ACHIEVEMENT TOWARDS SUSTAINABILITY: A STUDY IN THE NORTH-EAST INDIA WITH SPECIAL REFERENCE TO ECO- FRIENDLY HARVEST

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ABSTRACT

The North Eastern economy is mostly dependent on agricultural and allied activities. Regarding the demerits of water shortage vis-à-vis irrigation different communities from different States is skilled to utilize local people's farming potentials and the natural resources as a cost effective manner using locally available resources. Some of such traditional harvesting techniques include 'DONGS' in Assam, 'ROOF TOP RAIN WATER HARVESTING' in Mizoram, 'BAMBO DRIP IRRIGATION' in Meghalaya, 'WET RICE AND FISH CULTIVATION' of Ziro Valley of Arunachal, 'ZABO' in Phek district of Nagaland by the Chakhesang Naga tribes and so on. These styles of harvesting are eco friendly and productive .The tangible result of Sikkim proved the same .This article is an attempt to focus the major traditional way of harvesting system in North eastern region and their effectiveness in agricultural as well as environmental sustainability. Secondary data are utilized in order to compare the agricultural productivities of these states (using traditional way of harvesting) with the rest of the States of India as possible. At the end of the paper some problems of North-Eastern farming system are also presented with some suggestive solutions.

Key Words: North-East India, Traditional Water Harvesting System, Sustainability

1. Introduction:

Rain water harvesting system is one of the most important traditional harvesting systems have been in existence in India since the Indus valley civilization. This type of traditional harvesting system mostly practised in North Eastern states and also in other states State of India .The north eastern region comprising the states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. Economy of NE states is mainly rural and agrarian with its about 80% population depend agriculture and allied industries for their livelihood. The agricultural system is predominately traditional and can be broadly classified in two distinct types, viz; settled farming practiced in the plains, valleys, foot hills and terraced slopes, and shifting cultivation practiced in the hill slopes. This paper mainly focuses on the traditional harvesting system mostly practised in the North Eastern region. The NE region is one of the most ethnically diverse regions of the country. Each of these 8 states including Sikkim today has their own culture and ways of farming. The NE

region is a home of several traditional harvesting systems. Some of these traditional harvesting systems are still prevalent like Dongs system in Assam, bamboo drip irrigation system in Meghalaya, Wet rice cum fish cultivation in zero valley of Arunachal Pradesh, Zabo system of Nagaland, Roof top Water harvesting system of Mizoram and Meghalaya. From the ecological point of view, the entire region falls within the sub tropical belt of warm summer monsoon climate and it is found that the local water harvest system not only secures crop production but also stops soil erosion and improve the soil fertility i.e. these practises are eco friendly as well as product friendly. 'Water Harvesting' is the general name used for all the different traditional techniques to collect runoff or flood water for storage in the soil profile or in tanks so that it can be used for the production of crops, trees or fodder. Water harvesting also can be the collection of runoff water for human or livestock consumption. Much of the enormous water resources remain unutilized due to absence of proper water resource planning and scientific management. The efficient utilization and management of available rainwater is the core issue if the cropping intensity and production is to be enhanced. Rainwater harvesting and its recycling through the micro irrigation systems may revolutionize the regions agriculture by enhancing the production, productivity and quality of produce.

2. Objectives of the Study:

1. To focus on the various major traditional water harvesting system practise in the NE States of India & their effectiveness.

2. To show the consistency of the growth rate in agricultural production and the percentage share of north eastern states in total GSDP of the country from agriculture.

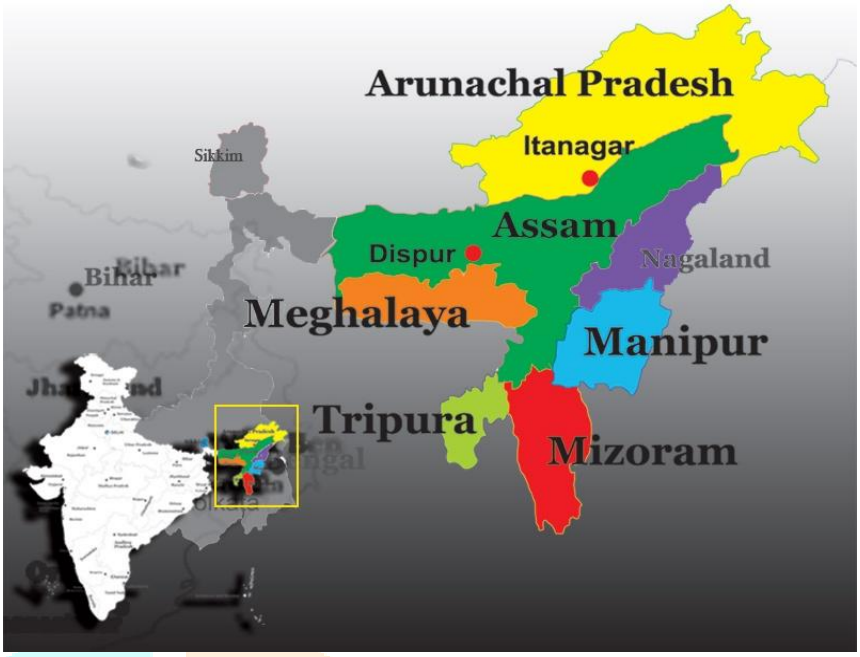
Actually we try to link this objective with the former. The basic reason is to prove that the NE regions are not lacking behind in comparison to the other Indian states in terms of agricultural productivity.

3. Statement of the problem:

The problem of the current study is to measure both at quantitative and qualitative achievements towards agricultural as well as environmental Sustainability in the North Eastern region using eco friendly harvest.

4. Glimpse of Study Area:

The north eastern region comprising the states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim lies between 20 81' and 29 30'N latitudes and 89 40' and 97 50' E longitudes. The region has an area of 26, 2240 Km2 (7.9% of the total land area of India), of which 72.6 per cent is hilly.



5. Methodology:

In order to study the problem both quantitative and qualitative approaches have been utilized .For both the approaches the entire data source is secondary collected from various journals, books, research papers, various government reports, articles, websites, various e-journals and other reliable sources.

6. Analysis and Discussions:

Just as in other things like agriculture, cuisine, dress and culture, the water managements system of NE were peculiar to the region. People in north east believe that it was creativity at its best when Earth was addressed as the Mother and the earth surface was compared to the lap of motherland. People in these states are masters of farming and know how to take care and seek all her blessings. They also know to evolve a harvesting system which is acceptable to all and sustainable to the environment as well as productive also. (*Dev,Nirendra,(2016) " sustainability & prosperity through eco friendly harvest" Yojana , April,2016, pp33)*

The major constraints are undulating topography, highly eroded and degraded soils and inaccessible terrain, land tenurial system, size of land holding and prevalence of shifting cultivation. Infact, there is no water when we really need it, but when we do not need water there is plenty of Water (*Ngachan, S.V.Rain water harvesting and its diversified uses for sustainable livelihood support in NEH region of India; ICAR Research Complex for NEH Region,Umiam-793 103, Meghalaya.)* .Perhaps this is the reason why rain water harvesting became an indispensable part of the NE region:

This section of the study explain major and very popular traditional Water harvesting systems which are still relevant in the NE regions -

Table no 1: Current water harvesting system in North-Eastern region

S.N	North -Eastern States	Respective Traditional Water Harvesting system
1.	Assam	DONG
2.	Mizoram	ROOF TOP RAIN WATER HARVESTING
3.	Arunachal	WET RICE AND FISH CULTIVATION
4.	Tripura	-
5.	Nagaland	ZABO
6.	Meghalaya	BAMBO DRIP IRRIGATION,JALKUND
7.	Manipur	-
8.	Sikhism	-

6.*1Dongs* -

Dongs are water canals constructed by the local people of Assam to harvest water for irrigation in the paddy field. These are mainly found in the Bodo populated area. In Bodo language it is called Doisa. These are individually owned with no community involvement. The sources of dongs are natural streams from which canals are cut to divert water to the fields. Water in the field is accumulated in a pond like structure from where water is lifted and taken in to the necessary portion by an instrument called "*LAHONI"*. Another structure called "*KOON"* is also used to harvest water from pond to the field. Koon is a wooden boat like structure handled with leg. With the help of Koon about 25Lof water is harvested per time. This is sufficient to irrigate a plot of land of 4-5 beegha in one day. With Lahoni about 10L of water can be harvested per time and a plot of 2 beegha can be irrigated in a day. The sources of dong are natural streams and most of the dongs are perennial. Some of the existing dongs are Bordong, Salana dong, Lungsoom dong of Dimoria block, Suti doisa, Nepalpara to Narabari doisa, Jumfoi-Bima dong, Jorakia-Buri dong, Kungreb doisa of Kokrajhar district. Most of the villages through which these dongs are passing are populated with SC, ST, general caste people and ex tea garden labours. The occupation of these people is mainly cultivation. The Kokrajhar district is mainly Bodo populated area. The 'Nepalpara to Narabari doisa' is unique as its source of water is rain water. The poor cultivators of about six villages constructed this canal as they are solely depended on cultivation. The head work of this canal is located at village Hazarika under Dotoma development block in Kokrajhar district of Bodoland Territorial Council. They used to trap rain water by constructing a pond at the northern side of the village Hazarika. The rain water

so accumulated has been distributed by the canal system to the vast agricultural fields of the villages Hazarika, Baladonga, 1 no Nepalpara, 2 no Nepalpara, 1no Narabari, 2 no Narabari under Dotoma development block. But after every heavy rainfall, this canal is destructed as huge run off enter the canal. Now the irrigation department has constructed the regulator to control the flow of water to the canals through various **switch gates**.

Dongs are traditional canals that carry water from the streams to the fields. Use of deep tube well water for irrigating fields can carry Iron and so may degrade the land. But dongs carry surface water and rain water and so these harmful effects can be ignored.

Fig 1- Koon to lift water from dong to crop field in Assam (Source:Inetrnet)

6.*2 Roof Top Rain Water harvesting system-*

Rainwater harvesting refers to structures like homes or schools, which catch rainwater and store it in underground or above-ground tanks for later use. One way to collect water is rooftop rainwater harvesting, where any suitable roof surface —tiles, metal sheets, plastics, but not grass or palm leaf — can be used to intercept the flow of rainwater in combination with gutters and downpipes (made from wood, bamboo, galvanized iron, or PVC) to provide a household with high-quality drinking water. A rooftop rainwater harvesting system might be a 500 cubic meter underground storage tank, serving a whole community, or it might be just a bucket, standing underneath a roof without a gutter.

The Main Objective of rooftop rain water harvesting is to make water available for future use. Capturing and storing rain water for use is particularly important in dry land, hilly, urban and coastal areas.

Rain water harvesting is practiced in Meghalaya, Mizoram and Nagaland. In Aijwal rooftop harvesting is practiced in almost every household. In Meghalaya rain water is collected by using gutters and stores them in earthen ponds. These ponds are covered by opaque plastics, straw or any locally available material to check evaporation. The floor of the pond is compacted to avoid seepage. The side of the tank is framed with bamboo. All these things are done in low cost.

Fig 2-Tanks for locking rain water for harvesting as well as drinking (source: Internet)

6.3Wet Rice cum Fish Cultivation-

The Ziro valley which is located at an altitude of 1564m is home to the Apatani tribe of Arunachal Pradesh.Apatanis have highly evolved indigenous system of farming which is unique in cultivation of both rice and fish together. The cause behind this highly evolved system is the limited resources available to them. So they have to develop a system through which they can utilise their limited resources perfectly. For maximum utilisation of their land they cultivate both fish and rice in the same field. For this field preparation starts after harvesting and continues till the end of the spring. Weeding is done three to five times and the weeds are dumped in the field to decompose. They

prepare the field by dumping household wastes, chicken and pig excreta, crop residue etc. Inorganic fertilizers are not used. They burn the rice stubbles that are left in the field after harvesting. Sometimes cow dung is used at a rate of 1000kg per hectare.

The Apatanis integrated fish cum paddy culture is a totally organic farming. They produce rice and fishes by properly utilizing their limited resources without wastage and pollution by using locally available material and unutilized materials in a productive way at a low cost which makes this system highly sustainable.

Fig 3- Earthen bunds in paddy field of Ziro(Source:Internet)

Fig 4 -Integrated rice-fish cultivation system (Source: Internet)

6.5 Zabo-

Zabo is an indigenous water harvesting system practised in Nagaland which has a combination of forest ,agriculture and animal husbandry with well founded conservation base soil erosion control, water resource development and management and preservation(*Agarwal, A. and Narain, S.,**1997**, Dying Wisdom: Rise and Fall of India's Traditional Water harvesting System. Centre for Science and Environment. New Delhi.p 59*) .The system is also called as 'ruza'.The place of origin of zabo system is in Kikruma village located at an altitude of 1270 meter in Phek district of Nagaland

inhabited by Chakesang tribe 'Zabo' means impounding of water. Zabo system involves harvesting with protected forestland towards the top of the hill, water-harvesting tanks in the middle and cattle yard and paddy fields at the lower side. Here, the water from the pond is passed through the cattle yard before taking it to the rice field for irrigation. The water carries with it the dung and urine of the animals to the field through split bamboo channels helping in providing good source of nutrition for the crops.

6.6 Bamboo drip irrigation system-

In Meghalaya, an ingenious system of tapping of stream and spring water by using bamboo pipes to irrigate plantations is widely prevalent. It is so perfected that about 18-20 litres of water entering the bamboo pipe system per minute gets transported over several hundred metres and finally gets reduced to 20-80 drops per minute at the site of the plant. The tribal farmers of Khasi and Jaintia hills use this harvesting system to drip irrigate their black pepper cultivation (Agarwal, A. and Narain, S., **1997**, *Dying Wisdom: Rise and Fall of India's Traditional Water harvesting System.* Centre for Science and Environment. New Delhi. p. 64)This system is known as bamboo drip irrigation. The bamboo drip irrigation system is normally used to irrigate the betel leaf or black pepper crops planted in areca nut orchards or in mixed orchards. Bamboo pipes are used to divert perennial springs on the hilltops to the lower reaches by gravity. The channel sections, made of bamboo, divert and convey water to the plot site where it is distributed without leakage into branches, again made and laid out with different forms of bamboo pipes. Manipulating the intake pipe positions also controls the flow of water into the lateral pipes. Reduced channel sections and diversion units are used at the last stage of water application. The last channel section enables the water to be dropped near the roots of the plant. About four to five stages of distribution are involved from the point of the water diversion to the application point. The water for betel leaf plants is diverted from streams by temporary diversions into very intricate bamboo canal systems. Betel leaf is planted in March before the monsoon. It is only during winter that irrigation water is required, and the bamboo pipe system is used. Hence, these bamboo systems are made ready before the onset of the winter, and during the monsoon no water is diverted into them.

Fig 5- Water ways and bamboo pipes used in Bamboo drip irrigation system (Source: Internet)

7. Rational behind rain water harvesting (sustainability and productivity approach):

7.1 North East is endowed with bounty of water resources accounting for about 40% of the total water resources in the country. The tentative assessment of this dynamic resource in the North East India is about 60 million hectare-meter. Unfortunately, this vast potential has not been exploited as yet. The region experiences a paradoxical hydro climatic environment and represents a typical hydrological entity in the world atlas. Endowed with huge water resources potential, it has also the worst water resource problems rendering untold sufferings to millions every year (*Ngachan, S.V.Rain water harvesting and its diversified uses for sustainable livelihood support in NEH region of India; ICAR Research Complex for NEH Regio ,Umiam-793 103, Meghalaya).* Based on the

Annual Report (1993), I.C.A.R. Research Complex for N.E.H. Region, Umiam **Monthly rainfall analysis** indicates that this region receives more than 84 per cent of annual rainfall during the months of May to October The region experiences excessive rainfall and high floods during these monsoon months and also suffer from acute shortage of even drinking, water in many areas in the other months. The basic issue underlying the water resources problems is recurring floods, drainage congestion, soil erosion, human influence on environment and so on and calls for its integrated use for drinking, irrigation, generation of hydropower, navigation, pisciculture, recreation etc. The **yearly rainfall analysis** indicates that out of the 15 years, the drought, normal and surplus months were 21.67, 70.56 and 7.78 per cent respectively. May to October is the major part of water surplus periods, while November to April is mainly categorized under the water deficit periods. The region loses the lion share of the rainwater through runoff (Surface water runoff & E.T Losses).It is in this background that the rainwater harvesting assumes significance. Rainwater harvesting is in reality extending the fruits of the monsoon based on the principle "Catch the water where it falls. Rainwater harvesting besides helping to meet the ever increasing demand for water (The approximate water demand for water in the region has been estimated to be 7.8 km3, 13.0 km3 and 19.2 km3 in 1995, 2010 and 2025, respectively.), helps to reduce the runoff, which is choking storm drains, avoid flooding of roads, augment the ground water storage and to control decline of water level, reduce groundwater pollution, improve quality of groundwater and reduce soil erosion. This is considered an ideal solution of water problem where there is inadequate groundwater supply or where surface resources are either not available or insufficient. The other advantages are that it helps utilize rainfall runoff, which flows into sewer or storm drains and therefore helps reduce flood hazards. The rainwater is bacteriologically pure and free from organic matter and soft in nature. The structures required for harvesting rainwater are simple, economical and eco-friendly.

Similarly now a day climate change had became a serious problem. Taking the example of Assam the average rainfall falls considerably .This is shown in the following table.

Table 2: Crop season wise average rainfall in Assam (in 2011)

		Kharif season				*Rabi season*				*All season*		
Year	**Actual**	**Normal**	**Deviation %**	**Pattern**	**Actual**	**Normal**	**Deviation %**	**Pattern**	**Actual**	**Normal**	**Deviation%**	**Pattern**
2011	**1411.1**	**2001.0**	**-29.5**	**deficit**	**155.5**	**295.3**	**-47.3**	**deficit**	**1566.6**	**2296.3**	**-29.5**	**deficit**

Source- Director of Agriculture Assam

On the other hand due to increase of population, burden on underground water is increasing day by day. So rain water harvesting can be a solution to this problem. Harvesting of rain water can minimize the problem of flash flood and also can recharge the ground water. In summary the rain water harvesting system have the following notable advantages.

- ✓ Provides self-sufficiency to water supply.
- ✓ Reduces the cost for pumping of ground water.
- ✓ Provides high quality water, soft and low in minerals.
- ✓ Improves the quality of ground water through dilution when recharged to ground water.
- ✓ Reduces soil erosion in urban areas.
- ✓ The rooftop rain water harvesting is less expensive.
- ✓ Rainwater harvesting systems are simple which can be adopted by individuals.
- ✓ Rooftop rain water harvesting systems are easy to construct, operate and maintain.
- ✓ In hilly terrains, rain water harvesting is preferred.
- ✓ In saline or coastal areas, rain water provides good quality water and when recharged to ground water, it reduces salinity and also helps in maintaining balance between the fresh-saline water interfaces.

7.2 In this section the paper tries to present some tangible benefits of this harvesting system. All the practises are organic as we know and they are also very productive.

Paddy cum fish cultivation is also practised by some farmers. Generally local variety of rice named 'Tanyekemucah' is cultivated. Annual yield of rice is 3-4 ton per hector and annual yield of fish is 50/60 kg / hector. The total production of fishes is 300-350kg per hector per year. The rice production is 3-4 t per hector under paddy cum fish cultivation in the Ziro valley (*Anonymous. **2006**, Annual report, Department of Fishery, Ziro, Lower Subansiri District, ArunachalPradesh).*

The hard work in Sikkim that stretched through last decade has been able to convert around 75,000 hectares of agricultural land into sustainable organic cultivation. In terms of tangible results, Prime Minister on January 18, 2016 has already declared Sikkim as country's first Organic state.

Besides, it is observed that the NE region have been experiencing an upward movement of the Gross State Domestic product(GSDP) in terms of agriculture & allied sector .Although We can't directly correlate this behaviour with the traditional rain water harvesting practices but these states uses such harvesting in extensive way in comparison to the other states of India .Again in the recent years there is no such significant boom in agricultural transformation in the NE region so that growth

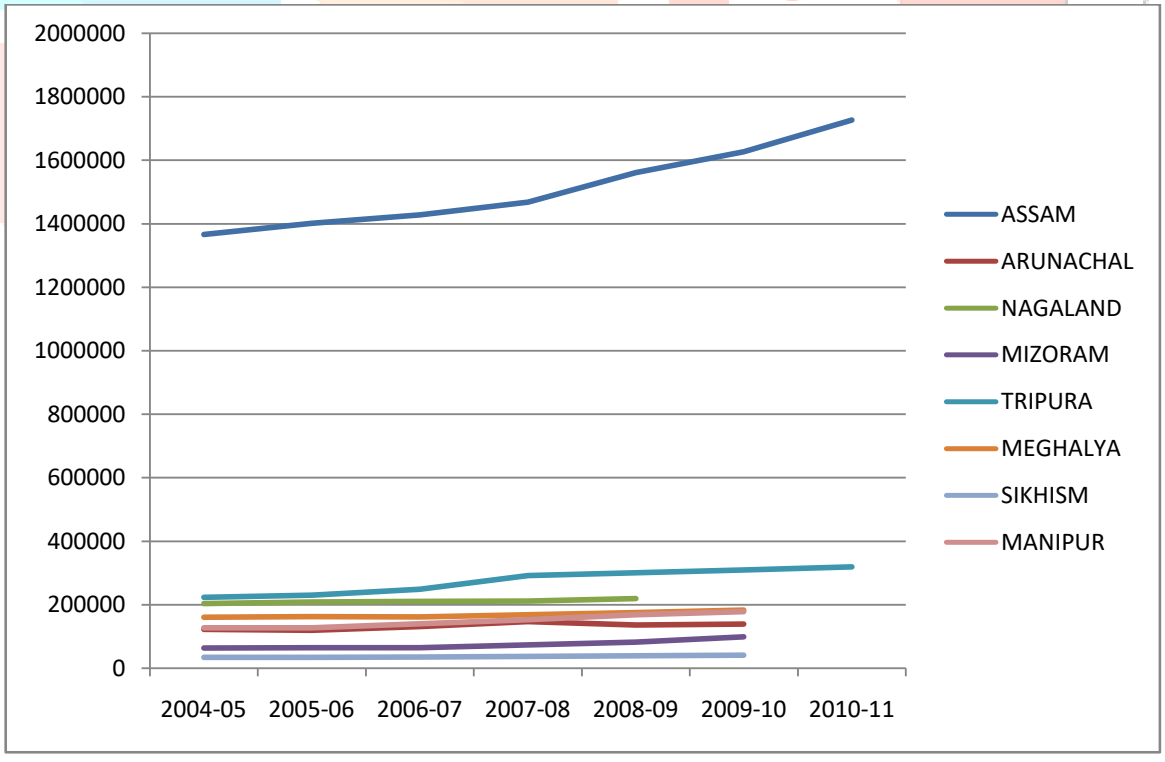
rate of Agriculture pushed up extensively. This is that background one can say the NE region maintaining a smooth growth rate through eco friendly harvest.

The following table & diagram shows the smooth growth rate of GSDP in terms of Agriculture & Allied activities are shown:

Table 3: Gross State Domestic Product of the NE region from Agriculture and Allied Sector at Constant (2004-05) Prices (Rs in Lakhs)

Sl.No.	*NE states of India*	*2004-2005*	*2005-2006*	*2006-2007*	*2007-2008*	*2008-09*	*2009-10*	*2010-11*
1	**Arunachal Pradesh**	**122199**	**119029**	**130642**	**146539**	**136093**	**138798**	**N.A**
2	**Assam**	**1365566**	**1400591**	**1427369**	**1467602**	**1560458**	**1626140**	**1725901**
3	**Manipur**	**127024**	**126644**	**126745**	**139434**	**152538**	**167724**	**178011**
4	**Meghalaya**	**152507**	**159973**	**162098**	**160612**	**167274**	**174681**	**182293**
5	**Mizoram**	**63025**	**64053**	**64227**	**73258**	**82198**	**98490**	**N.A**
6	**Nagaland**	**202912**	**208092**	**210112**	**211403**	**219263**	**N.A**	**N.A**
7	**Sikkim**	**32342**	**33677**	**33708**	**35027**	**36531**	**38842**	**40709**
8	**Tripura**	**223164**	**230328**	**248996**	**291763**	**300516**	**309531**	**318817**

Source: - Central Statistics Office, New Delhi.



The table & diagram shows the GSDP from agriculture of all the NE states at 2004-05 constant prices. The above table shows that how the agricultural productivity of north eastern states has been increasing over the years. .Among the north-eastern states the agricultural productivity of Arunachal Pradesh varying over the years from 2004-5 to 2009-10.But the other north-eastern

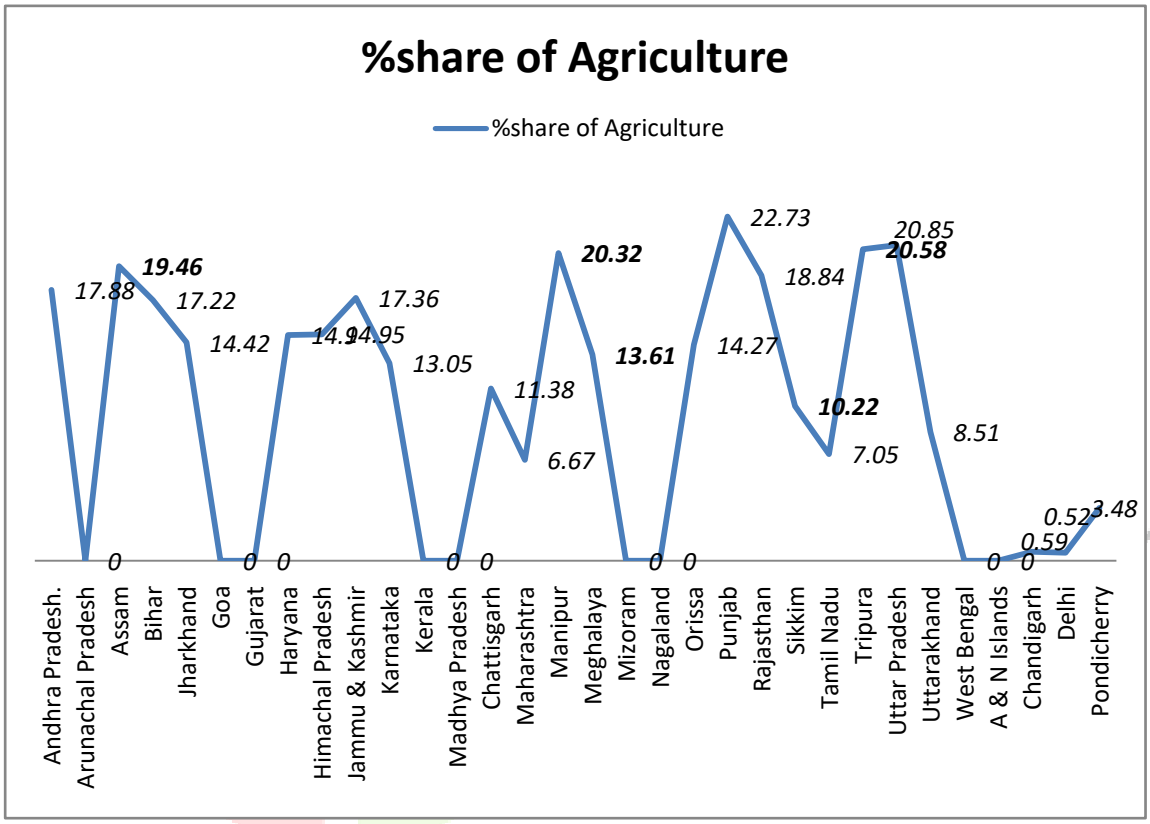
states like Assam, Mizoram Meghalaya, Tripura ,Sikkim, Nagaland and Manipur shows an increasing trend in their agricultural productivity growth rate over the years though the states practised traditional harvesting system. Among the N-E states Assam contribute highest in the country's GSDP from agriculture over the years. The contribution of agricultural productivity of other north-eastern in the GSDP of the country also has been improved over the years. .It has been observe that though the north-eastern states practise traditional harvesting system still their agricultural productivity shows an increasing trend compared to the rest of the States over the years. Similarly, % share of agriculture in total GSDP of the NE is very significant in comparison to the other states of India. This is shown in the following table & diagram -

Table 4: % share of Agriculture in the total Gross State domestic product (GSDP) at constant (2004-05) prices for 2010-11

Sl.No.	State\UT	GSDP from Agriculture(Rs in Lakhs)	Total GSDP(Rs in Lakhs)	% age share of Agriculture in total GSDP
1.	Andhra Pradesh.	6655400	37214200	17.88
2.	**Arunachal Pradesh**	**N.A**	**N.A**	**N.A**
3.	**Assam**	**1461357**	**7508207**	**19.46**
4.	Bihar	2445250	14203067	17.22
5.	Jharkhand	1125482	7804519	14.42
6.	Goa	N.A	N.A	N.A
7.	Gujarat	N.A	N.A	N.A
8.	Haryana	2464679	16538526	14.90
9.	Himachal Pradesh	584632	3911186	14.95
10.	Jammu & Kashmir	657883	3788692	17.36
11.	Karnataka	3542416	27135646	13.05
12.	Kerala	N.A	N.A	N.A
13.	Madhya Pradesh	N.A	N.A	N.A
14.	Chattisgarh	965663	8487986	11.38
15.	Maharashtra	5171485	77501995	6.67
16.	**Manipur**	**145993**	**718409**	**20.32**
17.	**Meghalaya**	**139608**	**1025915**	**13.61**
18.	**Mizoram**	**N.A**	**N.A**	**N.A**
19.	**Nagaland**	**N.A**	**N.A**	**N.A**
20.	Orissa	1813355	12710591	14.27
21.	Punjab	3415205	15024570	22.73
22.	Rajasthan	3693900	19604497	18.84
23.	**Sikkim**	**37206**	**364218**	**10.22**
24.	Tamil Nadu	2759356	39137245	7.05
25.	**Tripura**	**266468**	**1294740**	**20.58**

26.	Uttar Pradesh	8285780	39748819	20.85
27.	Uttarakhand	443633	5214288	8.51
28.	West Bengal	N.A	N.A	N.A
29.	A & N Islands	N.A	N.A	N.A
30.	Chandigarh	9357	1575400	0.59
31.	Delhi	96149	18325410	0.52
32.	Pondicherry	35935	1031750	3.48

Source: - Central Statistics Office, New Delhi.



The above table shows the percentage share of agriculture in the total GSDP of all the states of the country in 2010-11 at constant prices .Punjab occupies the 1St place followed by U.P. After that the NE region Tripura, Manipur, Assam occupy successive places by 20.58, 20.32 & 19.46% respectively. It has been observe that the north-eastern states also contribute a major portion to the total GSDP of the country from agriculture though they use the traditional harvesting system.

8. Problems:

Though rainwater harvesting is a good measure towards rescuing the state from acute water scarcity, it should be practiced with caution. Some problems are -

- **Unpredictable rainfall**-Rainfall is hard to predict and sometimes little or no rainfall can limit the supply of water for cultivation in the rain water harvesting system.

- **Jhum Cultivation**- The arguments against Jhum have included projecting it as an unsustainable practice that depletes the soil of nutrients, reducing the forest cover, causing Landslides,etc. Arguments against Jhum have come from state forestry departments, development ministries like DONER (Development of North East Region) or trade promoting entities like the World Bank who lean towards utilization of the region's forest resources for the benefit of national and private capital.
- **Initial high cost**- Depending on the system's size and technology level, a rain water harvesting system may cost high between Rs 13000 to Rs 130000 and from it cannot be derived until it is ready for use.
- **Regular maintenance**- Rainwater harvesting system may require regular maintenance as they may get prone to rodents, mosquitoes, algae growth, insects and lizards.
- **Certain roof types may seep chemicals or animal droppings**-Certain roof types may seep chemicals, Insects, dirt or animals droppings that can harm plants if it is used for watering the plants.
- **Storage limits**- During the heavy downpour, the collection system may not be able to hold all rain water which ends in going to do drains and rivers.

9. Suggestions:

- Using plastic sheeting is one option for storage of rain water without using a roof. Data revels that there would be an average daily yield of more than 60 litres over six months of the year from rainwater harvesting using an 8m2 plastic sheet for collection.
- Built of small tanks is one the main solution in case of shortage of rain water. The tanks were circular holes made in the ground, lined with fine polished lime, in which rain water was collected. In this way the people were able to meet their water requirements during the shortage of rain water.
- It is therefore more practical for people to make a onetime investment that will take care of their water needs permanently.
- The Public Health Engineering (PHE) department of the government conducts several workshops every year that impart grassroots, block and district level training to the masses regarding rainwater harvesting.
- Supplement water supply by drilling underground water. The water table recharged by planting numerous trees around courtyard, specifically chosen trees that raise and retain the water level, such as alders, plum trees and bottle brush.

- A collective effort towards all angles like forestation, recharging of the water table and pollution control will help alleviate the water crisis in the rain water harvesting system.

10. Conclusions:

The locally adoptable low-cost technologies for rainwater harvesting can be implemented as a viable alternative to conventional irrigation and drinking water supply schemes considering the fact that any land anywhere can be used to harvest rainwater. The experiences of NE region proved that the whole world have a lots of things to learn from them how to use the limited resources effectively for irrigation as well as drinking purpose and also maintain a healthy Environment. Sustainability is the outcome of proper use natural resources and Sustainability leads to progress in proper sense.

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