon dioxide reaching the

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atmosphere from biological respiration, incomplete burning of fossil, petroleum and other fuels that contain Carbon in their chains from oceans, automobiles and many other sources respiration by living organisms is a natural process of Carbon dioxide cycle in the biosphere. Fossil fuels such as coal, petroleum ,fuels on incomplete combustion give out a lot of Carbon dioxide into the atmosphere which unbalance the Carbon dioxide cycle..and contribute to green house effects.

Effects of Methan

Methane(CH_4)is potentially an atmospheric pollutant and this bad reputation has changed to after it was identified as a green house gas and also it is major contributor of Global Warming.Methane gas is formed mainly as a biproductof many biological process such as digestion , biological decomposition.

Effects of Nitrous Dioxide

Nitrous dioxide, called by the name Laughing gas is another green house gas. No one will laugh nor smile when we say it too contributes to Global Warming.within the last 120 year the amount of Nitrous oxide is rapidly increasing in the atmosphere.As per estimates the role of Nitrous oxide in global Warming. Nitrous oxide reaches the atmosphere from burning of fire wood and other biological waste.

Health Effects of Global Warming

Global warming is all about adverse climate change caused by trapping of green house gases in the earth's atmosphere that affects biodiversity and poses a serious health hazard. This will further spike global warming and have seriously damaging influence on human health.

Malarea

Malaria is a Mosquito borne parasitic disease that human and other animals caused by micro organisms in the plasmodium family .It begins with a bite from an infected female Mosquito which introduces the parasite through its saliva and into the infected hosts circulatory system .It then travels through the bloodstream into the Liver where it can mature and reproduce . The disease causes symptoms that typically include fever, headache, in severe cases can progress to coma or death. Climate is an influential driving force of vector-born diseases such as malaria. Malaria is especially susceptible to the effect of climate change because Mosquitoes lack the mechanisms to regulate their internal temperature. This implies that there is a limited range of

climatic conditions within the pathogen (malaria) and vector (Mosquito) can survive reproduce and infect hosts.

Dengue Fever

Dengue Fever is an infectious disease caused by the dengue virus known to be in the tropical regions .It is transmitted by Mosquitoes Aedes or Aegypti the cases of dengue Fever increased dramatically since the 1970s and continues to become more prevalent.

This disease is believed to be due to a combination of urbanizations ,population growth ,increased international travel ,and Global warming .This is because of some of the climate changes that are occurring are increased heat , presipitation and humidity which create prime breeding grounds for mosquitoes .The hotter and wetter a climate is the faster the mosquitoes can mature and the faster the disease can developed.

Conclusion

Climate change is very real phenomenon which has already impacted the global distribution of infectious diseases .The best way to reduce global warming and its impacts are known to everyone ,remedial precautions are to be implemented at a global scale .Tree are the major consumers of carbon dioxide, Forestations is the best remedies conventional forms of energy as proved to emit a large amount of greenhouse gases .Usage wind ,solar will replace the conventional forms of energy like coal and petroleum product. Plants can help is trackle climate change in future.

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Psychological Impact and Adaptation of Climate Change

Sandip Mali*, Maya Vanjare**

A changing climate impacts our health and wellbeing. Global climate change is likely to have significant negative effects on mental health and well being effects that will be felt most by vulnerable populations and those with preexisting serious mental illness (Costello et al.,2009; Fritze, Blashki, Burke and Wiseman, 2008; page and Howard 2010). As the planet warms, oceans expand and the sea level rises, floods and droughts become more frequent and intense, heat waves and hurricanes become more severe, it increased risk for health effect-physically and psychologically of the most vulnerable people such as children , elderly the poor and those with underlying health conditions. However, for many the psychological effects of climate change are likely to be gradual, cumulative and/or experienced only through media and social communication (weber and stern, 2011; Reser and Swim , 2011). An appreciation of psychological impacts entails recognizing multiple meanings and culture narratives associated with climate change and its complexity as a “Wicked problem” whose effects are interacted with other global phenomena such as increased population, urbanization and disparities is wealth (Kazdin 2009, Stokols, Mishra, Runner-Storm & Hipp, 2009).

According to Dr. page and Dr. Howard (2009), the climate change is likely to impact mental health in following ways.

- Adverse psychiatric outcomes are well documented in the aftermaths of natural disasters and include post traumatic stress disorder, major depression and somatoform disorders.
- The needs of people with chronic mental illness have often overlooked following disaster in favour trauma-focused psychological interventions and yet the mentally ill occupy multiply vulnerabilities for increased mortality and mortality at such times.
- As global temperatures increases, people with mental illness are particularly vulnerable to heat related death and death by suicide may also increase.
- Adverse impacts such as psychological distress, anxiety and traumatic stress resulting from emerging infectious disease outbreaks are also likely to increase if the predicated outbreaks of serious infectious disease become reality.

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- Coastal change and increased flooding is expected to lead more mental illness in affected population.
- Urbanization, a phenomenon which will be partially beneficial for example by increasing opportunities for work and better access to health services is associated with an increased incidence of schizophrenia in developed countries. In many low- and middle-income countries, mental health provision is already hugely inadequate and is likely to be prioritized should further economic collapse occur secondary to climate change.
- The knowledge of manmade climate change could in itself have adverse effects on individual psychological well being.

For ensuring effectiveness in mitigating the psychological impacts of global climate change, adaption to and coping with the threat is necessary. The governmental panel on climate change (IPCC) defines adaptation as “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2007). A psychological perspective on adaption includes many human setting and system considerations, and both anticipated and reactive responses to climate change, but goes beyond in encompassing human experience and psychological wellbeing. Psychological form of adaptation are very infrequently referenced or addressed in the current climate change science adaptation literature (IPCC, 2007; Leary et al, 2008; Schipper & Burton, 2009).

The psychological perspectives on climate change adaptation in multi and interdisciplinary perspectives on adaptation . These include multi-leveled approaches and analytic frameworks that encompass individual and experience -focused levels of analysis, social, psychological and motivational process responses to the threat and unfolding impacts of climate change and environmental psychological models, constructs and indicates relevant to accessing the psychological contexts and impacts of climate change (Giffort, Steg & Reser, 2001; Wamner et al, 2000). Psychological research on human response to global environmental change conservatively spans three decades, (Chen, Boulding & Schneider, 1983; National Research Council, 1992, 2009; Stern & Gardner, 1981) , providing particularly helpful perspective and insights on human adaptation and adjustment to environmental threat, natural & technological disasters and stressful and challenging environmental changes.

This psychological window on climate change impacts and adaptation helpful in interdisciplinary research and policy initiatives addressing the impacts of climate change (stokols et al, 2008).

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Physico-Chemical Properties of Termite Mound Soil from Lohare, Ahmednagar Maharashtra

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Abstract

We investigated the relative importance termite mounds soil and adjacent (control) soil at Lohare, District Ahmednagar, Maharashtra and assessed with interpretation of differences. There were significant differentiation between mound soil and adjacent soil measured. We also observed significant relationships between mound soil and surrounding soil. Generally all the parameters are inclining in nature but N, Ca, S and Mn were decline in mound soil when compared to adjacent soil. However, these relationships were also termite species specific between mound soil and adjacent soil. This study highlights that termite mound soil properties are generally more than the surrounding and beneficial to use in gardening or landing.

Introduction

The high cost of industrial fertilizer and their impact on the environment but it is also necessary for increasing food productivity. The frequent occurrence of drought and the prevalence of diseases, make it essential to increase food production. Termite (Class, Insecta) mounds are common in the low lands. If these mounds could be used to improve soil fertility, this could be a cheap and environmentally friendly way of improving food productivity. These mounds are observed in water stress areas. The mound soils are one of the poorly researched habitats. Women and children consume mounds soil. Chimpanzee feed on termite and mound soil. Hence present study was assigned to evaluate mound soil characters. However, termite mound soil can be used as fertilizer and preparation of barren land in to fertile soil.

Termites (Isoptera) are social insects having 3000 known species, in which 75% are soil-feeding and 28 species pests. The termite food is non-cellular organic material mixed with clay minerals. Termite gut is modified and adapted for rising of pH (up to 12.5), oxygen and hydrogen [1,2,3]. These characteristics are important for soil chemical and physical modifications.

Key words: Termite mound soil, adjacent, relation, Lohare area.

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Termites are ecosystem engineers [4], collect organic matter and mineral particles from different depths and built mounds, enhancing the content of organic carbon, clay and nutrients [5,6,7]. The termite mound soil redistributed by soil erosion, affecting soil microstructure and fertility [6, 4, 8, 9]. Termites also build galleries and increase soil porosity and water infiltration [10,11]. The galleries made with top soil materials, with rainfall contributing to the process of formation of deep, uniform Latosols [9]. Mounds are known as termitaria or ant hills [12] and above ground nest. It may be large about 9 m and dome or cone shaped. Clay content in mounds is usually 20% higher than adjacent soils, but it is not understood whether termites select particles, or soil undergoes a physical fractioning through their guts.

Materials and Methods

Study Area

The study has been carried out in the Lohare urban region, Ahmednagar district, Maharashtra, India. Village Lohare area is located 19°63'N latitude and 74°38' E longitude. It experiences an average rain fall 58 cm and mostly dry area. The soil is black cotton soil along with the Pravara river basin. There are several termites' mounds in the area. Physico-chemical property of termite mound tends to know the quality of soil to react to the external environment.

Collection of Soil Samples

The termite mound soil samples were collected from thirty different selected sites of village from Lohare. The collections were made during premonsoon (May-June). At each sites, soil sample was taken from different field survey number. The study sites were fixed, then digged at about 30 cm deep 'V' shaped pit and remove all soil after the samples were collected from margin of V shaped pit with help of large scalpel. Also five feet surrounding the mound soil samples were collected as control. The collected samples were made into four same sized parts and then removed two opposite parts. The process was repeated until the sample retained one half kg [13]. Each of samples then were labeled, numbered, with date of collection, survey number, name of village, type of field, etc.

Soil Analysis

The collected soil samples were analyzed for various physico-chemical parameters. The experiments were carried out in triplicates. It includes pH, electric conductivity (EC), organic carbon (OC), lime, calcium carbonate (CaCO₃), available Nitrogen (N), Phosphorus (P), Potassium (K), calcium (Ca), Magnesium (Mg), Sulfur (S), were determined by standard

methods [13]. The soil samples are subjected for the estimation of Cupper (Cu), Manganese (Mn), Zinc (Zn) and Iron (Fe) through atomic absorption spectrum (AAS).

Statistical Analysis

The analysis of variance was performed using MS/Excel/2007. The mean values were compared by Student t-test ($p \leq 0.05$). The main effect and interaction was analyzed by a general at a significant level of $p \leq 0.05$. Linear regression were determined by regression analysis and expressed as correlation coefficient r (significant correlation at $p \leq 0.05$ marked with *). The mean data is presented in table 1.

Result and Discussion

Present data show that the pH was observed 8.56 in termite mound soil and 8.07 surroundings respectively. It is more about 5.72% increase in pH. In the present study pH was not highly modified. There is about 0.05 pH differences. Termite modified pH, up to 12.5 [2]. The changes in pH depend upon species to species.

Our experimental result clearly indicates that the EC was 0.27 dS/m in adjacent soil and 0.32 dS/m in termite mount soil. There is about 15.63% incline over control. By agricultural point of view soils with an EC greater than 4 dS/m are considered saline. The mound soil was not saline in the studied soil. In actuality, salt-sensitive plants may be affected by conductivities less than 4 dS/m and salt tolerant species may not be impacted by concentrations of up to twice the maximum agricultural tolerance limit [14].

The table 1 depicted that carbon contents in termite mound was 0.51 % and adjacent soil as and 0.48% respectively. It was increased about 5.88% over the control. Soil carbon is the largest terrestrial pool of carbon [15]. Soil carbon plays a key role in the carbon cycle and thus it is important in global climatic models. Soil carbon improves the physical properties of soil. It increases the cation exchange capacity and water holding capacity of sandy soil and it contributes to the structural stability of clay soils [16].

In the present study nitrogen was observes as 24.77 mgg^{-1} in surrounding soil and 24.46 mgg^{-1} in termite mound soil. Termite mound soil showed decline in N content. Nitrogen is as necessary macronutrient for the plant growth. Although N is a key regulation of ecosystem processes [17]. The increased N causes acidification and eutrafication [18]. So it is essential to know about N present in soil and future planning for cropping pattern.

In the present study Phosphorus was found to be 18.47 mg/g in surrounding soil and 26.16 mg/g in termite mound soil. It is about 29.4% more than adjacent soil. Phosphorus is often recommended as a row-applied starter fertilizer. Starter applications may increase early growth even if P does not increase grain yield. Producers need to carefully evaluate cosmetic effects of fertilizer application versus increased profits from yield increases.

In the present study potassium was noticed as 36.96 mgg⁻¹ in the surrounding soil and 39.11 mgg⁻¹ in termite mound soil. It is 5.5% higher than adjacent soil. Potassium is essential element. The main role of K is to provide the ionic environment for metabolic processes which regulates various processes including growth regulation [19].

The study revealed calcium was 50.12mgg⁻¹ in surrounding soil and 48.76 gg⁻¹ in mound soil. There is about 2.85% reduction than control. The micronutrient magnesium was recorded was 14.22 mgg⁻¹ in surrounding soil and 16.55 mgg⁻¹ in termite mound soil. There is about 14.14% reduction.

The data pertains in table 1 showed sulfur contents as 12.68 mgg⁻¹ in the control soil and 11.29 mgg⁻¹ in termite mound soil. There is about 12.31 % reduction. The availability of sulfur to plants is dependent on the release of this element from soil organic matter [20]. Studies have shown that net mineralization of soil S is affected by organic matter additions [21] and plant growth [22], in addition to temperature [23] moisture [24]) and nutrient supply [25]. Ferrous in the termatoraria soil was 4.80 mgg⁻¹ and in the surrounding soil was 3.0 mgg⁻¹. It is about 37.50% higher than control. Zinc in the termatoraria soil was 0.41 mgg⁻¹ and in the surrounding soil was 0.29 mgg⁻¹. There is about 29.27% increase over the control. Zinc is essential for many plant functions such as production of auxins, activates enzymes in protein synthesis, regulation and consumption of sugars, starch formation and root development. It is necessary for the formation of chlorophyll and carbohydrates.

Copper in the termatoraria soil was 12.30 mgg⁻¹ and in the surrounding soil was 0.66 mgg⁻¹. There is about 27.83% decline over control. It is essential for plant functions such as a catalyst in photosynthesis, respiration, several enzyme systems, carbohydrate and protein metabolism. It is important to the formation of lignin in plant cell walls which contributes to the structural strength of the cells and the plant. Copper also affects the flavor, the storage ability and the sugar content of fruits. Manganese in the termatoraria soil was 5.91 mgg⁻¹ and in the surrounding soil was 6.42 mgg⁻¹. It is about 8.63% reduction over control. It was higher than prescribed standards.

Manganese has activated many enzymatic reactions involved in metabolize of organic acids. Manganese along with Fe plays role in the formation chlorophyll. The soil chemical properties showed significant differences between termite mounds and adjacent soil. It showed highly positive correlation between mound soil and adjacent soil ($r= 0.96$) The Student t-test was also significant at 0.05% level. The amount of organic C and N in the mound, compared with adjacent soil, was significantly greater. Such higher amounts of organic carbon and nitrogen are possibly derived from finely divided organic material used by termites for nest building once they do not only mix and pack soil but also can ingest mineral soil material to extract nutrients contained on it [26]. Termite enrich the soil with organic, total N, Ca, Mg, K and Na as a result of digesting plant materials and depositing feces and/or saliva in their working at the surface [27]. During this process they can breakdown the litter into minute particles, enhancing the action of fungi and soil bacteria, thus favoring the decomposition of organic matter, and helping for the formation of humic substances [26]. The organic material which passes through the digestive tract is subjected to various chemical and biological processes such as organic matter, as well as its humification degree and complication with metal ions [26]. Thus, the higher values of C and N in the termite nests in comparison with adjacent soil are attributed to termite behavior of ingesting soil organic matter and returning it as fecal or buccal pellets, in which organic matter is physically and chemically protected, forming stable aggregates. The acceleration of organic matter decomposition due to termite action can further increase the aggregate stability and soil porosity, which can enhance water retention [9,28,29]. In the oligotrophic environment, the source of phosphorous is mainly organic, the higher P associated with higher organic matter content in the mounds, compared with adjacent soil.

Thus, termite mounds contained more plant nutrients and were of a better physical condition than soils that were termite free. It is recommended that where the density and distribution of termite mounds are relatively low, soils may be collected from these mounds, broken down to smaller pieces, and mixed with other types of soil, and used for small scale gardening.

The following questions need to be addressed to adequately explain the mechanism and better predict how termite mound soil significantly showed differences at the habitat level.

- i. Does termite gut community affect on soil? If so, at what molecular level be best expressed in it.
- ii. How does gut chemicals and food materials interacts with each others?
- iii. What is the link or reaction between termite gut and normal soil?

iv. How will climatic changes affect termite mound soil?

v. Is there are species specific reaction between termites and mound soil?

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Climate Change and Nutrition Security

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Introduction

Under nutrition remains one of the world's most serious but least addressed socioeconomic and health problems the number of people suffering from hunger stood at 925 million in 2010 and maternal and child under nutrition remain pervasive in developing countries nearly one third of children are under weight of stunted under nutrition including micro nutrient deficiencies is caused by inadequate dietary intake and disease which in turn stem from food insecurity, poor maternal and child care practices and inadequate access to clean drinking water and safe food sanitation and quality health services. The human and socio economic costs of under nutrition are enormous falling hardest on the poorest especially on women and children climate change affects food and nutrition security and further undermines current efforts to reduce hunger and protect and promote nutrition. Additionally under nutrition in turn undermines the resilience to shocks and the coping mechanisms of vulnerable populations lessening their capacities to resist and adapt to the consequences of climate change.

Nutrition Security:

Climate change will increase the risk of hunger and under nutrition over the next few decades and challenges the realization of the human rights for health and adequate food climate change will affect nutrition through different casual pathways that impact food security sanitation, water and food safety health maternal and child health care practices and many socio economic factors with a likely change in the patterns of climate related extreme events such as heat waves, droughts, storms, heavy precipitation and floods and increased risk of disasters, vulnerable communities and households will suffer serious setbacks in terms of food and nutrition security climate change negatively affects food availability conservation access and utilization and exacerbates socioeconomic risks and vulnerabilities. Climate change is expected to further reduce food productivity and to make production even more erratic in regions where agricultural productivity in regions where agricultural productivity is already low with local production declining and probable disruptions.

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Caused by climate hazards income generating opportunities and purchasing power will decrease for vulnerable population.

Ensuring nutrition security in a changing climate

A combination of action and climate change adaptation and mitigation supported by research and technological development can reduce the threats to food and nutrition security. A revitalized twin – track approach has been proposed to address the impacts at climate change on food and nutrition security track one consists direct and immediate nutrition interventions and safety nets. Since the effects of climate change all are extremely location specific international and national stakeholders should work to ensure that technical, financial and capacity building support reaches local communities.

Support gender dynamics, gender equality and girls education in addition to a rural focus attention has to be given to urban and peri -urban areas the food supply in urban and peri - urban areas can be put at stake by climate change hazards these perturbation can have an important impact on the growing urban and peri- urban populations in particular the poorest and most vulnerable living in precarious conditions in slums with no access to social protections or safety nets young children, adolescent girls and pregnant women in rural, urban and peri- urban areas should receive specific attention.

Conclusion

Climate change directly affects food and nutrition security undermining current efforts to address under nutrition one of the world's most serious but least addressed socio economic and health problems. A combination of nutrition sensitive adaptation and mitigation measures nutrition smart investments increased policy coherence and institutional and cross sectoral collaboration can address the threats to food and nutrition security from climate change. A rights based approach engages the rural peri- urban stake holders most vulnerable and affected by climate impacts as active participants in this process.

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Effects of Global Warming on Environment

“Earth provides enough to satisfy every man's needs, but not every man's greed.”

~ Mahatma Gandhi

Savita Veer*

Abstract

Global warming is one of the most controversial science issues of the 21st century. The problem is that global warming is not just a scientific concern, but its complex of economics, sociology, geopolitics, local politics, and individuals' choice of lifestyle. Global warming is caused by the massive increase of greenhouse gases, such as carbon dioxide, in the atmosphere, resulting from the burning of fossil fuels and deforestation. There is clear evidence that we have already elevated concentrations of atmospheric carbon dioxide to their highest level for the last half million years and maybe even longer. Scientists believe that this is causing the Earth to warm faster than at any other time. The report by the Intergovernmental Panel on Climate Change (IPCC), amounting to 2,600 pages of detailed review and analysis of published research, declares that the scientific uncertainties of global warming are essentially resolved. This report states that there is clear evidence for a 0.6 °C rise in global temperatures and 20 cm rise in sea level during the 20th century. The IPCC synthesis also predicts that global temperatures could rise by between 1.4 °C and 5.8 °C and sea level could rise by between 20 cm and 88 cm by the year 2100. In addition, weather patterns will become less predictable and the occurrence of extreme climate events, such as storms, floods, and droughts, will increase.

Introduction

The energy received from the sun is in the form of short-wave radiation, i.e. in the visible spectrum and ultraviolet radiation. On average, about one-third of this solar radiation that hits the Earth is reflected back to space. Of the remainder, some is absorbed by the atmosphere, but most is absorbed by the land and oceans. The Earth's surface becomes warm and as a result emits long-wave 'infrared' radiation. The greenhouse gases trap and re-emit some of this long-wave radiation, and warm the atmosphere.

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Naturally occurring greenhouse gases include water vapor, carbon dioxide, ozone, methane, and nitrous oxide, and together they create a natural greenhouse or blanket effect, warming the Earth by 35 °C. The Earth's atmosphere is composed of 78% nitrogen, 21% oxygen, and 1% other gases. It is these other gases that we are interested in, as they include the so-called greenhouse gases. The two most important greenhouse gases are carbon dioxide and water vapor.

Currently, carbon dioxide accounts for just 0.03-0.04% of the atmosphere; while water vapor varies from 0 to 2%. Without the natural greenhouse effect that these two gases produce, the Earth's average temperature would be roughly 20°C.

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 jointly by the United Nations Environmental Panel and World Meteorological Organization because of worries about the possibility of global warming. The purpose of the IPCC is the continued assessment of the state of knowledge on the various aspects of climate change, including scientific, environmental, and socio-economic impacts and response strategies. The IPCC is recognized as the most authoritative scientific and technical voice on climate change, and its assessments have had a profound influence on the negotiators of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. The IPCC also compiles research on the main greenhouse gases: where they come from, and the current consensus concerning their warming potential.

The CO₂ data below provide a simple view of the annual trend.

Year	2012	2011	2010	2009	2008	2007	2006	1997	1992	1987	1959
CO ₂ ppm	393.84	391.65	389.92	387.35	385.45	383.61	381.83	363.76	356.37	348.93	315.98

Climate change

Climate change can apparent itself in a number of ways, for example changes in regional and global temperatures, changing rainfall patterns, expansion and contraction of ice sheets, and sea-level variations. These regional and global climate changes are responses to external and/or internal forcing mechanisms. An example of an internal forcing mechanism is the variations in the carbon dioxide content of the atmosphere modulating the greenhouse effect, while a good example of an external forcing mechanism is the long-term variations in the Earth's orbits around the sun, which alter the regional distribution of solar radiation to the Earth. This is thought to cause the waxing and waning of the ice ages. So in terms of looking for the evidence for global warming and predicting the future, we need to take account of all the natural external

and internal forcing mechanisms. For example, until recently the cooling that occurred globally during the 1970s was unexplained until the ‘external’ and cyclic variations every 11 years in the sun’s energy output, the so-called sunspot cycle, was taken into consideration. We can also try to abstract the way the global climate system responds to an internal or external forcing agent by examining different scenarios. Linking global warming with climate change we have seen that there is clear evidence that greenhouse gas concentrations in the atmosphere have been rising since the industrial revolution in the 18th century. predicting climate change is complex because it encompasses many different factors, which respond differently when the atmosphere warms up, including regional temperature changes, melting glaciers and ice sheets, relative sea-level change, precipitation changes, storm intensity and tracks, and even ocean circulation. This linkage between global warming and climate change is further complicated by the fact that each part of the global climate system has different response times. For example, the atmosphere can respond to external or internal changes within a day, but the deep ocean may take decades to respond, while vegetation can alter its structure within a few weeks (e.g. change the amount of leaves) but its composition (e.g. swapping plant types) can take up to a century to change. Then, add to this the possibility of natural forcing which may be cyclic; for example, there is good evidence that sunspot cycles can affect climate on both a decadal and a century timescale. There is also evidence that since the beginning of our present interglacial period, the last 10,000 years, there have been climatic cooling’s every $1,500 \pm 500$ years, of which the Little Ice Age was the last. The Little Ice Age began in the 17th and ended in the 18th century and was characterized by a fall of 0.5 -1 °C in Greenland temperatures, significant shift in the currents around Iceland, and a sea-surface temperature fall of 4°C off the coast of West Africa, 2°C off the Bermuda Rise, and of course ice fairs on the River Thames in London, all of which were due to natural climate change. So we need to disentangle natural climate variability from global warming.

Evidence for Climate Change

Climate change in the geological past has been reconstructed using a number of key archives, including marine and lake sediments, ice cores, cave deposits, and tree rings. These various records reveal that over the last 100 million years the Earth’s climate has been cooling down, moving from the so-called ‘Greenhouse World ’ of the Cretaceous Period, when dinosaurs enjoyed warm and gentle conditions, through to the cooler and more dynamic ‘Ice House World’ of today. It may seem odd that in geological terms our planet is relatively cold, while this whole

paper is concerned with our great fears of global warming. This is because even today we have huge ice sheets on both Antarctica and Greenland and nearly permanent sea ice in the Arctic Ocean. So, compared to the time of the dinosaurs, when there were no massive ice sheets, we live in chilly times. This long-term, 100-million-year transition to cooler global climate conditions was driven mainly by tectonic changes, such as the opening of the Tasmanian-Antarctic gateway and the Drake Passage, which isolated Antarctica from the rest of the world, the uplift of the Himalayas, and the closure of the Panama ocean gateway. There is also geological evidence that levels of atmospheric carbon dioxide have become significantly lower over the last 100 million years. These changes culminated in the glaciations of Antarctica about 35 million years ago and then the great northern hemisphere ice ages, which began 2.5 million years ago. Since the beginning of the great northern ice ages the global climate has cycled from conditions that were similar or even slightly warmer than today, to full ice ages, which caused ice sheets over 3 km thick to form over much of North America and Europe. Between 2.5 and 0.9 million years ago these glacial-interglacial cycles occurred every 41,000 years and since 0.9 million years ago they have occurred every 100,000 years. These great ice-age cycles are driven primarily by changes in the Earth's orbit with respect to the sun. In fact the world has spent over 80% of the last 2.5 million years in conditions colder than the present. Our present interglacial, the Holocene Period, started about 10,000 years ago and is an example of the rare warm conditions that occur between each ice age. The Holocene began with the rapid and dramatic end of the last ice age; in less than 4,000 years global temperatures increased by 6 °C, relative sea level rose by 120 m, atmospheric carbon dioxide increased by a third, and atmospheric methane doubled. It may seem strange in a paper about global warming to suggest that we are currently in a geological 'Ice House World'. This is, however, an important point when we look at the consequences of the world warming up, because, despite being in a relatively warm interglacial period, both poles are still glaciated, which is a rare occurrence in the geological history of our planet. Antarctica and Greenland are covered by ice sheets, and the majority of the Arctic Ocean is covered with sea ice. This means that there is a lot of ice that could melt in a warmer world, and, as we will see, this is one of the biggest unknowns that the future holds for our planet

Conclusion

- Main source of major green house gas CO₂ is combustion of fossil fuel, and today we are mainly dependent on fossil fuel for transportation, electricity production, and industrial use by developing cheap and clean energy production we can reduce CO₂ emission.
- Small steps by individuals like Tree plantation, use of public transportation, proper use of electricity, etc. can make big change.
- Use of energy sources like wind energy, tidal energy, hydro energy, solar energy, etc. must be increased and made affordable for everyone.
- Earth climate always will remain changing due to internal and external influences; we must be prepared for that.
- Population explosion is also one of the major reasons of CO₂ and other green house gases emission; we must take some serious steps to control population.

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Long-term Effects of Global Warming on Environment

Jayashri A. Dhumal*

Abstract

This article is about on the current climate change, or global warming. In the present time several studies around the globe show that climatic changes is likely to impact significantly upon ecosystem resources availability. We need urbanization, agriculture, population control, industrialization and economic development. At present changes in cropping pattern, land use problem, over exploitation of resources, etc are the problem and burden on developing and poor countries including current campaign. Author is not claiming about original but collective article from referred sources.

Introduction

Climate change generally refers to a long-term change in global temperatures. Since the beginning of the last century, the average global temperature has risen by 0.75 degrees, and over the coming decades the world could see a further rise in average temperature of up to 4 degrees, with some regions of the world experiencing temperature rises of as much as 16 degrees. Climate change doesn't just cause temperatures to rise. It is also believe that climate change is causing an increase in the frequency and severity of natural disasters.

The Earth's climate is now clearly out of balance and is warming. Many components of the climate system—including the temperatures of the atmosphere, land and ocean, the extent of sea ice and mountain glaciers, the sea level, the distribution of precipitation and the length of seasons—are now changing at rates and in patterns that are not natural and are best explained by the increased atmospheric abundances of greenhouse gases and aerosols generated by human activity during the 20th century. Global average surface temperatures increased on average by about 0.6°C over the period 1956–2006. As of 2006, eleven of the previous twelve years were warmer than any others since 1850. The observed rapid retreat of Arctic sea ice is expected to continue and lead to the disappearance of summertime ice within this century. Evidence from most oceans and all continents except Antarctica shows warming attributable to human activities. Recent changes in many physical and biological systems are linked with this regional climate change.

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A sustained research effort, involving many AGU members and summarized in the 2007 assessments of the Intergovernmental Panel on Climate Change, continues to improve our scientific understanding of the climate. The last century has seen a rapidly growing global population and much more intensive use of resources, leading to greatly increased emissions of gases, such as carbon dioxide and methane, from the burning of fossil fuels (oil, gas and coal), and from agriculture, cement production and deforestation. Evidence from the geological record is consistent with the physics that shows that adding large amounts of carbon dioxide to the atmosphere warms the world and may lead to: higher sea levels and flooding of low-lying coasts; greatly changed patterns of rainfall; increased acidity of the oceans; and decreased oxygen levels in seawater. There is now widespread concern that the Earth's climate will warm further, not only because of the lingering effects of the added carbon already in the system, but also because of further additions as human population continues to grow. Life on Earth has survived large climate changes in the past, but extinctions and major redistribution of species have been associated with many of them. When the human population was small and nomadic, a rise in sea level of a few meters would have had very little effect on Homo sapiens. With the current and growing global population, much of which is concentrated in coastal cities, such a rise in sea level would have a drastic effect on our complex society, especially if the climate were to change as suddenly as it has at times in the past. Equally, it seems likely that as warming continues some areas may experience less precipitation leading to drought. With both rising seas and increasing drought, pressure for human migration could result on a large scale.

Climate conditions in the past provide evidence that rising atmospheric carbon dioxide levels are associated with rising global temperatures. Human activities, primarily the burning of fossil fuels (coal, oil, and natural gas), and secondarily the clearing of land, have increased the concentration of carbon dioxide, methane, and other heat-trapping (greenhouse) gases in the atmosphere. There is international scientific consensus that most of the warming observed over the last 50 years is attributable to human activities. National and international science academies and scientific societies have assessed current scientific opinion on climate change. These assessments are generally consistent with the conclusions of the Intergovernmental Panel on Climate Change (IPCC), summarized.

Warming of the climate system is unequivocal, as evidenced by increases in global average air and ocean temperatures, the widespread melting of snow and ice, and rising global average sea level. Most of the global warming is likely due to human activities.

Benefits and costs of climate change for [human] society will vary widely by location and scale. Some of the effects in temperate and Polar Regions will be positive and others elsewhere will be negative. Overall, net effects are more likely to be strongly negative with larger or more rapid warming. It summarizes the current scientific evidence and highlights the areas where the science is well established, where there is still some debate, and where substantial uncertainties remain. The society has stated that "this is not the same as saying that the climate science itself is in error. There is strong evidence that the warming of the Earth over the last half-century has been caused largely by human activity, such as the burning of fossil fuels and changes in land use, including agriculture and deforestation.

Melting ice sheets and glacier mostly contributes to sea level rise (IPCC, 2001). Concern has been expressed about the stability of the West Antarctic ice sheet (WAIS). Vaughan and Spouge (2002) argued that the "WAIS most likely will not collapse in the next few centuries. In a recent article for members of the National Academy of Sciences in 2005, Timothy Lenton and others suggest that a collapse of the WAIS could occur within a millennium. Specifically they state although the timescale is highly uncertain, a qualitative WAIS change could occur within this millennium, with collapse within 300 years being a worst-case scenario. Rapid sea-level rise (greater than 1 m per century) is more likely to come from the WAIS than from the Greenland ice sheet (Lenton *et al.* 2008). Greenland's ice sheet contains enough fresh water as ice to raise sea level worldwide by 7 metres (23 ft) (IPCC, 2001).

Greenland may become warm enough by 2100 to begin an almost complete melt over more than 1,000 years (Gregory *et al.* 2004). James E. Hansen (2007) suggests that inadequate attention is being given to this issue (Dahl-Jensen, 2009). However, research comparing data from the Eemian period suggests that the Greenland ice sheet will remain at least in part at 5°C (Lowe *et al.* 2006).

The study suggests it would take 3,000 years to completely melt the Greenland ice sheet (Zwally *et al.* 2002). This figure was derived from the assumed levels of greenhouse gases over the duration of the experiment. As the Greenland ice sheet loses mass from calving of icebergs as

well as by melting of ice, any such processes tend to accelerate the loss of the ice sheet (Schmittner and Stocker, 1999). Some long term effects happen over thousands of years.

A schematic of the path of the thermohaline circulation. Blue paths represent deep-water currents, while red paths represent surface currents. Early work with simplified models suggested that global warming could cause a shutdown of the thermohaline circulation (Knutti and Stocker, 2002). This effect is not replicated in more sophisticated coupled ocean-atmosphere global climate models, which do not shutdown but do display varying degrees of slowdown. This may take a considerable time to occur, as Knutti and Stocker found, again from a simplified model, when : "...thermohaline shutdowns can occur thousands of years after the warming has stopped (Shaffer, *et al*, 2009).

The study suggests that the amount of oxygen dissolved in the oceans may decline, with adverse consequences for ocean life (Buffett and Archer, 2004). This effect was determined using a model run of several hundred years. The researchers predicted:- ...severe, long-term ocean oxygen depletion, as well as a great expansion of ocean oxygen-minimum zones for scenarios with high emissions or high climate sensitivity. We find that climate feedbacks within the Earth system amplify the strength and duration of global warming, ocean heating and oxygen depletion. Decreased oxygen solubility from surface-layer warming accounts for most of the enhanced oxygen depletion in the upper 500 m of the ocean. Possible weakening of ocean overturning and convection lead to further oxygen depletion, also in the deep ocean.

Worldwide distribution of confirmed or inferred offshore gas hydrate-bearing sediments, 1996. Methane clathrate, also called methane hydrate, is a form of water ice that contains a large amount of methane within its crystal structure. Extremely large deposits of methane clathrate have been found under sediments on the ocean floors of Earth (estimated at 3000-11,000 Gton) (Macdonald, 1990). As reported by the Intergovernmental Panel on Climate Change (IPCC), most of the observed global warming since the mid-20th century is very likely due to human-produced emission of greenhouse gases and this warming will continue unabated if present anthropogenic emissions continue or, worse, expand without control. CAETS, therefore, endorses the many recent calls to decrease and control greenhouse gas emissions to an acceptable level as quickly as possible.

MacDonald (1990) suggests clathrate volumes are about 11,000 Gt of carbon for ocean sediments and about 400 Gt for sediments under permafrost regions. Buffett and Archer predict

"eventual releases of 2000–4000 Gton C in response to a ~2000 Gton C anthropogenic carbon release (Archer and Buffett, 2005) for which they suggest no timescale.

Archer considered the timescale and determined that "...on longer time scales of 1–10 ky, there may be a positive feedback with ocean temperature, amplifying the long-term climate impact of anthropogenic CO₂ release (Archer *et al.* 2004). While the warm surface waters of the oceans have limited ability to absorb anthropogenic carbon dioxide, the coldest surface waters near the poles (2-3% of ocean surfaces) can transfer significant amounts of carbon dioxide to deep-ocean reserves. Over a period of many centuries, this process and the process of calcium carbonate absorption of carbon dioxide on land and in the oceans will remove 60–80% of the excess carbon dioxide (David Archer, 2009). In addition to impacting our water resources, energy supply, transportation, agriculture, and ecosystems, the United States Global Change Research Program concludes that climate change also poses unique challenges to human health, such as:

- Significant increases in the risk of illness and death related to extreme heat and heat waves are very likely.
- Some diseases transmitted by food, water, and insects are likely to increase.
- Certain groups, including children, the elderly, and the poor, are most vulnerable to a range of climate-related health effects.

Igneous rock when exposed to a near surface environment absorbs carbon dioxide through a very slow weathering rate, but weathering increases in a warmer, higher rainfall climate, speeding the process. This geological weathering will absorb the remaining 20–40% of anthropogenic carbon dioxide over the period of tens of thousands to hundreds of thousands of years (David Archer, 2009).

Climate prediction is difficult because it involves complex, nonlinear interactions among all components of the earth's environmental system.... The AASC recognizes that human activities have an influence on the climate system. Such activities, however, are not limited to greenhouse gas forcing and include changing land use and sulfate emissions, which further complicates the issue of climate prediction. Furthermore, climate predictions have not demonstrated skill in projecting future variability and changes in such important climate conditions as growing season, drought, flood-producing rainfall, heat waves, tropical cyclones and winter storms. These are the type of events that have a more significant impact on society than annual average global temperature trends. Policy responses to climate variability and change should be flexible and

sensible- The difficulty of prediction and the impossibility of verification of predictions decades into the future are important factors that allow for competing views of the long-term climate future. Therefore, the AASC recommends that policies related to long-term climate not be based on particular predictions, but instead should focus on policy alternatives that make sense for a wide range of plausible climatic conditions regardless of future climate... Finally, ongoing political debate about global energy policy should not stand in the way of common sense action to reduce societal and environmental vulnerabilities to climate variability and change. Considerable potential exists to improve policies related to climate.

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Comparative Study of Different Printing Techniques On Silk with Eco-Friendly Vegetable Dyes

Rekha B. Lonikar*

Introduction

Colour has always fascinated man. For centuries man used colour derived from nature, for tinting his skin and later for the colouration of natural fabrics which he made from cloth, silk and wool in every civilization from the remote ages to the present day, colour has played an important part in adding beauty to the world. It is difficult to tell when exactly people started making colours, but it must have been pretty early since their evaluation. The art of natural colour extraction and its use was discovered and perfected in India. India has the distinction of being the colour box of the ancient world. Dyeing, printing and painting were not the only uses of natural dyes in India. Such dyes were extensively used as cosmetics especially by the women folk e.g. Henna/Mehandi for decorating the palms and soles catechu with lime (betel leaf for tinting the lips), Surma to heighten the effect of eye lashes. Natural dyes are also being used till today in food and confectionery examples saffron, turmeric, Kashmir chilly etc. With the invention of synthetic dyes in 1856, the use of natural dyes was found to decline due to brilliance and fastness offered by synthetic colours. Synthetic dyes are based on some amines which are carcinogenic, allergic or poisonous and therefore should not be used on textiles, which had direct contact with skin. Synthetic dyes create havoc in life, system and need to be replaced. In dyeing with these dyes enormous chemicals are released to the environment in the form of unusual dye or industrial waste, which has put ecology in jeopardy.

Present increasing awareness about environment pollution and ecology both nationality and internationally has revived the adoption of age old techniques of natural dyeing. Natural dyes are safe and compatible with environment. They are biodegradable and eco-friendly. Natural dyes are soft in colour, cool to eyes and good to skin. They also have medicinal and curative properties. Vegetable sources of natural dyes are renewable; these dyes were obtained from various parts of plants like roots, barks, leaves, flowers, fruits and seeds.

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Certain insects and shellfish are colour sources from the animal world. Water from mineral springs and various sorts were also utilized, though they made cloths, harsh and tended to weaken the fiber. Natural dyes are fixed on cloth with the help of mordants. Mordant is the chemical, which create bond between textile material and dye. Mordants commonly used for dyeing with natural dyes are Potassium aluminum sulphate (Alum), Potassium Dichromate (Chrome), Copper sulphate and ferrous sulphate. These natural dyes were not only used for plain dyeing on fabrics but were also used in other surface enrichment techniques like bandhej and different printing styles like block printing and traditional kalamkari painting mordents on cloths and then dyeing in vats to produce fixed colours. These traditional arts of printing with vegetable dyes will be used to give the sample a traditional touch. But as these methods are time consuming genuine attempts is made by the author to even use the modern method of printing like screen printing technique. The screen printing principle is almost the same as that of stenciling.

Thus, this research aims at findings which printing techniques is most suitable with the use of vegetable dyes. Also when we talk about consumer satisfaction it is necessary that these colours be fast. For this purpose colour fastness properties will also be tested.

Objectives

- 1) To identify the resources, such as agro-based dyes and animal based fiber.
- 2) To evolve the national profiles of availability and trends of agro-based dyes and animal based fiber.
- 3) To develop the three vegetable dyes through different techniques of cottage level adoption.
- 4) Printing with three natural dyes on silk.
- 5) Assessment of colour fastness tests of the printed samples to washing, rubbing, sunlight and perspiration.

Limitations

- 1) Pure silk material is used.
- 2) Only ladies tops will be dyed.
- 3) Screen printing, block printing and bandhani techniques are used.
- 4) Percentage of shade used will be same in all techniques.

Hypothesis:

- 1) Dyed silk samples by using natural dyes give good results to colour fastness test.
- 2) Silk has good affinity towards natural dyes.
- 3) Vegetable dyes used in the screen printing technique will give the best effect.

Methodology

The experimental procedure will be included following points

- 1) Collection of materials

Acacia flowers, Pipal bark, Flame of forest flowers, Silk fabric, Chemicals for mordanting

- 2) Preparation of dye powder for dyeing

Acacia flowers, Pipal bark, Flame of forest flowers

- 3) Preparation of fabric for printing

Cutting of tops, Mordanting , Printing and tie & dyeing of tops, Stitching of tops

- 4) Colour fastness tests were performed on the prepared tops of Silk

Washing, Rubbing, Sunlight, Perspiration

Results and Discussion

Three vegetable dyes were selected in this study i.e. Flame of forest flower, Acacia flower and pipal bark on silk material each of them was printed by using three different technique like screen printing, block printing and bandhani. These were then tested to see their colour fastness to washing, rubbing, sunlight and perspiration. The samples were also tested for popularity, to see which technique of printing and the type of dye made the best combination. A questionnaire was prepared and evaluation was done by selected judges. All the samples to the colour fastness tests gave good results to the colour fastness tests. In popularity tests, it was seen that 80% judges liked the colour of Acacia flower. The comparison of printing techniques shows that screen printing was given 80% preference.

Conclusion

Colour has been playing a dominant role in the life of man from time immemorial. The art of dyeing has played an important part in adding beauty of colour in the world. One of the fascinating aspects of dyeing from natural sources is the colour combinations that are possible from what would appear to be very ordinary plants. The art of natural colour extraction and its use was discovered and perfected in India. India has the distinction of being the colour box of the ancient world. Lots of work has been done on natural dyes. Since there is an increasing

awareness about environment and ecology. After reviewing these studies, it was decided to conduct a study on vegetable dyes by using different printing techniques. The three sources of vegetable dyes which were used. Flame of forest flowers, Acacia flowers and Pipal bark. During peak flowering period, the sources were collected dried in shade and ground to powder. After the preparation of dye powder, these dyes were used for printing the tops by using three techniques viz screen printing, block printing and bandhani. Colour fastness tests such as washing, rubbing, sunlight and perspiration were then carried out, silk tops printed by using natural dyes gave good results to the colour fastness tests. The samples were also exposed to selected judges for testing as to which dye combination gave the best result. It was seen that 80% judges liked the colour of Acacia flowers. The comparison of printing techniques shows that screen printing was given 80% preference. According to the preference given by the judges. It was concluded that the best combination was of screen printing with dye of Acacia flower.

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Environment and Human Health

Jaysheela Baswant Manohar*

Abstract

Environment related issues that affect our health have been one of the most important triggers in the increasing awareness of the need for better environmental management. The changes in our environment induced by human activities in nearly every sphere of life have an influence on our health patterns. The assumption that the only indicator of human progress is economic growth is not true. We expect urbanization and industrialization to bring in prosperity, but on the downside, it leads to diseases related to overcrowding and poor quality drinking water, resulting in an increase in water borne diseases like infective diarrhea and air borne bacterial diseases like tuberculosis. High density city traffic leads to an increase in respiratory diseases like asthma. Agricultural pesticides that enhanced food supplies during the green revolution have affected both the farm worker and all of us who consume the produce. Modern medicine promised to solve many health problems, especially associated with infectious diseases through antibiotics, but bacteria have found way to develop resistant strains, frequently even changing their behavior in the process, making it necessary to keep on creating newer antibiotics. Many drugs have been found to have serious side-effects. Sometimes, the cure is as damaging as the disease process itself.

Introduction

Environmental health, as defined as WHO, comprises those aspects of human health, including the quality of life, that are determined by physical, chemical, biological, social and psychosocial factors in the environment. Our environment affects health in a variety of ways. Climate and weather affect human health. Public health depends on sufficient amounts of good quality food, safe drinking water, and adequate shelter. Natural disasters such as storms, hurricanes, and floods still kill many people every year. Unprecedented rainfall triggers epidemics of malaria and water-borne diseases.

Keyword: Human Health, Infection Disease, Malaria, Tuberculosis

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Infectious Diseases

Many infectious diseases have re-emerged with a vengeance. The loss of effective control over diseases, such as malaria and tuberculosis, have led to a return of these diseases decades after being kept under stringent control. Ex. Acute Immuno Depressive Syndrome (AIDS), due to the Human Immuno Deficiency Virus (HIV) caused through sexual transmission and severe Acute Respiratory Syndrome (SARS). While these cannot be directly related to environmental change, they affect the environment in which we live by forcing a change in lifestyles and behavior patterns.

Globalization and Infectious Diseases

Globalization is a world-wide process which includes the internationalization of communication, trade and economic organization. It involves parallel changes such as rapid, social, economic and political adjustments. Whilst globalization has the potential to enhance the lives and living standards of certain population groups, for the poor and marginalized populations in both the non-formal as well as formal economic sectors of developing countries, globalization enhances economic inequalities.

Tuberculosis (TB) kills approximately 2 million people each year. In India the disease has re-emerged and is now more difficult to treat. In 1993, the WHO declared that TB had become a global emergency. It is estimated that between 2002 and 2020, approximately 1000 million people will be newly infected, over 150 million people will get sick, and 36 million will die of TB if its control is not rapidly strengthened. TB is a contagious disease that is spread through the air. Only people who are sick with pulmonary TB are infectious. When infectious people cough, sneeze, talk or spit, they emit the tubercle bacilli into the air. When a healthy person inhales these, she gets infected by the diseases. The symptoms include prolonged fever, coughing spells and weight loss. It is estimated that left untreated, each patient of active tuberculosis will infect, on an average, between 10-15 people every year. But people infected with TB will not necessary get sick with the disease. The immune system can cause the TB bacilli, which is protected by a thick waxy coat, to remain dormant for years. When an individual's immune system is weakened, the chances of getting active TB are greater.

Some facts about TB

- 1) Nearly 1% of the world's population is newly infected with TB each year.

- 2) 5-10% of the people who are infected with TB (but who are not infected with HIV) become sick or infectious at some time during their life (WHO, 2002).
- 3) TB kills about 2 million people each year (including persons infected with HIV)

Malaria

Malaria is a life-threatening parasitic disease transmitted by mosquitoes. The cause of malaria, a single celled parasite called plasmodium, was discovered in 1880. Later, it was found that the parasite is transmitted from person to person through the bite of a female Anopheles mosquito, which requires blood for the growth of her eggs.

At present, approximately 40% of the world's population, mostly those living in the world's poorest countries, risk getting malaria. The disease was once more widespread but it was successfully eliminated from many countries with temperate climates during the mid – 20th century. Today, malaria has returned and is found throughout the tropical and sub-tropical regions of the world and causes more than 300 million acute illness and at least one million deaths annually (WHO).

Water-related diseases

Water supply, sanitation and hygiene development

Among the main problems are a lack of priority given to this sector, lack of financial resources, erratic water supply and sanitation services, poor hygiene related behavior patterns, and inadequate sanitation in public places such as schools, hotels, hospitals, health centers, etc. one of the most important aspects is a lack of environmental education and awareness that these diseases processes are related to poor environment management in various sectors. Providing access to sufficient quantities of safe water, facilities for the sanitary disposal of excreta, and introducing sound hygiene – related behavior can reduce the morbidity and mortality caused by these risk factors.

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Effects of Climate Change on Plant Biodiversity

Vrushali Ashokrao Gagrepatil

Abstract

Climate change has already triggered species distribution shifts in many parts of the world. Climate is a potent selective force in natural populations, yet the importance of adaptation in the response of plant species to past climate change has been questioned. As many species are unlikely to migrate fast enough to track the rapidly changing climate of the future, plant biodiversity is greatly affected. This paper review recent work that has documented effect of climate change on plant biodiversity and also describe studies that have looked at the potential evolutionary responses of plant populations to future climate change. Rapid climate change has the potential to overwhelm the capacity for variation in many plant species populations and dramatically alter their genetic composition. The consequences are likely to include unpredictable changes in the presence and abundance of species within communities and a reduction in their ability to resist and recover from further environmental perturbations, such as pest and disease outbreaks and extreme climatic events. Overall, a range-wide increase in extinction risk is likely to result. Ecosystems are already showing negative impacts under current levels of climate change which is modest compared to future projected changes. In addition to warming temperatures, more frequent extreme weather events and changing patterns of rainfall and drought can be expected to have significant impacts on biodiversity.

Introduction

The 20th century experienced the strongest warming trend of the last millennium with average temperatures rising by about 0.6 °C (Jones *et al.* 2001). Future temperature rises are likely to exceed this with a predicted rise of between 0.1 °C and 0.4 °C per decade across Europe (IPCC 2001) – a rate that is unparalleled in recent history (Huntley 1991). One of the predicted consequences of climate change is the movement of plant species to higher elevations and latitudes as the climate to which they are adapted is displaced leading to change in biodiversity.

Keywords: Biodiversity; climate change; conservation; decreased fitness; extinction risk;

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There is now considerable evidence that such changes in plant distribution are occurring. The links between climate and plant reproduction and vegetative survival are well understood (Woodward 1987), providing a clear mechanism for expansion of a species at its leading edge. For those species where geographical limits are described by climate, poor reproduction and survival at the poleward and upper altitudinal limits of distribution are likely to be ameliorated by increasing temperatures. At the equatorial and lower altitudinal limit of its range, a species may be replaced through competitive exclusion (Woodward 1987), most likely influenced by both water availability (Pigott & Pigott 1993) and higher temperatures (Conolly & Dahl 1970). Changes in climate are however likely to differ between continental and oceanic environments, possibly leading to lack of range expansion or even range reductions in some northern regions (Crawford & Jeffree 2005). A review of current evidence for changes in plant distribution and community composition is presented by Walther (2003).

Rapid climate change may act as a potent agent of natural selection within populations and its likely interaction with habitat fragmentation in altering population genetic structure resulting in changing plant biodiversity. In the final section of the paper we discuss some of the consequences of reduction of genetic diversity in plant populations and communities and their possible ramifications for the persistence of individual species. Climate change is multidimensional and simultaneous changes may occur in a number of variables such as temperature, precipitation, growing season length and changes in day length during latitudinal range changes. Although we focus primarily on the effects of climatic warming, the arguments we present are equally applicable to rapid changes in other variables.

Objectives

Assess effects of climate change on plant biodiversity.

Data used

The data used in this study is obtained from primary as well as secondary sources.

Results and Discussions

Effect of climate change on Biodiversity

Historical climate change has had a profound effect on current biogeography, so we can expect our ongoing and rapid climate change, to have as great an effect. Climate change has important implications for nearly every aspect of life on Earth, and effects are already being felt.

Temperature effects—average, minimum or maximum can be important determinants of plant distribution for example, the *Palmae /Arecaceae* are cold intolerant as their single meristem is susceptible to frost. Conversely, boundaries between vegetation types (e.g. Arctic treeline) are generally determined by summer warmth. Rainfall is also an important determinant: for example it affects the balance of grasses to woody vegetation

Other factors: Such as soil type or herbivory may also be affected by climate change.

In general, loss of biodiversity in a region may lead to

- (a) Decline in plant production
- (b) Lowered resistance to environmental perturbations such as drought and
- (c) Increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycles.

Effects of climate change on Plant Diversity

- Species ‘left behind’ as they are unable to change distribution fast enough. Species with long life cycles and/or slow dispersal are particularly vulnerable.
- Plant genetic composition may change in response to the selection pressure of climate change.
- Some plant communities or species associations may be lost as species move and adapt at different rates.
- Increased invasions by alien species may occur, as conditions become more suitable for exotic species whilst native species become less well suited to their environment (for example, *Bromus* is more invasive in wet years (Smith et al, 2000)). This is especially true given human interventions which have deliberately and accidentally facilitated the spread of species across the globe.
- Many plant communities act as 'sinks' (store carbon), which helps to offset carbon emissions. However, over the next 70 years, the effects of climate change on plants mean many terrestrial sinks may become sources.
- Finally climate change adversely affects plant biodiversity.

Methods of conservation of plant biodiversity

Earth’s rich biodiversity is vital for the very survival of mankind. The reasons for conserving biodiversity are narrowly utilitarian, broadly utilitarian and ethical. Besides the direct benefits (food, fibre, firewood, pharmaceuticals, etc.), there are many indirect benefits we receive through

ecosystem services such as pollination, pest control, climate moderation and flood control. We also have a moral responsibility to take good care of earth's biodiversity and pass it on in good order to our next generation. Biodiversity conservation may be in situ as well as ex situ.

In in situ conservation, the endangered species are protected in their natural habitat so that the entire ecosystem is protected. Ex situ conservation methods include protective maintenance of threatened species in botanical gardens, in vitro fertilization, tissue culture propagation and cryopreservation of gametes.

Conclusion

Biodiversity is necessary for life and that species preservation is important to all of us. Every species is linked with a multitude of others in an ecosystem. All living organisms are part of food webs that include plants and animals of other species. Minor disruptions in a particular ecosystem tend to lead to changes that eventually restore the system. But large disturbances of living populations or their environments may result in irreversible changes. Maintaining diversity increases the likelihood that some varieties will have characteristics suitable to survival under changed conditions. Thus protecting biodiversity from adverse effect of climate change is urgent need.

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Environmental Impact on Social Development

Vandana Phatale

Introduction

This review of the environmental effects of freight is structured by transport mode, addressing shipping, air cargo, trucking, rail, pipelines and intermodal terminals. It begins with a brief overview of the major environmental media or mechanisms through which transport can affect the environment. These include air pollution, global climate concerns, noise, water pollution, accidents, land use and habitat fragmentation. The modal discussions focus on air pollution, global climate issues, water pollution, accidents whose costs are environmental rather than primarily in human life, and certain land use planning issues. The review describes the impacts in qualitative terms, and then provides emission factors per unit of freight transported.

An environmental problem arises whenever there is a change in the quality or quantity of any environmental factor which directly or indirectly affects the health and well-being of man in an adverse manner. Environmental problems can be studied from two different view points. One is simply to look for adverse effects without regard to their origin in order to detect trends that call for further investigation; the other is to try to understand the cause and effect relationships, which make better prediction and proper management possible. Some of the environmental problems which are critical at the present time are fairly widely known because of the growing awareness of all levels of society, including governments, general public and the scientific community. However, our present information on the structure and function of the biosphere is not sufficient to allow an accurate evaluation of the total situation, except to indicate some broad problem areas. There may be serious potential problems of which we are as yet aware; other known problems may be lesser than we think. The Commission has made an extensive survey and analysis of those problems which are currently regarded as being of critical importance. The following criteria were used in an attempt to assess the critical nature of the problems to be solved in the near future:

- a) Number of people and nations involved
- b) Geographical distribution of the problem

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- c) Temporal distribution of the problem (temporary or long-term effects)
 - d) Degree of irreversibility of the effects
 - e) Degree of impact on health, standard of living, social structure and economy
 - f) Degree of international significance of the problem
- Although these criteria overlap and may not be exhaustive, they find a useful basis for judgment. The consensus of the Commission's survey was that a fairly restricted number of problems were found to recur time and again. The major critical problem may be summarized as, "the adverse effects of a changed environment on human health and well-being";Le., the possibility that a changing environment may lead to increased mortality, increased frequency of diseases, lowered nutritional status via decreased agricultural productivity, or lowered psychological value of the environment. Concern has been widely expressed that these possible effects on man may be caused by direct input of toxic substances into the environment or improper land use. Climatic changes as a result of human activity may also adversely affect the standard of living through, for example reduced crop productivity, and increased energy consumption, etc. Environmental issues.

Defining Environmental Impact:

"Environmental impact" may be considered to have three components:

- Environmental stressors such as pollutants, noise, or exotic species are released in natural ecosystems. Each tone of goods transported places additional stress on the environment; many stressors may therefore be measured in units per tone of goods transported;
- The total amount of stress placed on the environment depends on the quantity of goods and the distance they are transported; in the simplest form, total stress is the quantity of goods times the distance carried multiplied by the stress per tone. The second component of stress involves the spatial pattern of goods transported, including the transport mode used;
- The environmental impact of the total stress is determined by the nature of the receiving environment. Ambient characteristics such as physical ecosystem characteristics, density of the human population affected, and whether the receiving ecosystem is considered critical or includes endangered species will determine both the physical impact of the stress and willingness to pay to prevent it.

Care about the Environment

People care about the environment for many reasons, some emotional and some practical. Many people like the way it looks and enjoys spending recreation time in relatively unspoiled places. Life on Earth is both beautiful and valuable, and we should do more to preserve habitats, species and ways of life that are being destroyed by the over exploitation of natural resources and wilderness areas. We need these for materials, food, fuel, and as source of genetic diversity for artificial breeding programmes - many of our medicines, for example, have been developed from natural materials, and there may be many useful ones that we have not yet discovered. And bio-geo-chemical cycles are vital for life on the planet - for example, tropical rain forests have been called the "lungs" of the planet, and it might be hard for the planet to manage without them. In permitting the loss or destruction of natural resources, we may inadvertently be damaging ourselves - we don't always know what might be important or useful in the future, and so should preserve as much biodiversity as possible, just in case. It is difficult or impossible to protect or reintroduce species once their habitat has been destroyed, and thousands of species become extinct every year, impossible to revive. Our planet is small and becoming increasingly overcrowded. At the end of the 20th century, the world population had reached 6 billion people, doubling in the previous forty years. If we are not careful, it could double again in the next forty years, and all these extra people will need food, water, shelter and fuel. Many of them will want far more than this. Although humans in the past, and other animals, have also damaged the Earth and its atmosphere, modern population growth and technology have speeded up the process. Increasingly, human beings can control their own, and other species', fertility and evolution, and this places considerable responsibility on us. We will all be less well off if we use up valuable resources such as forests, water, fossil fuels, the fish in the oceans. These resources are often shared between nations and it is easy to foresee increasing tensions and even wars over basic resources if we do not come up with sensible ways of conserving and sharing them.

Environmental Emergency Phase

- Create an interim Environmental Agency, dedicated to environmental preservation and management within the governmental design established during the early days of the transition period.
- Preserve databases, assessments, studies, projects, research results, as well as human resources and materials dedicated to environmental protection.

- Establish a small and efficient nationwide environmental inspection mechanism.
- Set up the framework and guarantees needed for the rise and development of independent environmental associations and organizations.
- Promote education and a culture of respect for environmental conservation.
- Establish ties of cooperation and exchange on environmental issues with homologous international agencies.
- Design and establish or adapt the interim regulations and legal instruments needed to deal successfully with the most critical environmental problems, namely: land degradation, deforestation, water pollution, and environmental sanitation.
- Create a national program for basic soil conservation, by means of an economic benefits package, together with regulations that encourage land conservation.
- Establish a national program for reforestation and recovery of natural forests, with priority given to gallery or riverbank forests, while an economic benefits package encourages the planting of trees.
- Create the government institution that will be devoted to the conservation of the republic's forest resources (a National Forestry Service).
- Declare a temporary moratorium on any type of construction, development, marketing, or exploitation within the "protected areas" recognized within the current system and any other areas of equal interest.

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Consequences of Noise Pollution on Human Health

Ujwala P. Tikhe*, Chhaya K.Kokate**

Noise is also referred as silent killer. Sound is mechanical energy from a vibrating source. Noise is defined as unwanted sound. It is a state of discomfort restlessness caused to human by unwanted high intensity sound. A type of sound may be pleasant to one, at the same time it can be unpleasant for other. The unpleasant and unwanted sound is called noise. Noise is an environmental pollutant and does not remain in environment for longer time.

Noise pollution usually called environmental noise in technical venues, is displeasing human or machine created sound that disrupts the environment. The dominant form of noise pollution is from transportation sources, principally motor vehicles. The word “Noise comes from the Latin word nausea meaning ‘Seasickness’, or from a derivative of Latin noceo ‘I do harm’, “referring originally to nuisance noise. The ancient Romans realized the importance of addressing noise pollution. Chariots were banned from the streets at night because their wheels made too much noise on the cobblestone and would disrupt citizen’s sleep. In medieval Europe, horses and horse drawn carriages were forbidden on the streets at night, and straw was laid over the stone to reduce noise. The Environmental Protection Agency (EPA) defines noise pollution as “Unwanted or disturbing sound”, explaining that “Sound becomes unwanted when it either interferes with normal activities such as sleeping or conversation, or disrupts or diminishes one’s quality of life. The annoyance can have major consequences, primarily to one’s overall health”

The annoyance of sound is the most general problem now a days. Various noise level groups and their corresponding impact on affected person are given since harmful effects of noise on the body increase with duration and intensity of the noise; hence noise levels should not exceed the limits.

- i) **Auditory effects:** These include auditory fatigue and deafness. Auditory fatigue appears in the 90 dB and may be associated with side effects as whistling and buzzing in ears. Deafness can be caused due to continuous noise exposure. Mumbai and Kolkata are the noisiest cities in the world. Many persons have risk of deafness.
- ii) **Speech Interference:** High background noise level affects the efficiency of offices, schools and other places where communications is of vital importance. External sound can also interfere with conversation and use of the telephone, as well as the enjoyment of radio and TV. The maximum acceptable level of noise under such conditions are 55 dB.

- iii) Sleep Interference: The loss of sleep from noise affects personal well being and job performance. The preferable level is below 40 dB. Frequent sleep interference is a health hazard, since it deprives a person of the restorative process for his organs to renew their supply of energy and nutritive elements provided by the good night's sleep.
- iv) Behavioral Effects: Noise pollution lowers down the hearing capabilities of an individual, in turn; results in poor attention and concentration, nervousness etc.
- v) General Annoyance: General annoyance is felt at about 75 to 85 dB balanced persons express great annoyance at even low level of noise as crowded, highway, radio etc. Blood vessels get constricted, breathing rate is affected and muscle tension changes.
- vi) Loss of working Efficiency; Many people complain that noise makes them mentally ill and reduced their working efficiency. Irregular bursts of noise are more disruptive those steady noises and sound levels of 90 dB. May interfere with the performance of a task.
- vii) Emotional and personal Logical effects: It is observed that people suffering from hypertension isomania, fatigue, blood pressure and deafness show symptoms of living in noise polluted area. Continuous exposure to high noise level is likely to cause stable reactions in the individuals and thus disturbing his personality make up.
- viii) Pathological effects: High frequencies sound above the normal audible range can effect the semi circular canals of the inner ear and make one suffer from, excessive fatigue and headaches vomiting.

On the other hand, low frequency sound below the normal audible range (Infra sound, whose frequency is less than 16 Hz) can cause dizziness, nervous fatigue nausea and loss of balance at higher intensities, infrasound. Noise is any unwanted sound occurring in the wrong place and time, noise, though is undesired, could be meaningful or meaningless. Meaningful noise such as a baby crying or a person screaming acts as a stimulus on the body, it helps to convey a message and receives one's attention or a responses in turn. But meaningless nose is distractive disturbing and annoying.

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Causes and Impacts of Global Climate Change

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Abstract

An appreciation of the psychological impacts of global climate change entails recognizing the complexity and multiple meanings associated with climate change; situating impacts within other social, technological, and ecological transitions; and recognizing mediators and moderators of impacts. This article describes two causes of Climate Change: Natural and Human.

Introduction

In addition to direct and indirect psychological impacts, climate change is likely to have impacts on social and community relationships. Some of these impacts may result directly from changes in climate, but most are likely to be indirect results of changes in how people use and occupy territory. The effects of a changing climate on the suitability of territory for agriculture, aquaculture, and habitation means that the experiences of people in particular geographical locations, as well as the geographical distribution of populations, will be altered, with consequences for both interpersonal and intergroup relations. The severity of climate change impacts is partly dependent on other simultaneous trends and patterns. Even when the impact is restricted to one country or one part of the world, there may be economic consequences that will have spillover effects on other countries.

Causes of Climate Change

The earth's climate is dynamic and always changing through a natural cycle. The causes of climate change can be divided into two categories - those that are due to natural causes and those that are created by man.

Natural causes

There are a number of natural factors responsible for climate change. Some of the more prominent ones are continental drift, volcanoes, ocean currents, the earth's tilt, and comets and meteorites.

Keywords: climate change, and CFC(Chlorofluorocarbon)

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Continental drift

The continents that we are familiar with today were formed when the landmass began gradually drifting apart, millions of years back. This drift also had an impact on the climate because it changed the physical features of the landmass, their position and the position of water bodies. The separation of the landmasses changed the flow of ocean currents and winds, which affected the climate. This drift of the continents continues even today; the Himalayan range is rising by about 1 mm (millimeter) every year because the Indian land mass is moving towards the Asian land mass, slowly but steadily.

The earth's tilt

The Earth's orbit is somewhat elliptical, which means that the distance between the earth and the Sun varies over the course of a year. The axis does move, at the rate of a little more than a half-degree each century. So Polaris has not always been, and will not always be, the star pointing to the North. This gradual change in the direction of the earth's axis, called precession is responsible for changes in the climate.

Ocean Currents

The oceans are a major component of the climate system. They cover about 71% of the Earth and absorb about twice as much of the sun's radiation as the atmosphere or the land surface. Ocean currents move vast amounts of heat across the planet - roughly the same amount as the atmosphere does. But the oceans are surrounded by land masses, so heat transport through the water is through channels. Winds push horizontally against the sea surface and drive ocean current patterns. Certain parts of the world are influenced by ocean currents more than others. Ocean currents have been known to change direction or slow down. Much of the heat that escapes from the oceans is in the form of water vapour, the most abundant greenhouse gas on Earth. Yet, water vapor also contributes to the formation of clouds, which shade the surface and have a net cooling effect.

Human Causes

The Industrial Revolution in the 19th century saw the large-scale use of fossil fuels for industrial activities. These industries created jobs and over the years, people moved from rural areas to the cities. More and more land that was covered with vegetation has been cleared to make way for houses. Natural resources are being used extensively for construction, industries, transport, and consumption. All this has contributed to a rise in greenhouse gases in the atmosphere.

Impacts of Climate Change

Climate change will have significant effects on the health of wildlife, domestic animals, and humans, according to scientists. The Intergovernmental Panel on Climate Change projects that unprecedented rates of climate change will result in increasing average global temperatures; rising sea levels; changing global precipitation patterns, including increasing amounts and variability; and increasing mid continental summer drought (Intergovernmental Panel on Climate Change, 2007). Increasing temperatures, combined with changes in rainfall and humidity, may have significant impacts on wildlife, domestic animal, and human health and diseases. When combined with expanding human populations, these changes could increase demand on limited water resources, lead to more habitat destruction, and provide yet more opportunities for infectious diseases to cross from one species to another.

Conclusion

In recent years, the climate of the world is undergoing a significant change. There are many reasons behind this climatic change. Among them greenhouse effect is the most likely cause of this climatic change. On the other hand, there are many reasons of greenhouse effect. The first reason is the huge emission of carbon dioxide around the world produced by the destruction and burning down of tropical rain forests and fossil fuel. Rapid growth of industry, traffic, the use of CFC (Chlorofluorocarbon) and methane are also responsible for this greenhouse effect.

Today climatic change and its impact are the prime concern of the climatologists. We are noticing global warming around the world due to the climatic change. If this global warming is not stopped, the lower parts of the world may one day go under water. The balance of the environment will break down and the average temperature of the world will increase. If such condition goes on for a long time, the world would be hotter. There would be drought throughout the world. Agriculture, forestry, fishery and wildlife will be seriously damaged.

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Acid Rain: Causes, Effects and Solutions

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Origin of the Term "Acid Rain"

The concept of acid rain originated in 1872 when the term was first used by Robert Angus Smith, an English chemist, to describe acidic precipitation in and around the city of Manchester, England. Subsequent scientific research on acid rain was sporadic and largely focused on local problems until the late 1960s, when Scandinavian scientists began more systematic studies. Acid precipitation was not identified in North America until 1972, when scientists found that precipitation was acidic in eastern North America, especially in the northeastern United States and eastern Canada. The 1975 First International Symposium on Acid Precipitation and the Forest Ecosystem (in Columbus, Ohio) helped scientists define the acid rain problem and initiated further research.

Rain is one of the most essential ingredients for human and animal life. The water provided by rain allows all life on Earth to survive. Although rain is naturally acidic, it is being increasingly acidified by pollution from homes, factories, power stations and cars. The term used to describe this problem is “acid rain”. **Acid rain** hasn’t just occurred in the last twenty to thirty years. In fact a chemist named Robert Smith found rainfall in Manchester, U.K., to be very acidic. He suggested a link between acid rain and SO₂ given off when coal was burnt by local factories. This was over 100 years ago.

Acid rain is caused when pollutants from cars, homes, factories and power stations mix with atmospheric moisture. These pollutants may be carried in clouds for long distances before falling, which means that forests and lakes far away from factories may be damaged by acid rain. Two of the major ingredients of acid rain are the chemicals sulphur dioxide [SO₂] and nitrogen oxides [NO_x]. When large quantities of these two particular chemicals come in contact with the atmosphere, they team up with moisture [H₂O] to produce strong acids called sulphuric and nitric acid. These two acids which are formed in the atmosphere, are very strong pollutants.

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Some air pollution as a matter of fact comes from natural sources, but most is human made. The burning of oil and coal by plants and factories, homes and cars, is the main source of chemicals that cause acid rain. Power stations and factories emit large amounts of sulphur dioxide and also nitrogen oxides, whilst car exhausts contain large amounts of nitrogen oxides. When volcanoes erupt, they emit various gases which have been trapped under the ground, including sulphur dioxide. This can cause air pollution, which can then be made much worse by the addition of human-made emissions. The air in many towns and cities is overfull of harmful pollutants. In the northern hemisphere sulphur emissions are decreasing steadily, due to pollution controls in industry. NOx emissions, however, are not yet in such steady decline.

The acid from rain takes important minerals from the leaves of trees and from the soil. Acid rain also releases toxic metals from the soil which damage the roots of the trees. The trees are weakened, cannot grow properly and are attacked by viruses, fungi and pests. Eventually the trees may die. Direct damage to trees occurs when SO₂ blocks the pores on the leaves, through which the trees take in the air they need to live. Forest floods that are affected by acid rain have high concentrations of metals like aluminium and lead. When animals drink from acidic lakes and dew that have been affected, the metals they take in may gradually poison them.

There is an obvious link between acid rain and damage to human health. People can be harmed by breathing in the chemicals from dry deposition, causing chest illness. Also when acid rain causes the release of metals and chemicals into drinking water, it can damage people's health. When air pollution is breathed in as people walk along the street, it gets into their lungs. Once in the lungs, it acts like a poison, causing the airways in the respiratory system to become narrower. To reduce acid rain industry's have to cut down the amount of SO₂ being produced when fossil fuels are burnt. Therefore, they can: use coal which contains little sulphur, remove the sulphur which is in the coal, use another type of fuel, or burn the coal in such a way that the sulphur is destroyed. There are many other ways of combating this problem, however, the best way to solve this issue is to prevent emissions of pollutants in the first place. Reducing the amount of NOx emissions caused by car exhaust is an effective solution. Public transport systems need to be improved so that people can travel without having to use their cars. If more people used public transport, it would cut the number of private vehicles on the roads, and would reduce pollution dramatically. Everybody needs to work together to reduce pollutants to make the world a safer and healthier place to live.

Formation of Acid Rain

One of the main components of acid rain is sulfur dioxide. When sulfur dioxide reaches the atmosphere, it oxidizes to first form a sulfate ion. It becomes sulfuric acid when it joins with hydrogen atoms in the air and falls back to earth. The most oxidation occurs in clouds, especially in heavily polluted air where other compounds such as ammonia and ozone help catalyze (accelerate) the reaction, converting more sulfur dioxide to sulfuric acid. Not all of the sulfur dioxide, however, is converted. In fact, a substantial amount of sulfur dioxide can float up into the atmosphere, be transported to another location, and return to earth unconverted.

Nitric oxide and nitric dioxide are the other major components of acid rain. Like sulfur dioxide, these nitrogen oxides rise into the atmosphere and are oxidized in clouds to form nitric acid. These reactions are also catalyzed in heavily polluted clouds where iron, manganese, ammonia, and hydrogen peroxide are present. Acid rain is rain consisting of water droplets that are unusually acidic because of atmospheric pollution - most notably the excessive amounts of sulfur and nitrogen released by cars and industrial processes. Acid rain is also called acid deposition because this term includes other forms of acidic precipitation such as snow.

Acidic deposition occurs in two ways: wet and dry. Wet deposition is any form of precipitation that removes acids from the atmosphere and deposits them on the Earth's surface. Dry deposition polluting particles and gases stick to the ground via dust and smoke in the absence of precipitation. This form of deposition is dangerous however because precipitation can eventually wash pollutants into streams, lakes, and rivers.

Acidity itself is determined based on the pH level of the water droplets. PH is the scale measuring the amount of acid in the water and liquid. The pH scale ranges from 0 to 14 with lower pH being more acidic while a high pH is alkaline; seven is neutral. Normal rain water is slightly acidic and has a pH range of 5.3-6.0. Acid deposition is anything below that scale. It is also important to note that the pH scale is logarithmic and each whole number on the scale represents a 10-fold change.

Today, acid deposition is present in the northeastern United States, southeastern Canada, and much of Europe including portions of Sweden, Norway, and Germany. In addition, parts of South Asia, South Africa, Sri Lanka, and Southern India are all in danger of being impacted by acid deposition in the future.

Causes and History of Acid Rain

Acid deposition can occur via natural sources like volcanoes but it is mainly caused by the release of sulfur dioxide and nitrogen oxide during fossil fuel combustion. When these gases are discharged into the atmosphere they react with the water, oxygen, and other gases already present there to form sulfuric acid, ammonium nitrate, and nitric acid. These acids then disperse over large areas because of wind patterns and fall back to the ground as acid rain or other forms of precipitation. The gases responsible for acid deposition are normally a byproduct of electric power generation and the burning of coal. As such, it began entering the atmosphere in large amounts during the Industrial Revolution and was first discovered by a Scottish chemist, Robert Angus Smith, in 1852. In that year, he discovered the relationship between acid rain and atmospheric pollution in Manchester, England. Although it was discovered in the 1800s, acid deposition did not gain significant public attention until the 1960s and the term acid rain was coined in 1972. Public attention further increased in the 1970s when the New York Times published reports about problems occurring in the Hubbard Brook Experimental Forest in New Hampshire.

Sources of Acid Rain

Acid rain is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air. These substances can rise very high into the atmosphere, where they mix and react with water, oxygen, and other chemicals to form more acidic pollutants, known as acid rain. Sulfur dioxide and nitrogen oxides dissolve very easily in water and can be carried very far by the wind. As a result, the two compounds can travel long distances where they become part of the rain, sleet, snow, and fog that we experience on certain days.

Human activities are the main cause of acid rain. Over the past few decades, humans have released so many different chemicals into the air that they have changed the mix of gases in the atmosphere. Power plants release the majority of sulfur dioxide and much of the nitrogen oxides when they burn fossil fuels, such as coal, to produce electricity. In addition, the exhaust from cars, trucks, and buses releases nitrogen oxides and sulfur dioxide into the air. These pollutants cause acid rain.

Acid Rain is caused by Reactions in the Environment. Nature depends on balance, and although some rain is naturally acidic, with a pH level of around 5.0, human activities have made it worse. Normal precipitation—such as rain, sleet, or snow—reacts with alkaline chemicals, or

non-acidic materials, that can be found in air, soils, bedrock, lakes, and streams. These reactions usually neutralize natural acids. However, if precipitation becomes too acidic, these materials may not be able to neutralize all of the acids. Over time, these neutralizing materials can be washed away by acid rain. Damage to crops, trees, lakes, rivers, and animals can result.

Effects of Acid Rain

We generally consider acid rain to affect areas which are downwind of pollution generating sites. The northeastern United States, for instance, suffers from acid precipitation generated both locally and by coal fired plants in the mid-western states. As a result, ecosystem damage is localized. However, acid precipitation can be caused by some natural events (volcanic eruptions, erosion and oxidation of organic-rich sedimentary rocks) and some catastrophic events (bolide impact) which increase the amounts of CO_2 , NO_x and SO_2 in the atmosphere. As a result, it is important to understand the effects of acid rain on animals in order to evaluate both possible causes for past extinction events, as well as the potential for modern ecosystem damage.

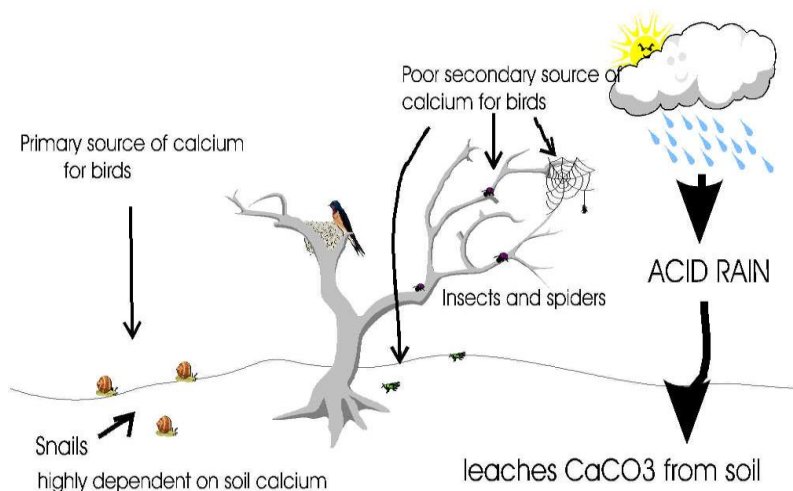
After studying the Hubbard Brook Forest and other areas today, there are several important impacts of acid deposition on both natural and man-made environments. Aquatic settings are the most clearly impacted by acid deposition though because acidic precipitation falls directly into them. Both dry and wet deposition also runs off of forests, fields, and roads and flows into lakes, rivers, and streams.

As this acidic liquid flows into larger bodies of water, it is diluted but over time, acids can accrue and lower the overall pH of the body. Acid deposition also causes clay soils to release aluminum and magnesium further lowering the pH in some areas. If the pH of a lake drops below 4.8, its plants and animals risk death and it is estimated that around 50,000 lakes in the United States and Canada have a pH below normal (about 5.3 for water). Several hundred of these have a pH too low to support any aquatic life. Aside from aquatic bodies, acid deposition can significantly impact forests. As acid rain falls on trees, it can make them lose their leaves, damage their bark, and stunt their growth. By damaging these parts of the tree, it makes them vulnerable to disease, extreme weather, and insects. Acid falling on a forest's soil is also harmful because it disrupts soil nutrients, kills microorganisms in the soil, and can sometimes cause a calcium deficiency. Trees at high altitudes are also susceptible to problems induced by acidic cloud cover as the moisture in the clouds blankets them.

Damage to forests by acid rain is seen all over the world, but the most advanced cases are in Eastern Europe. It's estimated that in Germany and Poland, half of the forests are damaged, while 30% in Switzerland have been affected. Finally, acid deposition also has an impact on architecture and art because of its ability to corrode certain materials. As acid lands on buildings (especially those constructed with limestone) it reacts with minerals in the stones sometimes causing it to disintegrate and wash away. Acid deposition can also corrode modern buildings, cars, railroad tracks, airplanes, steel bridges, and pipes above and below ground.

Effects of Acidity on Plants and Animals

As a first example of the effects of acid rain, we can examine a case which is not obvious - effects on non-aquatic, tree nesting birds. This study was carried out in the Netherlands. It was observed that the proportion of birds laying defective eggs rose from roughly 10% in 1983-84 to 40% by 1987-88. The defective eggs had thin and highly porous egg shells, which resulted in eggs failing to hatch because of shell breakage and desiccation. As a result, there was also a high proportion of empty nests and clutch desertion. It was also observed that these effects were limited to areas of acid rain.



Since the birds did not appear to be directly affected by the acidity, the food chain was examined (these birds are positioned at the upper part of the local food chain). The difference between areas of normal soil pH (buffered by high calcium content due to limestone and marble outcrops and bedrock) and those with acidic soil appeared to be the presence of snails. The snails depend on the soil as their calcium source as they secrete their shells. With much of the CaCO₃ leached out of the soil by the acid precipitation, the snails could not survive in the area. The birds did

not, at first, appear to be affected, because they continued to eat spiders and insects which, while supplying a sufficiently nutritious diet for the birds, were a poor source of calcium.

To test the hypothesis that the lack of calcium was the cause of the bird's laying defective eggs, ecologists "salted" the area with chicken egg shell fragments. The birds began to eat the chicken egg shells, and those that did laid normal eggs. In this case, acid precipitation had effects that passed on up the food chain.

Because of these problems and the adverse effects air pollution has on human health, a number of steps are being taken to reduce sulfur and nitrogen emissions. Most notably, many governments are now requiring energy producers to clean smoke stacks by using scrubbers which trap pollutants before they are released into the atmosphere and catalytic converters in cars to reduce their emissions. Additionally, alternative energy sources are gaining more prominence today and funding is being given to the restoration of ecosystems damaged by acid rain worldwide.

Solutions

There are many possible solutions to the acid rain problem. One solution is to use fuels that burn more cleanly. Another solution is to burn coal more efficiently. Power plant and factory chimneys can be fitted with scrubbers that remove 90-95% sulfur from smoke and also produce sludge from which gypsum, a building material, can be produced. This problem can also be solved by enforcing tight emission standards on vehicles that burn gas and diesel. One other solution is fitting devices such as a catalytic converter into car exhaust pipes to minimize the amount of sulfur dioxide in car exhaust.

Modern science has proven that acid rain is a dangerous and highly destructive problem. As a result, various ways to limit acid rain have been invented, and some are now being used.

Debate over acid rain and ways of preventing it have raged between environmentalists and corporations. Businesses such as power companies and car makers oppose controlling acid rain because they fear the effects on their profits.

But in some cases, industries have attempted to curb acid rain production. The Northern States Power company began working to reduce acid rain in the 1980s, and has invested over a billion dollars to that end. There are many ways that power plant companies like Northern States can reduce acid rain creation. They can use coal with a low sulfur content, they can remove the sulfur from smoke their plants release, and they can limit processes known to generate high

levels of acid rain. Policy makers and environmental experts are now looking into the best methods to limit acid rain. Environmentalists advocate the installation of sulfur cleaning scrubbers in factories, washing sulfur out of coal, and finding new methods of burning coal. Power plant operators are looking for less expensive solutions to the problem. Individuals can help by conserving energy or driving their cars less. Governments can pass laws restricting pollution levels, or can use a variety of methods such as tradable emission permits to reduce acid rain. Whatever way it is done, acid rain will certainly have to be limited in the future.

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Climate Change and Human Health in India

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Introduction

Climate affects water, food, air quality, diseases, physical comforts and human health. Any change in climatic conditions is likely to affect human health. Relationship between climate and health is an old one as evidenced by increase in the visit of patients to clinics after severe heat, rain and cold. Changes in climatic conditions are usually termed as climate variability which varies from month/year-to-year. But the variability of temperature over a period of 100 years in India has been reported as 0.5°C . Since 1990, there has been sharp increase in global temperatures which explains the greater awareness about the potential impact of climate change on different sectors including human health. Rise in temperature, changes in rainfall and sea level rise are the major aspects that have been projected by the year 2100. The IPCC in its report of 2007 has projected rise of about 4°C in temperature, increase and decrease in rainfall patterns, and a rise in sea level up to 0.59 meter by the year 2100. Extremes of weather resulting in excessive heat and cold events, and disasters are also projected. Melting of glaciers is likely to result in floods, cyclones and disasters. Thus, climate change is basically climate variability which has become faster in the last two decades.

In view of the latest developments and governments' policies, economics and political will, it is pertinent to review the latest scenario of climate change and human health in the Indian context. The article reviews the potential impact of climate change on health with a view to identify the scope of formulating steps to address the negative impact in the Indian context.

Impact on human health

Possible impact of climate change on health is well documented by the World Health Organization and other international organizations like IPCC. The direct impact of weather on human health is mortality due to increased temperature, disasters resulting in flood, loss of life and infrastructure due to cyclones etc, impact on water and vector-borne diseases, malnutrition and respiratory diseases⁷.

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Impact of heat

In India, loss of life due to excessive heat occur every year. Andhra Pradesh, Odisha, Punjab, Uttar Pradesh, Rajasthan, Bihar and Madhya Pradesh were the most affected states. With projected rise in temperatures, mortality is expected to rise due to heat waves. Increased temperatures are also likely to cause increase in eye diseases like cataract, dry eyes, and skin diseases. The impact of global warming and ultra-violet radiation on eye diseases is being studied in the National Capital Region of Delhi and Guwahati (R. Tandon, AIIMS, New Delhi, India personal communication. This indicates that the local adaptive capacity of people plays a key role. The only expected positive impact of rise in temperature on health is reduction in mortality due to cold wave in some parts of northern India.

Disasters

Excessive floods, cyclones, storms and earthquakes usually cause loss of life, infrastructure and human resources. Coastal areas of India, particularly the east coast and Andaman & Nicobar Islands are vulnerable to cyclones and tsunamis. Lessons learnt from the past would serve as guiding principle for formulating preventive measures and combating tools. National Institute of Disaster Management, set up by the Government of India is making headway in imparting training to different sectors and mapping the disaster prone areas in India which should serve as a baseline for development of preparedness plans to meet adverse impacts.

Water scarcity and malnutrition

Water is fundamental for life. Scarcity of water or excess water due to floods, cyclones are likely to affect human health. Scarcity of availability of water for crops and high temperatures will affect agriculture resulting in less production. As per World Bank, India ranks at number 2 after Bangladesh where about 47% of children exhibit a degree of malnutrition. Diseases like diarrhoea, malaria, typhoid and pneumonia further add misery to the problem. The apple production is projected to be reduced. Coconut yield may increase by 30% in coastal areas while there is projection of reduction in Tamil Nadu, Maharashtra and parts of Karnataka. Livestock produce like milk may also reduce. The reduction in agricultural produce is bound to have a negative impact on human health leading to malnutrition, if not addressed in time.

Vector-borne diseases

Spatial and temporal distribution of vector-borne diseases like malaria, dengue and chikungunya are likely to be affected the most as the mosquitoes which transmit the diseases are cold blooded.

Their life cycle and development of pathogen in their body are likely to be affected at varying temperature and relative humidity.

Dengue

Impact of climate change on dengue also reveals increase in transmission with 2°C rise in temperature in northern India as reviewed in 2010. The thresholds of temperature and relative humidity for indigenous transmission of dengue need to be redefined. Risk factors in terms of water availability, storage practices and life style also need to determine. As adaptation measures, early warning system for preventing outbreaks is need of the hour. However, it seems inconclusive in view of water storage practices, intra-domestic breeding of *Aedes* vector and socioeconomic conditions of inhabitants.

Current evidence

Reporting of malaria and dengue in Nepal and Bhutan, chikungunya in India since 2005, and occurrence of kalaazar in Himachal Pradesh and reappearance in Assam are some of the examples which can be linked to climate change but need verification. It is true that intervention measures have remarkable impact on disease incidence than other factors like insecticide resistance in mosquito vectors and drug resistance in parasites. As regards dengue, almost the whole of India is suitable from the climatic conditions point of view but central and northeastern states are not endemic. Life style and water supply system are the major determinants of indigenous transmission of dengue. However, it seems difficult due to covert infection and unsatisfactory impact of indoor residual spraying. No major outbreaks since 2006 have been witnessed except in a localized area at construction sites in Mumbai during 2010-11.

Conclusion

Climate change has set in and will alter spatial and temporal distribution of vector-borne diseases, exacerbation in heat related mortality, air pollution related respiratory diseases and water borne diseases, if current scenario continues. In tropical countries like India, most of the identified adverse health effects due to climate change are already experienced. The need of the hour is to undertake situation analysis for reasons of persistent disease burden and for identifying the operational gaps.

Present Issues of Bio-Medical waste Generation & Disposal Practices in Malshiras Tahasil

Gorakh Mane*, Balasaheb Salunkhe**

Introduction

Hospital is one of the complex institutions which is frequented by people from every walk of life in the society without any distinction between age, sex, race and religion. This is over and above then or malin habitants of hospital i.e patients and staff. All of them produce waste which is increasing in its amount and type due to advances in scientific knowledge and is creating its impact. The hospital waste, in addition to the risk for patients and personal who handle these wastes poses a threat to public health and environment keeping in view inappropriate biomedical waste management, the Ministry of Environment and Forests notified the “Biomedical Waste (management and handling) Rules, 1998” in July 1998. In accordance with these rules it is the duty of every “occupier” i.e a person who has the control over the institution and or its premises, to take all steps to ensure that waste generated is handled without any adverse effect to human health and environment. The hospitals, nursing homes, clinic, dispensary, animal house, pathological lab etc., are therefore required to set in place the biological waste treatment facilities. It is however not incumbent that every institution has to have its own waste treatment facility. The rules also envisage that common facility or any other facilities can be used for waste treatment. However it is incumbent on the occupier to ensure that the waste is treated within a period of 48 hours.

Biomedical Waste Management Process :- Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of biomedical waste in any establishment. The key to minimisation and effective management of biomedical waste is segregation (separation) and identification of the waste. The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into colour coded plastic bags or containers.

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Biomedical waste should be segregated into containers/ bags at the point of generation in accordance with Schedule II of Biomedical Waste (management and handling) Rules 1998.

General waste like garbage, garden refuse etc. should join the stream of domestic refuse. Sharps should be collected in puncture proof containers. Bags and containers for infectious waste should be marked with Biohazard symbol. Highly infectious waste should be sterilised by autoclaving. Cytotoxic wastes are to be collected in leak proof containers clearly labelled as cytotoxic waste. Needles and syringes should be destroyed with the help of needle destroyer and syringe cutters provided at the point of generation. Infusion sets, bottles and gloves should be cut with curved scissors.

Disinfection of sharps, soiled linen, plastic and rubber goods is to be achieved at point of generation by usage of sodium hypochlorite with minimum contact of 1 hour. Fresh solution should be made in each shift. On site collection requires staff to close the waste bags when they are three quarters full either by tying the neck or by sealing the bag. Kerb side storage area needs to be impermeable and hard standing with good drainage. It should provide an easy access to waste collection vehicle. Biomedical waste should be transported within the hospital by means of wheeled trolleys, containers or carts that are not used for any other purpose. The trolleys have to be cleaned daily. Off site transportation vehicle should be marked with the name and address of carrier. Biohazard symbol should be painted. Suitable system for securing the load during transport should be ensured. Such a vehicle should be easily cleanable with rounded corners.

All disposable plastic should be subjected to shredding before disposing off to vendor. Final treatment of biomedical waste can be done by technologies like incineration, autoclave, hydroclave or microwave. The cost of construction, operation and maintenance of system for managing biomedical waste represents a significant part of overall budget of a hospital if the BMW handling rules 1998 have to be implemented in their true spirit. Govt of India in its pilot project for hospital waste management in Govt hospitals has estimated Rs.85 lakh as capital cost in 1000 bedded super Speciality teaching hospital which includes on site final disposal of BMW. Two types of costs are required to be incurred by hospitals for BMW mgt, internal and external. Internal cost is the cost for segregation, mutilation, disinfection, internal storage and transportation including hidden cost of protective equipment. External cost involves off site transport of waste, treatment and final disposal. Hospitals, private practitioners, emergency care centers though aware of the rules do not have the time or resources to arrange satisfactory

disposal of biomedical waste. Self contained onsite treatment methods may be desirable and feasible for large healthcare facilities. They will not be practical or economical for smaller institutes. An acceptable common system should be in place which will provide free supply of colour coded bags, daily collection of infectious waste, safe transportation of waste to offsite treatment facility and final disposal with suitable technology. Methods of storage and segregation at ward / department level, internal transportation, kerb side storage, external transportation and on site final disposal / offsite disposal were studied for all Study hospitals by direct observation and infrastructure for the same was studied. Informal discussion with various hospital functionaries was carried out. Common regional facility for final disposal of infectious waste was also studied.

Objective

- 1) To Measure the BMW in Malshiras Tahasil.
- 2) To find Sources of BMW pollution in study universe.
- 3) To find the importance and effect of BMW.
- 4) To analyze the growth curve affected BMW pollution.

Research Methodology

The researcher has collected information from various sources from 15/12/2011 To 05/01/2012 with the help of research. After getting the samples researcher vavars Hospital,Clinic,Pathological Lab blood bank,Medical has Colleted the Sampal of BMW & disposal practicles analyses statistical and mathematical methods.

Discussion

Comparison of All hospitals studied in terms of bed strength, waste generation, method of final disposal It was observed that Govt service hospital where BMW management was implemented as per BMW 1998 rules had process of segregation of waste at generation level into various colour coded bags and plastic drums, internal transportation of waste through trolleys to kerb site, storage at kerb site in various colour coded metallic drums, movement of plastic disposable waste to plastic shredders and transportation of infectious waste to on site incinerator was found to be completely in place. Safai karmacharis were using complete protective equipment like gloves, masks, shoes etc while handling waste and also sodium hypochlorite was available in each and every sharp generating site in wards as well as departments.

The capital and recurring cost worked out for complete process thus was found to be high as compared to other hospitals as other hospitals had some shortcomings at every step of BMW management. Plastic waste receptacles of different colour codes were being used in other non Govt hospitals without any consideration of rules. However, all these hospitals were collecting infectious waste into yellow colour coded bags (biodegradable) provided by Image India, a central facility. No plastic bags were being used for lining plastic buckets / receptacles for other type of wastes and other waste was being collected in single container. All the hospitals were using needle destroyers for disposable needles. Plastic bottles, catheters and disposables were being mutilated physically and then either were sold to contractor or donated. private hospital was utilizing facility of onsite incineration for infectious waste disposal. Incinerator was found to be twin chambered oil fired with regular checks from pollution control board. All hospitals were sending their infectious waste to central facility of incineration. No hospital safai karmacharis were found to be using complete protective equipment, some of them were using latex gloves. waste destined for incineration is physically checked by laying out the waste and manual segregation is carried out which can result in injury to health care workers and should be avoided at any cost. Sodium hypochlorite is being very sparingly used and fresh solution was not available at most of the hospitals. State run hospital was having plastic buckets of assorted variety at ward and department levels for waste collection, however most of them were in broken condition and no replacement was provided. Use of hypochlorite solution for sharps was non-existent. Proper segregation was not being carried out. Plastic waste was taken by rag pickers and sold to contractors at hospital waste dump itself. Trolleys for transportation of waste were being used for other purposes like carriage of linen and stores etc. Needles were being destroyed at source, however most of the needle destroyers were non-function aland physical mutilation was being resorted to which can prove to be dangerous for health care worker (HCW). Onsite incinerator is available and is oil fired double chambered type of very old vintage, however it remains non functional most of the time resulting in all the infectious waste finding its place in main municipality dump. Local municipal body as well as state Pollution Control Board do not check existing waste disposal arrangements of this hospital. It has appointed M/s Image India to, offer the services of handling BMW on pay and use basis. The services include provision of bags, collection of bags containing infectious waste from all the hospitals with more than 30 beds, their transportation to the incinerator

site, its incineration and final disposal of ash State Pollution Control Board checks only common waste facility. Nursing homes / hospitals registered with this facility are under constant scrutiny and are punished by levying fine, if any disposable plastic / sharps are found in yellow bags leading to forced re-checks of their waste which can result in injuries to HCWs. Use of central incineration facility should be made compulsory for those hospitals who have defective incinerators as they are a source of pollution.

Conclusion

After analysing the results of the study it was felt that there is an urgent need to standardise the infrastructural requirement so that hospitals following BMW handling rules meticulously do not suffer additional costs. Hospitals having defunct / defective incinerators should be made to utilise central incineration facility as efforts of Govt are towards reducing the number of incinerators tahasil to prevent rise in air pollution. Small health care establishments tahasil city which have still not registered with central facility should be encouraged to register thereby bringing down the operating cost of contractor and decrease the cost of incineration per kg. Govt hospitals which at present are totally left on their own, should be brought into net of rigorous checking as far as BMW management is concerned and a corpus grant can be allotted to them to improve their infrastructural requirements for which provision exists in Govt of India Rules. Community is utilising the services of hospitals and by “Polluter Pays” principle, it needs to contribute in building infrastructure for BMW mgt. This contribution can be in the form of assistance in sharing the cost of consumables and capital cost of BMW mgt by Municipality, State Govt, Public bodies.

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Effects on Nutritional Status

Rohit A. Tambe*

Introduction

Diet has always played a vital role in supporting health. Today, over consumption of foods – especially those high in fat – is a major concern for people. When we look at the ten leading causes of illness and death in India, the top categories are heart disease, cancer, stroke, and diabetes. Diet influences the development of the chronic diseases. Taken together, These causes are stated as if single conditions such as heart disease caused death, but most chronic diseases arise from multiple factors over many years. If you go into any gym in the world and randomly ask 100 people to pinpoint the most important thing for achieving success in bodybuilding and fitness, you'd probably get just as many different answers. Most replies, however, would involve various training programs or styles. As important as training is, nutrition plays an equally large role — your diet is almost always responsible for either success or failure in bodybuilding and virtually any fitness program.

Nutrient Balance

Carefully planned nutrition must provide an energy balance and a nutrient balance.

The nutrients are:

- **Proteins** - essential to growth and repair of muscle and other body tissues
- **Fats** - one source of energy and important in relation to fat soluble vitamins
- **Carbohydrates** - our main source of energy
- **Minerals** - those inorganic elements occurring in the body and which are critical to its normal functions
- **Vitamins** - water and fat soluble vitamins play important roles in many chemical processes in the body
- **Water** - essential to normal body function - as a vehicle for carrying other nutrients and because 60% of the human body is water.

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What are the daily energy requirements?

Personal energy requirement = basic energy requirements + extra energy requirements
Basic energy requirements (BER) includes your basal metabolic rate (BMR) and general daily activities

- For every Kg of body weight approximately 1.334 Calories is required every hour (An athlete weighing 60Kg would require $1.334 \times 24\text{hrs} \times 60\text{Kg} = 1921$ Calories/day)
- For a calculation of your BMR, see the calculator on the Resting Daily Energy Expenditure (RDEE)

Extra energy requirements (EER)

- For each hours training you require approximately an additional 8.5 Calories for each Kg of body weight. (For a two hour training session our 60Kg athlete would require $8.5 \times 2\text{hrs} \times 60\text{Kg} = 1020$ Calories) An athlete weighing 60Kg who trains for two hours would require an intake of approximately 2941 Calories (BER + EER = $1921 + 1020$)

Energy Fuel

Like fuel for a car, the energy we need has to be blended. The Dietary Guidelines for Americans recommends the following blend:

- 45-65% Carbohydrates (sugar, sweets, bread, cakes)
- 20-35% Fats (dairy products, oil)
- 10-35% Protein (eggs, milk, meat, poultry, fish)

For the purposes of the following examples and calculations I will use the following values:
Fat 27%, Carbohydrate 52% and Protein 21%

The approximate energy yield per gram is as follows: Carbohydrate - 4.2 Calories, Fats - 9.5 Calories and Protein - 4.1 Calories.

What does a 60 kg athlete require in terms of carbohydrates, fats and protein?

- Carbohydrates - 52% of 2941 = 1529 Calories - at 4.2 Calories/gram = $1529 \div 4.2 = 364$ grams
- Fats - 27% of 2941 = 794 Calories - at 9.5 Calories/gram = $794 \div 9.5 = 84$ grams
- Protein - 21% of 2941 = 617 Calories - at 4.1 Calories/gram = $617 \div 4.1 = 151$ grams

Our 60kg athlete requires 364 grams of Carbohydrates, 84 grams of Fat and 151 grams of Protein

Eating and Competition

What you eat on a day-to-day basis is extremely important for training. Your diet will affect how fast and how well you progress, and how soon you reach competitive standard. Some provides general nutritional advice to help you manage your weight and body fat.

Once you are ready to compete, you will have a new concern: your competition diet. Is it important? What should you eat before your competition? When is the best time to eat? How much should you eat? Should you be eating during the event? In addition, what can you eat between heats or matches? A lot of research has been done in this area, and it is clear that certain dietary approaches can enhance competition performance.

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Dr. Onkar Rasal is presently working as a Asst. Prof. at Post Graduate Department of Economics. He has earned Ph.D. in Economics. He is engaged in research work with publication of six research papers in various journals. He was the member of the research team of Gokhale Institute of Politics and Economics, Pune.



Uncertainty and inadequacy are the fundamental characteristics of the Indian monsoon. Variations in the monsoon affect the agricultural production. However, the agriculture in Maharashtra is comparatively developed in India. But at the same time, there have been a huge amount of disparities in agricultural development in the state. Adequate irrigation facilities are the prerequisite for the sustainable development of the sector. Over the years there is increase in number of failure of Indian monsoon. It is an outcome of the changing nature of climate and moreover, the increase in temperature of earth surface. I strongly believe that to come up with the problem we need a long term constructive policy measure. As well as the people participation is the prerequisite while coping with the problem of climate change. I congratulate the organizer for the conducting the academic discussion on this burning issue. The academic debate on this vital issue will be helpful for designing the long term policy on climate change and its impact. I wish great success for the National Seminar.

Hon'ble Padmabhushan Shri. Balasaheb Vikhe Patil
President, Pravara Rural Education Society,
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