SELF-SUFFICIENT GREEN VILLAGES: FUTURE OF INDIA

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ABSTRACT

Green building is one of measures been put forward to mitigate significant impacts of the building stock on the environment, society and economy. The most prominent factor that can contribute to the cause of building a stable world order is effective and efficient planning of green villages. It has been recognised that one of the root causes of India's lack of progress in rural areas is inadequate waste management and lack of modern energy services, and thus the concept of Green Village can be a revolutionary step towards smart development. Green Village is a process that can help these villagers to attain sustainable development. In addition, the concept of green village opens the doors for making villagers self-reliant and self-subsistent on green energy that creates a concessional situation for economy, environment as well as society. This paper takes a major step towards this concern and considers the methods for initiating and accelerating the green approach in each part of development cycle in order to make a sustainable village.

Key words- Green village, Sustainable energy, Waste management

INTRODUCTION

India– "The Golden Bird of the World" is a nation of traditions, culture and villages. There is a total of 649481 villages in India. Nearly 70% of the country's population lives in rural areas where, for the first time since independence, the overall growth rate of population has sharply declined, according to the latest Census Of the 121 crore Indians, 83.3 crore live in rural areas while 37.7 crore stay in urban areas, said the Census of India's 2011 provisional population totals of rural-urban distribution in the country, released by Union Home Secretary Mr. RK Singh.The level of urbanization has increased from 27.81% in the 2001 Census to 31.16% in the 2011 Census, while the proportion of rural population declined from 72.19% to 68.84%.

"The slowing down of the overall growth rate of population is due to the sharp decline in the growth rate in rural areas, while the growth rate in urban areas remains almost the same," anomalous. However, according to the report, the number of births in rural areas has increased by 9 crores in the last decade. The statistics reveal that while the maximum number of people living in rural areas in a state is 15.5 crore in Uttar Pradesh, Mumbai tops the list having the maximum number of people in urban areas at five crores.

So, there is a strong need to develop rural area to develop our nation. These villages not only need development, but also sustainable development as non-renewable resources are depleting day by day. To achieve big target, we first must take a small step. This is the reason why we started the development in the village namely RanoliLatifpur. The survey of the village has been conducted to look for the ground situation and then to come with green-sustainable solutions.

STUDY AREA:

According to census 2011, RanoliLatifpur is a large village of area 353.8 ha located in Dadri Tehsil of Gautam Buddha Nagar district, Uttar Pradesh with total 447 families residing. The RanoliLatifpur village has population of 2878 of which 1539 are males while 1339 are females as per Population Census 2011.

In RanoliLatifpur village population of children with age 0-6 is 448 which makes up 15.57 % of total population of village. Average Sex Ratio of RanoliLatifpur village is 870 which is lower than Uttar Pradesh state average of 912. Child Sex Ratio for the RanoliLatifpur as per census is 723, lower than Uttar Pradesh average of 902.

RanoliLatifpur village has higher literacy rate compared to Uttar Pradesh. In 2011, literacy rate of RanoliLatifpur village was 77.78 % compared to 67.68 % of Uttar Pradesh. In RanoliLatifpur Male literacy stands at 88.82 % while female literacy rate was 65.51 %.

Table1: 2011 census data of RanoliLatifpur

Particulars	Total	Male	Female
Total No. of Houses	447	-	-
Population	2,878	1,539	1,339
Child (0-6)	448	260	188
Schedule Caste	308	159	149
Schedule Tribe	0	0	0
Literacy	77.78 %	88.82 %	65.51 %
Total Workers	1,017	732	285
Main Worker	865	682	183
Marginal Worker	152	50	102

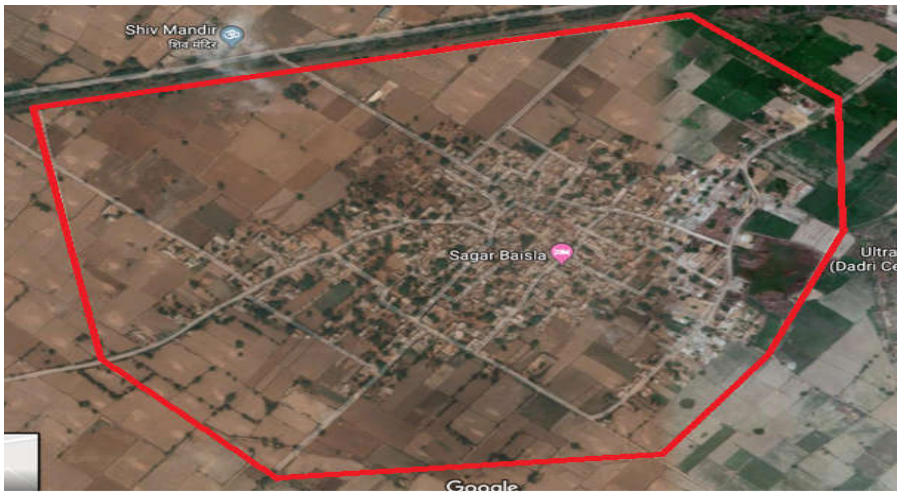

Fig 1: Google earth image of RanoliLatifpur

Table2: Census of India 2011Amenities and Land use

Tap water (Treated/Untreated)	Yes
Well water (Covered / Uncovered well)	Yes
Hand Pump	Yes
Tube wells / Bore well	No
Spring	No
River / Canal	No
Tank / Pond / Lake	No
Community toilet including bath.	No
Community toilet excluding bath.	No
Rural sanitary mart or sanitary hardware outlet available near the village.	No
Community bio- gas or recycle of waste for productive use.	Yes

TECHNOLOGY IDENTIFICATION FOR THE ENHANCEMENT OF VILLAGE:

The basic need for a healthy life is proper waste management, clean drinking water, hygienic environment and clean air. From the survey it has been found that the village lacks in basic water purification system and waste disposal system. And a large area is available barren. So, in this paper we are proposing three technologies for the support and enhancement of village.

1. Proper solid organic waste disposal
2. Utilisation of plastic waste
3. Water conservation

1. Solid waste Management

There is an evident problem of solid waste management in the rural areas and also in our many of the cities. Solid waste management is an important step towards sustainable development, it includes segregation, storage, collection, relocation, processing, and disposal of solid waste to minimize its adverse impact on environment. Unmanaged solid waste becomes a factor for propagation of innumerable problem.

This includes collection of solid waste from the source to ultimately disposing off it hygienically, in order to prevent any further problem that can be caused by it and make the area clean.

Fig2. Unmanaged solid waste in India(source: gazipur landfill)

1.1Composting Process: This process is carried out by the action of microorganism. These microorganisms break the organic matter to produce carbon dioxide (CO_2), water (H_2O), heat energy and humus which can be further used as fertilizers in the field as shown in Fig 3.

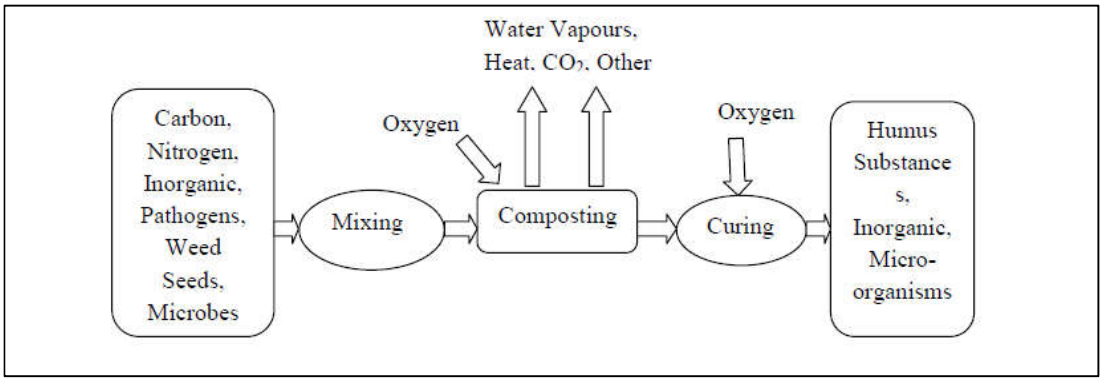

Fig 3. Flow chart of composting process

The effectiveness of the composting process is depending on the environmental conditions present near the composting system i.e. oxygen, temperature, moisture, material disturbance, organic matter and the size and activity of microbial populations.

1.1.1 DRUM COMPOSTING

Drum composting is a special method of composting in which a rotating drum is used to make this process aerobic and thus very fast and effective.

In this method the organic waste was taken to the self-made compost tumbler which helped in efficient composting. The compost tumbler was made using the following things; rotating drum, frame for base, axial rod for drum, perforated sides for providing aeration. Use of drum composting instead of ground composting which has many benefits, it speeds up the composting process, eliminates composting odour, land requirements problem is eliminated, it is tidy, attractive, suitable for urban and suburban areas. The usual time required for composting is 45 to 60 days and drum composting can be done in 15-20 days.

Fig 4. Compost tumbler for drum composting

Table 3: Material required for the drum composting

MATERIAL	DETAIL
Plastic barrel	100 litre
PVC Pipe	for axis
PVC tubes	for aeration
Base	for making supporting base
Bolts nuts and handle etc	for joints

Steps:

a) Waste collection: Waste collection was done using the different coloured labelled bins at college at different sites. An analysis of food waste generated in the college hostels was also done which helped in understanding the requirements and necessity for the self-efficient waste management system for the college and how this drum composting method can help.
b) Waste segregation: It was done simultaneously using different coloured bins. The waste was segregated as biodegradable and non-biodegradable waste and the biodegradable part was used in the process of drum composting. The cycle was done using 10 kg wet waste which mostly included fruit pulp, fruit peel, vegetable waste, etc.
c) Use of compost tumbler: This wet waste (10 kg) was then transferred to the compost tumbler which was rotated after every 24 hours and readings of temperature, pH were taken, and the data was recorded.
d) Aerobic digestion: the waste in the compost tumbler underwentaerobic digestion which uses the presence of air for the digestion of waste and conversion to manure, there were provisions in the tumbler for providing air through perforated sides.
e) Formation of compost: The compost is matured after about 20 days. This compost was then sundried for removal of any moisture. After that it was crushed and used for experimental purpose.

Fig 5. Composting process conducted at JSSATE

2. UTILISATION OF PLASTIC WASTE

Plastic is light weight; resistant polymer molded in variety of ways and has many applications. The global consumption of plastic can be estimated by plastic waste produced as it is the major component of every household. Plastic waste is polluting our environment day by day. Its disposal has been a major concern from so many years as it takes hundreds of years to biodegrade in landfills and people usually dump it into landfills, oceans or simply burnt which ultimately causes pollution, erosion, and irrigation blockage and health problems also. From eco-friendly point of view recycling and reuse are the most suitable option but if we think but if we think out of box then why not use this plastic as a building material for construction which turns out to be sustainable, eco-friendly and economical.

BEST OUT OF PLASTIC WASTE:

Plastic waste generated from different household can be utilized by:

- Using plastic bottle filled with sand to build walls
- Using mixture of plastic waste with sand/clay in process of making bricks
- Using plastic waste in road construction

For making bricks from plastic bottles materials used are waste plastics, River sand, Red oxide (ferric oxide). Different tests were conducted on these bricks to compare them with conventional clay bricks and the results are as shown below:

Fig 6 Plastic bottle bricks

EFFLORESCENCE TEST OF BRICKS

If bricks form a white or grey layer on absorption of water, then it signifies the presence of alkalis. For this test bricks are immersed in water for 24 hours and then dried.

Table 4: Observation table for clay bricks

S.NO.	OBSERVATION	REMARKS
1.	We observed the brick more than 50% of the area is cover with white patches	Heavy-efflorescence

Table 5: Observation table for plastic bricks

S.NO.	OBSERVATION	REMARKS
1.	No perceptible deposit	Nil efflorescene

WATER ABSORPTION TEST

For this test firstly, the weight of brick in dry state is taken then the bricks are immersed in water for 24 hours. After that bricks are taken out from water and weight of brick is noted.

Table 6: Result table for clay brick

S.no.	Dry weight	Wet weight	Water absorption percentage
1.	2572 gm	2970 gm	15.4%

Table 7: Result table for plastic brick

S.no.	Dry weight	Wet weight	Water absorption percentage
1.	747 gm	747 gm	0%

COMPRESSIVE TEST

Also known is crushing strength test.Generally, five specimen of brick are taken and tested one by one and is put on crushing machine and pressure is applied till it breaks and average of all five are taken.

Table 8: Observation table for clay bricks

S.no.	Brick no.	Size of the testing brick mm^2	Load KN	Compressive strength of bricks(in N/mm2)
1	A	20*9	160	8.89
2	B	20*9	167	9.27
3	C	20*9	158	8.77

Table 9: Observation table for plastic brick

S.no.	Brick no.	Size of the testing brick mm^2	Load KN	Compressive strength plastic bricks(in N/mm2)
1	A	27.5*7.6	88	4.21
2	B	27.5*7.6	80	3.82
3	C	27.5*7.6	85	4.06

Result:

1. Compressive strength of clay brick=8.97 N/mm2

2. Compressive strength of plastic bricks=4.03N/MM2

3. Economical-

In accordance with swachh bharat abhiyan government provide 12000 rupees to make toilet in one village which become in sufficient to make toilets. This the reason why these bricks can be used in these toilets as they are very economical as compared to burnt clay bricks.

3. WATER CONSERVATION

Due to water scarcity, we are putting enormous pressure on quality of surface and ground water. In many surveys held every year, it is found that 83% of potable water is used for irrigation purposes and hence rain fall becomes the primary source of fresh water.

Also Harvesting Rain fall is the most efficient, productive and easy technique that can be implemented in any region.

Benefits of storing rain water include:

1. It solves the scarcity of water.
2. It strengthens the ground water level
3. It also reduces the consumption of potable water by 50-70%
4. It can also be used for various household purposes

Method of Rainwater harvesting

Though there are numerous methods for harvesting the rain water, but RanoliLatifpurvillage was focused on Slow Sand Filtration method, due to it's cheap, highly efficient and it can even produce potable water.

Fig 7 . Household water purification unit

Slow Sand Filtration

The most efficient, reliable and low-cost method which uses biological process to clean water and do not need chemicals or any other sources of Energy to function.

SSF is self-helped technique which needs basic human skills and construction material.

Studies indicates that application of such systems can significantly reduce the occurrence
of diarrheal diseases, which affect a large population of the world. (By Carolina Gemelli-2015)

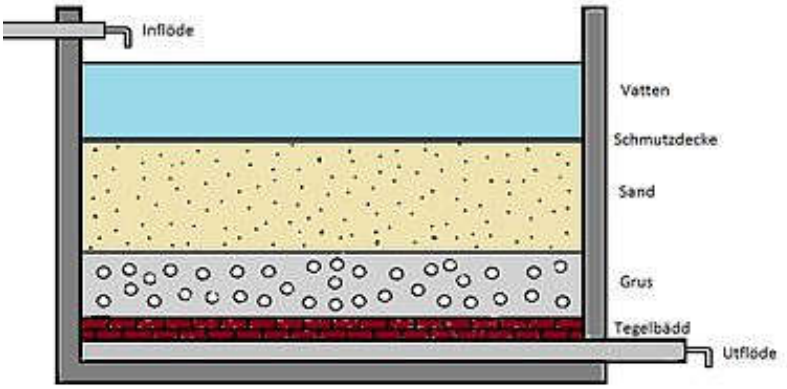

Fig 8 Slow sand filter

In Fig 8 there are three tanks, highest tank contains the raw water (i.e. rain water from roofs), middle tank works as rain water filter and lower tank is used to contain clean water. Fig 8 describes the slow sand filtration method. Primary filter purpose is to separate large particles from water. Depending upon the quality of water. A red brown sticky hypogenouslayer (dirty layer contain bacteria, fungus, algue, metal ions etc.) is formed on the top of sand layer. The water now filtrates through the Schmutzdecke, and thereafter filtrate through the layers of sand, and the two gravel layers, in the bottom a tube leads the water further in the system. The SSF purification techniques is further developed and explained under the titles function and maintenance.

Finally, water is now in the reservoir tank. Here the water is waiting to be poured through the tap installed at the end of the system, now the water is ready to be consumed as per Juni 2015 Handledare: Helén Williams

CONCLUSION:

1) Zero waste target can be achieved from solid waste management as all the waste is converted into manure.
2) Supports “Swachh bharat abhyan” as waste plastic is used to make bricks hence clean the environment.
3) 25% to 30% of wastage of water is reduced by rain water harvesting and slow sand filters.
4) It makes the project very economical and resource efficient.

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