PERI-URBAN AGRICULTURE & ECOSYSTEMS

RESILIENT NARRATIVES

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PERI-URBAN AGRICULTURE AND ECOSYSTEMS
RESILIENT NARRATIVES

BACKGROUND

"URBANIZATION – BOTH AS A SOCIAL PHENOMENON AND A PHYSICAL TRANSFORMATION OF LANDSCAPES – IS ONE OF THE MOST POWERFUL, IRREVERSIBLE AND VISIBLE ANTHROPOGENIC FORCES ON EARTH."

(SANCHEZ-RODRIQUEZ, ET AL. 2005, 8)

More than half the world's population now live in urban areas and cities, and the trend of urbanisation is anticipated to continue, with Asian cities at the heart of urban growth. Cities are important entities in the climate change arena and particularly vulnerable to the impacts of climate change. They constitute complex socio-technical systems which makes it difficult to predict or assess their level of resilience to climate change.

As the cities grow and expand as a result of rapid urbanisation, the peri-urban areas become part of the cities and new peri- urban areas are formed. This phenomenon in India is creating severe problems in terms of infrastructure delivery resulting into inheritance of physical underdevelopment. In comparison to the enormous growth and environmental stress these peri-urban areas absorb, by virtue of their spatial adjacency to the city, their own conditions are dismal. These peri-urban areas also have the semi-natural ecosystems which provide natural resources for growing cities while depending on the urban markets for sales and employment. This two-way interaction changes even the lifestyles and mentalities of peri-urban inhabitants. The 'extractive' nature of urbanisation places a low premium on preserving the ecosystem, affecting not only the livelihoods of those directly dependent on it but also the city itself. Peri-urbanisation leads to encroachment of ecologically sensitive lands for housing and other construction activities. These change the face of agriculture, reduce open spaces, and enhance pressure on natural resources like water. These areas are marked by a lack of hygiene and sanitation infrastructure, industrial effluence, air pollution and inadequate provision of basic services. Often, the solid waste of a city is dumped in peri-urban areas (Marshall et al., 2009:7). All this leads the holistic development of cities into a precarious situation.

Environmental management of peri-urban areas is critical to the sustainability of urban and rural development as the ecological, economic and social functions performed by and in them impact on both the city and the countryside (Dutta, 2012: 4; Narain, 2009; Allen, 2003). Contemporary land acquisition policies in developing cities disregard social equity and environmental integrity, undermining a city's capacity to adapt to climate change and rendering the peri-urban areas and poorer populations very vulnerable. Environmental degradation, natural resource conflicts, health concerns and social injustice are particularly acute in the peri-urban areas that are excluded in formal planning processes (Prakash, 2012; Marshall et al., 2009). The lack of basic knowledge and timely information of the urbanisation process and its long-term ecological impacts constrains development planning authorities in analysing, managing and restoring peri-urban ecosystems (Dutta, 2012; Narain, 2007). Left unaddressed, the process leads to rural-urban synergies breaking down, environmental degradation and rising urban inequities and poverty (Prakash, 2012) which could be worsened by the impact of climate change (Mitra and Singh, 2011).

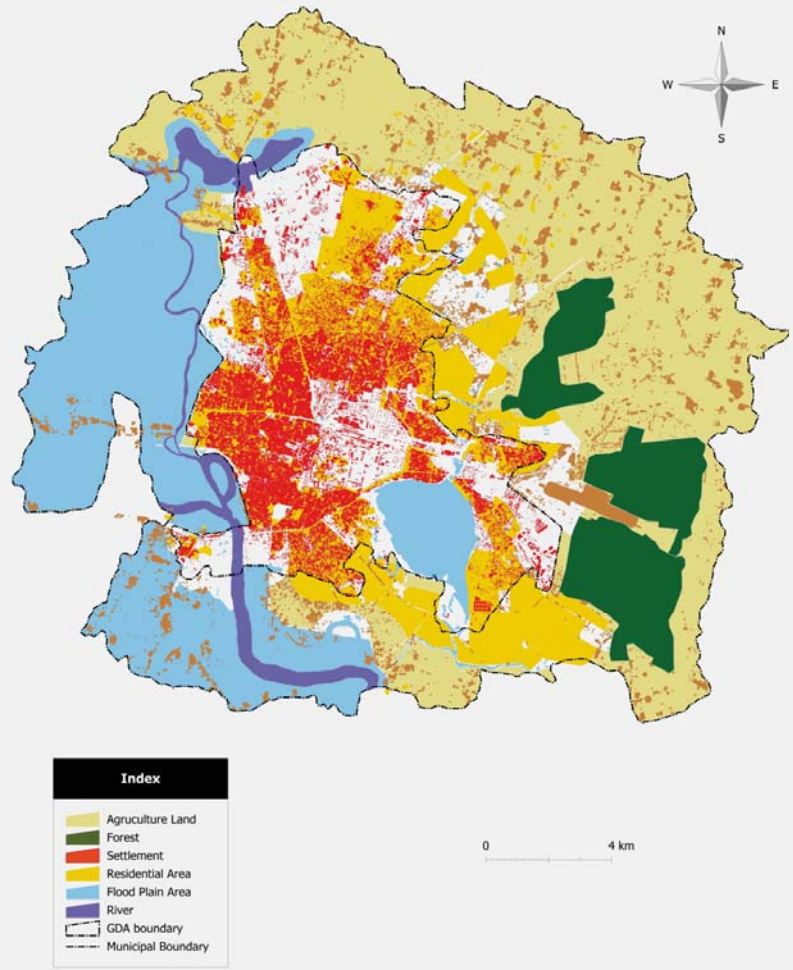
GORAKHPUR CITY – CHALLENGES OF PERI-URBAN AREAS

Gorakhpur, a secondary city, located in eastern Uttar Pradesh at the confluence of rivers Rapti and Rohin, has grown rapidly into an economic and institutional hub in the region. Its proximity to Himalayas has made the city susceptible to floods and water logging due to multiple factors, such as being located at a level lower than the river Rohin along which it is situated, discharge of excess water from Nepal and city's bowl-shaped topography. These problems are further exacerbated by climate uncertainties, impacting the livelihoods of poor and marginalized communities. Climate projections have indicated that the intensity of extreme rainfall in Gorakhpur is likely to increase in the coming years causing significant flooding in the city. Climate change is likely to increase the intensity of similar rainfall events by 10 to 20% in the future. The peri-urban areas of Gorakhpur are particularly prone to recurring floods and waterlogging for 2 to 3 months every year due to which small and marginal farmers suffer from crop losses.

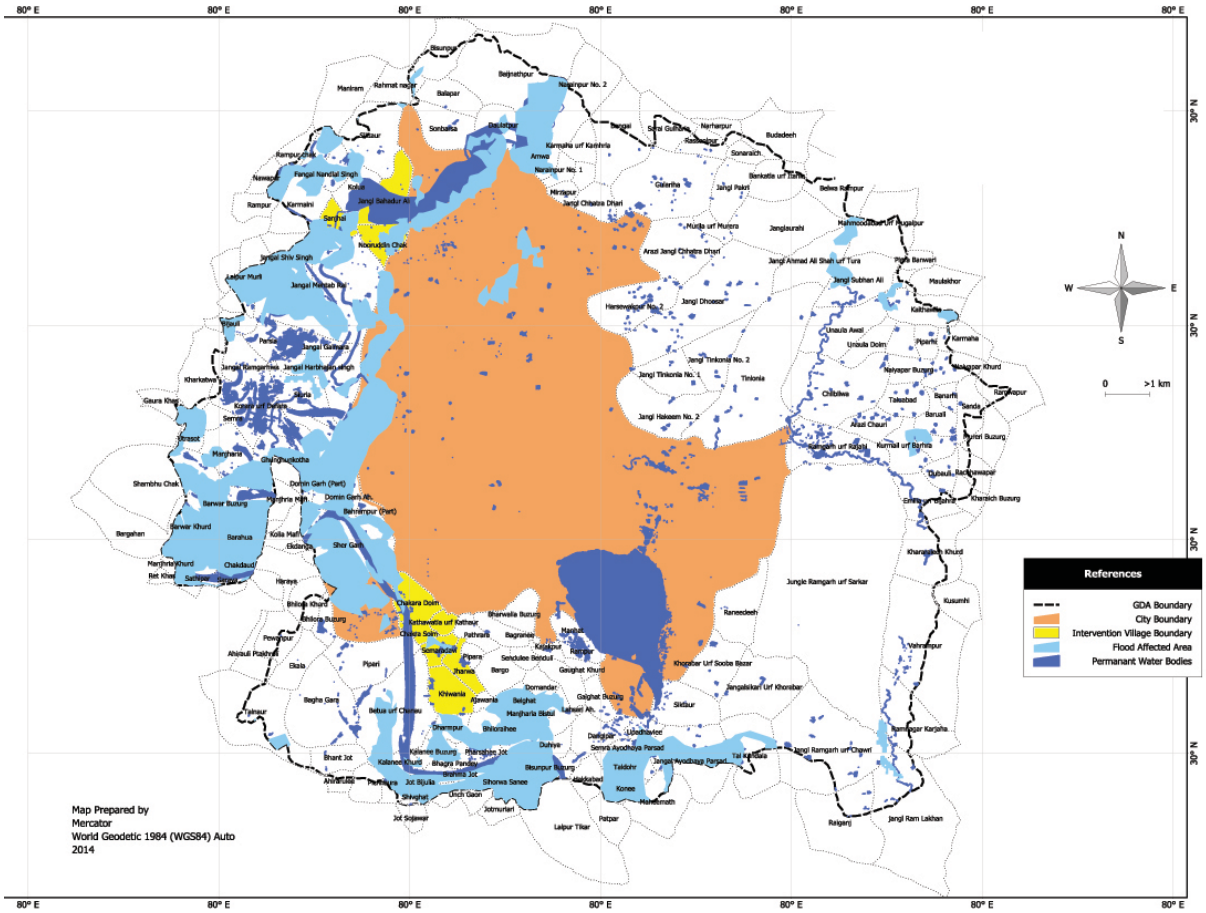
In the peri-urban areas of Gorakhpur, 8089 hectares of land is prone to flood. This is located in the western part of the city and gets inundated every year. In spite of flood plains and being a no construction zone, the rapid encroachment is being manifested in many parts. As per the satellite images of two time period (2002 and 2015), 267.42 hectares (33%) of land has been converted into built-up area. The north, north-east, east and south-eastern part of the city periphery are free from water logging and flood. This segment accounts 11558.17 hectares which is marked as agriculture land/green land. The city is growing in this direction. Due to rapid urbanization, the land mafias (builders) are more active in this zone and converting the open spaces/agriculture lands into residential area.

The rapid urbanisation occurring in Gorakhpur is straining the natural resources and is absorbing the existing agricultural land on the periphery of the city leading to decreased green/open spaces, interrupted supply of food items to cities, disrupted livelihood patterns, and reduced natural drainage of excess storm water. Large scale conversion of agriculture land for non-agriculture uses is exacerbating climate change risks by increasing water logging and run-off.

GORAKHPUR AND ITS PERIPHERY



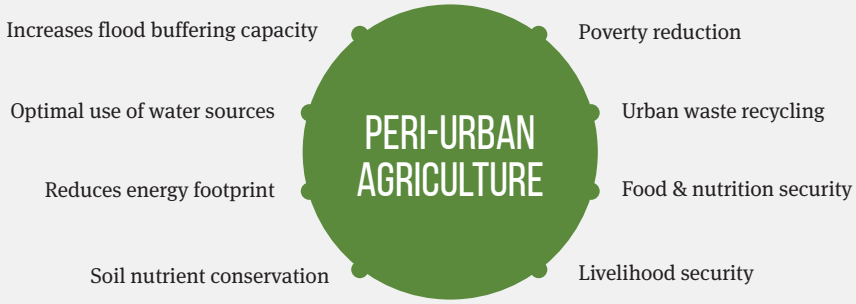
PERI URBAN GORAKHPUR FLOOD AFFECTED AREA



About 54% of the peri-urban area represented in the Gorakhpur city Master Plan-2021 for agricultural use, has a population of 0.1 million of which a significant proportion belongs to small and marginal farmers category. These farmers are hit by several problems which make them socially and economically vulnerable and prevent them from taking up agriculture in the peri-urban areas:

- **Floods and waterlogging:** Approximately 25% of the total peri-urban area in Gorakhpur is flood prone and in most parts, severe waterlogging takes place for 2 to 3 months. This results in deterioration of soil fertility and increased incidence of pests and diseases in the crops. Due to increased inundation, farmers were unable to sow the summer crops (*Kharif*) which eventually created burden on the winter crops (*Rabi*). This severely impacted the food security of the small and marginal farmers.
- **Sewage dumping:** Peri-urban areas are waste and sewage dumping grounds for the city. Improper management of solid waste and sewage leads to health problems, deteriorating the quality of soil and contaminating groundwater.
- **Increasing input cost in agriculture:** Peri-urban agriculture has become expensive for small and marginal farmers. The high input costs of seeds, fertilizer, irrigation and labour makes it almost unaffordable for these farmers. Due to this, the net gains are very low.
- **Inaccessibility to agricultural services:** The peri-urban farmers do not have access to agricultural schemes which are largely meant for rural

ROLE OF PERI-URBAN AGRICULTURE IN FLOOD AFFECTED AREAS OF GORAKHPUR



farmers. They are neither eligible for government subsidies on agricultural inputs nor have access to extension services. Hence, they lack knowledge and information on new farming techniques.

- **Changing land use patterns:** The land use patterns are changing in the peri-urban areas of Gorakhpur as farming has not remained remunerative enough for the farmers. This is also leading to distressed migration. Unplanned developments and non-compliance of the city Master Plan is leading to infrastructural developments on the agricultural lands.

PERI-URBAN AGRICULTURE – STRATEGY FOR BUILDING URBAN RESILIENCE IN GORAKHPUR

Peri-urban agriculture in Gorakhpur city of India represents a practical mechanism for diversifying urban livelihoods, particularly those of poor and marginalised communities, ensuring the availability of local food supplies, particularly vegetables and fruits and maintaining open areas that can serve as flood buffers. The land use pattern and ecosystem services in these areas are maintained to promote climate resilient peri-urban agriculture with innovative methods. This has resulted in securing livelihoods of small and marginal farmers, enhancing agricultural productivity and ensuring urban food security.

With the support of The Rockefeller Foundation, Gorakhpur Environmental Action Group (GEAG), an NGO based in Gorakhpur undertook this initiative which sought to mitigate flood risks through maintenance of open spaces by strengthening peri-urban agriculture based livelihoods around the city of Gorakhpur. While the initiative aimed at enhancing incomes and increasing food security for low-income residents, it also targeted to influence citywide land use planning decisions towards the goal of developing greater flood resilience.

Peri-urban agriculture, adopted as a strategy in the flood prone areas of Gorakhpur, is serving as a means to keep areas that are vulnerable to flooding, free from construction and to maintain their natural functions (enhancing water storage and infiltration; reducing run off) resulting in less floods and reduced impacts of high rainfall. It has worked in reducing vulnerabilities of the urban poor and enhanced their coping capacity to deal with impacts of floods. It has also helped in enhancing the food and income sources of peri-urban agricultural communities. Since most of the agricultural activities are done by the women members of the family, nutritional security has also been an important outcome of peri-urban farming. Peri-urban agriculture has helped in diversifying the food sources, thereby reducing energy footprints. This has also led to diversification in income opportunities which helped in times of economic crisis and in alleviating poverty. Preservation of local biodiversity and recycling of urban waste are other potentials that peri-urban agriculture has offered in Gorakhpur.

INNOVATIONS IN PERI-URBAN AGRICULTURE

GEAG has been promoting peri-urban agriculture in 200 hectares of Gorakhpur especially with small and marginal and woman farmers. The interventions are aimed at reducing risks and vulnerabilities of the poor population dependant on peri-urban agriculture and also of the flood affected population of the city. The underlying strategy is to make peri-urban farming economically viable among the farmers and demonstrate new techniques of farming which is climate resilient.

Climate resilient agriculture, based on the principles of integration of livestock-household-agricultural field is being promoted which is enhancing the diversity-complexity and recycling processes in the farming systems. Use of low external bio-inputs, appropriate crop varieties, space and time management, seed banking, land shaping and potable nursery systems are practices being followed by these farmers. Keeping in view the geographical conditions of the area and frequent flood events, farmers have adopted innovative farming practices to sustain their livelihoods:

Integrated and diversified farming systems

The integration and diversification of farming systems have helped the farmers in achieving robustness which makes it flood resilient because the chances of losses are minimized. Increasing **diversity** in agriculture means increasing the number of elements performing one function. Beyond the crops, the number of sub-systems in the farm like pond for aquaculture, orchards/kitchen garden, livestock, poultry and other such aspects has also added to the diversity of farm system. **Complexity** is also ensured as each of these elements performs multiple functions. **Recycling processes** adopted by the farmers among various farm sub systems fulfils several needs of the farm and hence reduces the need for external inputs. The figure below demonstrates an example of integration of farm sub-systems in the agriculture field of a peri-urban farmer. The figure also shows the resource flows which were existing before the intervention and the added flows post intervention.

Time and space management

Altering the timings of cropping cycle through pre-ponement, or postponement of crops was a successful strategy adopted by the farmers. Sowing varieties which can sustain water inundation was also helpful in saving the crops from flood effects. The traditional varieties in the area and other developed varieties by various research institutions were identified through participatory exercises and adopted by the farmers. Multi-tier cropping was another effective practice adopted by the farmers. The layers of crops were able to deal with various water levels during flooding in this area.

Loft Farming

In waterlogged areas, loft farming is an innovative way of doing farming. Farmers fill old tyres or sacks with soil and manure and seeds of climber vegetable crops. Lofts or stilts are made using wooden sticks on which the climber crops are supported for growing. The produce is saved from getting spoilt in the waterlogged fields.

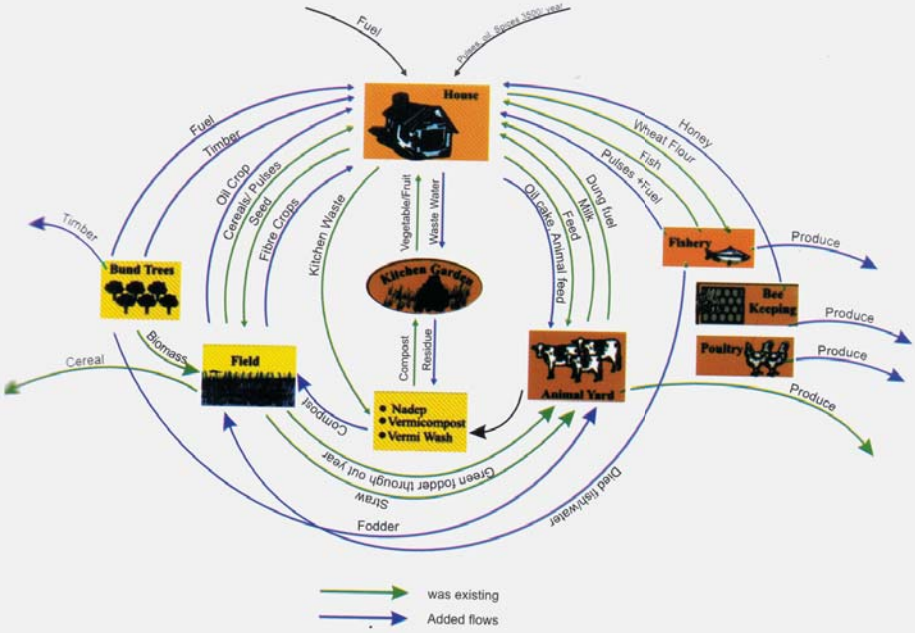
Raised low tunnel polyhouse

Raising crop nurseries during summers for transplanting in winters used to be extremely difficult due to extensive waterlogging. Farmers were trained to prepare and use polyhouse for raising crops. Farmers prepared a seed bed at high elevation (1 to 1.5 feet from the ground) in the field which was free from waterlogging. A mound of six inches high around the seed bed was made with a sloppy drain so that the rain water could not enter in the seed bed and excess amount of water drains out easily. This high raised bed was covered by low height tunnel polyhouse supported with bamboo sticks. Vegetable seeds of tomato, cauliflower, brinjal, chilly, etc are prepared in these seed beds and are ready for early transplantation.

Climber farming

Farmers of the area grow creeper vegetables like sponge gourd, bottle gourd, etc. but due to excess water and humidity in the soil, these crops do not survive. Farmers adopted an innovative practice of growing *dhaincha (Sesbania aculeata)* for green manuring and also used it as a support for the creeper vegetables.

INTEGRATION OF FARM SUB-SYSTEMS



Raising crops in thermocol boxes and jute bags

In waterlogged fields, farmers are using thermocol boxes and jute bags to raise climber crops such as bottle gourd, ridge gourd, etc. Soil and manure is filled in the boxes or bags and the vegetable seeds are sown in it. The climbers are supported through wooden sticks for growing.

Flood resilient crop varieties

Flood resilient crop varieties have been promoted among farmers. *Swarna Sub-1* variety of paddy and *PV-7* variety of lady's finger have shown successful results. These crop varieties grow even in flood and waterlogged situations.

Climate information advisory

Weather stations have been installed and mobile SMS-based climate information advisories are set up which provides weather information to the farmers in advance. Information on temperature, rainfall, wind and humidity are sent to farmers through SMS which acts like early warning systems and helps the famers in scheduling their irrigation, harvesting or other crop activities.

Promoting Low External Input Sustainable Agriculture (LEISA)

The adoption of LEISA practices such as local preparation of organic manure and pesticides has significantly reduced the use of high-cost external inputs like chemical pesticides and fertilisers, thereby increasing the net gain to small and marginal farming communities.

Presented in this document, are a few glimpses of very unique and successful experiences of innovations by the peri-urban farmers – innovations that are an effective synergy of science and indigenous traditional knowledge and wisdom of these farmers. These farmers have proven that peri-urban farming can be remunerative making their livelihoods profitable and resilient. Moreover, the peri-urban agriculture strategy has worked successfully in Gorakhpur where land-use patterns have not changed, the open and green spaces are being conserved hence, proving to serve as buffers against flood situations.

1. DIVERSIFICATION
MORE OPTIONS, LESS RISK

In the last several decades in Eastern Uttar Pradesh the frequency and intensity of floods has increased, with a recurrence every 3-4 years. In some places, this has become an annual feature and has had a considerable impact on people's lives and livelihoods. Summers too are prolonged with temperatures going over 45 degree Celsius, while monsoons have become erratic. As farmers face the brunt of changing weather patterns they find it increasingly difficult to plan for planting. The small and marginal farmers in peri-urban areas face further difficulty as they tend to receive very low returns for their agricultural products, both because of the poor produce quality and high input costs in the form of chemical fertilizers and pesticides. The added headache of water logging causes short shelf life of the produced vegetables often resulting in distress sales. All this makes these farmers extremely vulnerable, with almost no alternate sources of income.

Such was the case of Mahajan Yadav, a farmer from Semra Devi Prasad village, who traditionally grew only few types of crops on his 1.8 acre land. Then in 2012, he attended a training programme on multi cropping, and decided to change his approach to farming.

Today, Mahajan has moved beyond those few crops he formerly planted. His winter crop vegetables include potato, coriander, garlic, onion, wheat, peas, mustard, radish, cabbage, brinjal, gourds and tomato; while the monsoon palette has beans, gourd, lady's finger, paddy, maize and a range of lentils. He plants a mixed variety of vegetables simultaneously; like spinach which grows along with coriander. This diversity ensures that if one crop fails, the other may still work. He has build bunds between plots, and planted fruit trees like banana, guava, gooseberry, mango, lychee and papaya on them. These trees besides producing fruit and providing shade, also give enough wood that can be used as fuel. The trees number on his farm has increased by more than 60% now.

What Mahajan practices today is an integrated system of farming that combines vegetable farming with horticulture and animal husbandry. He prepares vermicompost, which combined with cattle manure gives him his own supply of organic manure. Besides this he makes chemical free pesticide for his crops and has developed a system for irrigation; all of which makes him self-sufficient. Mahajan is happy to experiment now, and uses innovative techniques, particularly during floods. He uses gunny bags filled with soil, compost and relevant seeds to grow limited vegetables during this phase. All these diverse techniques have led to increased profitability, better agricultural productivity, reduced market dependency and enhanced knowledge and capacity for Mahajan himself.

Mahajan explains,"More income means, lesser loans taken. There is more to eat for the family". Today he has become a role model

for other farmers. His experience has enabled many others to adopt multiple vegetable farming techniques and almost 25% farmers in the vicinity have embraced these techniques on their own farms. He is a mini celebrity, and has been interviewed on television and written about in the local newspaper.

Land is at a premium in the expanding town of Gorakhpur and land acquisition has become a primary threat to peri-urban areas. Over the last few years, land prices have risen drastically. Land within the Gorakhpur Development Authority boundary costs INR 250,000 or US$4000 per dismil (0.0099 acre) in the village of Semra Devi Prasad. Farmers here are under tremendous pressure to sell off their lands. Mahajan, when asked if he would sell his land says simply, "If I sell, what will be left for my children?" With a steady income from his land, Mahajan is now confident that he can hold on to his ancestral land and still make a confortable living.

42% Reduction of market costs due to minimal external inputs

Net Annual Profit
(Before project intervention)
INR 8-10,000/-

INR 70,000/-
Net Annual Profit
(After project intervention. Intervention includes increased vegetable farming that resulted in higher returns and less external inputs)

2. HERE COMES THE 'AGRICULTURE LADY'

Marginal farmers (who own less than one hectare of land) in Gorakhpur district of Uttar Pradesh, constitute 74% of the farming population. Besides them, there is also a significant population of landless (shared croppers and agricultural labourers) who depend on agriculture as a source of livelihood. With increase of state control over agriculture, there has been an effort by the state to provide extension services to farmers. But these services generally address large landholding and primarily male farmers, and are by and large 'need-based' and 'top down', rarely involving farmers in the planning process. Further, they are target oriented and not focused on the capacity building of farmers. This leaves the farmers uninformed about new techniques and technologies of farming for a particular cropping season. And more importantly, these extension services have no clear strategy to address women farmers or how to involve them in the trainings. The Extension staff is mostly men, who are generally not sensitive to the convenient times and locations where women can participate in trainings in greater numbers. Moreover, extension support systems are geared towards high external input agriculture, particularly of cereal crops and rarely address issues related to low inputs farming carried out by small and marginal farmers.

What was needed was an 'alternate extension system' that could address the specific needs of small, marginal and women farmers. One of the initiatives that emerged for the peri-urban areas of Gorakhpur, was the Farmers Field School (FFS), a platform where farmers could share experiences and collectively solve agriculture related problems. The concept of FFS is based on two premises; the first, that though farming is done independently on individual farms, farmers do like to share information and extend support to each other when required; and the second, that farmers based on their traditional and other inherent knowledge, like to experiment and also 'learn while they do'.

FFS does just that. It facilitates experimentation, dialogue and shared decision-making. The process itself involves village meetings, held on a fixed day every month, where a seasonal action plan is prepared each year. A few farmers are selected as Master Trainers, and are schooled on issues related to low input sustainable agriculture, ranging from seed selection to preparation of bio-manure and bio-pesticides. 'Problem cards' are distributed a fortnight before the meeting, wherein farmers note their specific query which are addressed and solved through discussion in the FSS. Master Trainers and other subject specialists ensure their follow up in the succeeding meetings. Besides this, FFS also attempts to link farmers to agricultural universities and other government departments .

Additional support to the farmers also comes from the Agro Service Centres that have been set up. These centres established in clusters of five villages are coordinated and managed by women's Self Help Groups. They enable the availability of quality inputs such as seeds, vermicompost, bio-fertilizers, bio-pesticides and treadle pumps (low-cost,

"Being a Master Trainer has given me the confidence to deal with the flower agents even on the phone"

manually driven pumps for irrigation) and facilitate the direct marketing of these inputs to the farmers. They also have small laboratories that allow farmers to test their soil for better outputs.*

Asha is one such Master Trainer from the village of Semra Devi Prasad, trained through the FFS. Her family owns 3 acres of land, on which they practiced mixed farming, growing primarily wheat and mustard with very little diversification earlier. Asha recalls how these fields were bereft of any crop during monsoon and subsequent flooding. Today the situation is quite different, and they are able to grow paddy in their field even during the rainy season. Her family also has guava orchards, that act as a kind of insurance during floods. For value addition, Asha participated in a training programme on jam and jelly making. She now makes guava jam and sells it in the market. Asha has five children, all of whom lend a helping hand in farming.

The success of mixed farming has given Asha the confidence to experiment and she has begun to dabble in floriculture too. She cultivates Gladioli and Marigold flowers, for which there is ample market demand, and buyers approach her directly. She confesses shyly, "Being a Master Trainer has given me the confidence to deal with the flower agents even on the phone".

But it has not been an easy journey for Asha. People were skeptical about how she, a woman, could understand diverse farming techniques, let alone teach them. But, as successful results from mixed farming became evident, fellow farmers began to respect her and now say, " Here comes the 'agriculture lady' ".

Living in the peri-urban area of Gorakhpur, Asha realizes that farmers like her gain from the city because they can sell their produce with ease. Also their agricultural land acts as a buffer against floods in the city. A win-win situation for both!

Asha has:
conducted training sessions
15
has trained
126
farmers
(85 female and 40 male)

Net annual profit before intervention
INR 14,325/acre

Net annual profit after intervention
INR 26,342
/acre

* ftp://ftp.fao.org/sd/sda/sdar/sard/English%20GP/EN%20GP%20Asia/Alternate_extension_India.pdf

3. UNITED WE GAIN

The village of Semra Devi Prasad, like all the others in this region, has no sewerage system and open drains run uninterrupted through the entire village. Lack of adequate drainage system results in sewer water spilling over large peri-urban areas and contaminating drinking water sources. This problem acquired ominous proportions, as over 165 households were affected with severe health problems, as also 45 acres of farm land. These water quality and health problems were assessed, and a petition filed in office of Municipal Commissioner and Divisional Commissioners.

Decentralized Waste Water Treatment System (DEWATS)

DEWATS stands for "Decentralized Wastewater Treatment Systems". DEWATS represents a technical approach rather than merely a technology package.

DEWATS applications are designed to be low-maintenance: most important parts of the system work without technical energy inputs and cannot be switched off intentionally.

DEWATS applications provide state-of-the-art technology at affordable prices because all of the materials used for construction are locally available.

The unique feature of Decentralised Wastewater Treatment Systems (DEWATS™) is that it mimicks nature without the intervention of chemicals and mechanical elements.

Sources: http://www.cddindia.org/about-us.html and http://www.borda-net.org/basic-needs-services/decentralized-wastewater-treatment.html

Meanwhile, efforts were made to improve the village sanitation and reuse sewer water for micro-irrigation. A baseline survey of the village was conducted to determine the consumption of water per household and the volume of discharge. Based on the information collected, a drainage map was prepared and discussed with the village. The village was asked if they would consider establishing a Decentralized Waste Water Treatment System (DEWATS). A committee was then set up to look for appropriate land where the system could be established and a 0.004 acre plot was allocated for this purpose.

The village Panchayat gave permission and construction started, with the village community pitching in with free labour. However, there was opposition from the government at Block level, and construction was halted. The Farmers Club then took up the issue and approached the Block Development Officer (BDO), who after being convinced of the plan, gave permission. There was initial opposition from people who were skeptical about the efficacy of the system, and those who were interested in encroachment of the selected land. However, the system was formally inaugurated by the Divisional Commissioner in 2014, with the construction completed in 2015 and it was finally handed over to the community in 2016. The Consortium for DEWATS™ Dissemination (CDD) Society helped establish this system.
Previously sewage water was used for irrigation in

"We now have clean water for irrigation, less conflict and healthier people"

the surrounding fields, but after the establishment of this system, treated water is used. Six hectares of the surrounding land now benefits from this irrigation. All drains in the village are covered, resulting in less disease and better sanitation and hygiene. The rainwater that resulted in flooding of the streets earlier is now channelized into the drains. This has also resulted in less conflict amongst the people.

Says Vinod who is a member of the Panchayati Raj Institution, "We now have clean water for irrigation, less conflict and healthier people. Importantly, this has given an impetus to continue agriculture in the peri-urban spaces. Further, if not used for irrigation, this water will replenish our water bodies".

This village has set a precedence, and led by example.

Mohammad Razakh
The Game Changer for Village Shekhpurva

In the village Shekhpurva, it was not possible to find appropriate Gram Sabha land where the drains could be connected at one place. Few people came forward to donate part of their own land, but withdrew the offer at a later stage. It was then that Mohammed Razakh made the offer for some of his land. Mohammed Razakh is a highly respected elder in the village and is looked upon as a role model. He is also a model farmer and practices mixed farming. The DEWATS is under construction here. 70-100 farmers will benefit from this system and it is estimated that the clean water will irrigate 60 acres of land.

Total No. of households involved
150

Direct Irrigation from DEWATS
3.50ha

4. THE RELUCTANT FARMER

Agriculture has become an expensive proposition for small and marginal farmers in the peri-urban areas of Gorakhpur. With high costs due to external inputs such as seeds, fertilizer, irrigation and labour, the net gains have reduced considerably. The impending threat of flooding made farming even more risky until some villagers adopted a new idea, the Low External Input and Sustainable Agriculture (LEISA). This is an agriculture system based on principles and options that are ecologically sound, economically feasible and culturally acceptable. It includes bio-pesticide (cow urine, neem products, tobacco, ash etc), composting (pit), tree plantation, vermicomposting, liquid compost, nadep compost, seed treatment and seed production. This has significantly helped in reducing the high cost of external inputs; for example, preparation of organic manure and pesticides cut down on the purchase of the same products from the market.

Kamboj Kumar, from village Jharva, was not a farmer in the true sense. He did grow wheat on his 0.6 acre field, but got very low returns, since the land was low lying and subject to water logging. His income came from a small shop that served as a means of livelihood for him and his family. He attended the Farmers Field School, but did not actively participate in its activities nor showed any interest until almost a year after the training.

What caught his interest was the low tunnel poly house technology, particularly beneficial for low-lying areas. This is based on a greenhouse technology that lets in light and sun, and prevents heat from escaping. However instead of glass these structures are made from a cheaper alternative, polythene or plastic. He builds such low tunnels on the higher reaches of his fields (bunds), with transparent coverings fixed over vegetable rows to help plant growth. Not only did he raise saplings for out of season vegetables but also reduced plant mortality. Today Kamboj has a vegetable nursery and sells seedlings and saplings to neighbouring farmers. He has also taught this technology to others farmers and helped twelve farmers set up these structures.

Kamboj is now a Master Trainer, and has been interviewed by the national television channel, Doordarshan. He says proudly, “Farmers come to me for a range of information relating to agriculture”. Improved monetary benefits have enhanced his

"Farmers come to me for a range of information relating to agriculture"

and his family's lives. From a very reluctant farmer, Kamboj has now become a proponent of LEISA, particularly the low tunnel poly house technology. He believes that vegetable cultivation gives him more profit and better nutrition for his family, compared to the wheat he was growing earlier, even though the work now is more intensive. Innovative technology and the resulting benefits have reaffirmed Kamboj's faith in agriculture. He does not want to lose his land to urbanization and hopes that this will not happen at least in his or his children's lifetime.

Loss of annual income as a result of water logging

INR 8,000/-

Net profit per season

INR 3,500/-

Income before intervention

NIL

Annual output income after intervention

INR 6,000/-

5. BUILDING BRIDGES AND ESTABLISHING LINKAGES

The term 'peri-urban' is relatively new, defined in multiple ways. It is the transitional zone between a city and its rural surroundings. Despite the fact that this area in India is occupied by a significant number of people, it lacks a formal recognition and/or status by governments. In the context of Gorakhpur, although the word itself is not mentioned, it is used by officials and is classified on the basis of whether the locality falls within the city's master plan or not. There is a lack of clarity about the concept by the administration which gives rise to several administrative issues. The primary one is that there is no separate distinct department to deal with this region. There is even less coordination between the existing departments, no common platform or forum and no action plan. As a result, peri-urban areas are often excluded from rural agricultural schemes and developmental programmes. Thus no extension support is available to this already vulnerable population. There appears to be a void that needs to be bridged.

Ramrajya Yadav, from village Jharva, worked on restoring this link at the village level. In 2007, he was part of the Kisan Mitra Yojana that provided technical support to farmers and also helped to link them to various government schemes. However, this scheme did not last very long and he worked for 15 months in a government department. This exposure helped him understand how farmers could be provided with support services. In 2012 he got associated with GEAG's ongoing initiative in the region. He now facilitates farmers to link with relevant government programmes and schemes such as the National Food Security Mission. He facilitated the setting up of veterinary camps for cattle vaccination, an important activity for flood prone areas and helped organize the Kisan Mela in his village in 2011. Today he helps farmers who are interested in poultry farming, and assists other farmers, particularly women to establish linkages with relevant people for floriculture. Says, Ramrajya, "I have myself learnt through experience and now hope to help others".

"I have myself learnt through experience and now hope to help others"

Ramrajya has facilitated:

5 FARMERS
with cultivation of marigold flowers

8 FARMERS
with cultivation of gladiolus flowers with the support of gladiolus bulbs

10-12 FARMERS
with seed input of wheat

3 VILLAGES
to procure organic manure through government schemes

2 BORE WELLS
through government schemes

6. MAXIMIZING RETURNS

Ram Bilas, a farmer from village Chakradoyam, has a guava orchard and an additional one-acre of land. He supports a family of five, a wife and four children. Over the years, Ram Bilas has dabbled in many livelihood means. He has sold soil; bought fruits and vegetables from farmers and sold them in the market; worked as a mason and also sold dairy products. All this gave him a good income, and returns from dairy enabled him to get his daughters married. At this point he also bought an acre of land, where he produced wheat. In 2012, he participated in the Farmers Field School, and was introduced to the concept of mixed vegetable farming.

Today, Ram Bilas grows a range of vegetables in his one-acre plot with adequate time and space management. Using techniques under LEISA, he has significantly increased the output in his field. Earlier, he would get one quintal of spinach in the season, now he gets 15. So inspired is Ram Bilas by the techniques taught to him in the Farmers Field School and the results he has encountered from applying them, that he is now ready to share his knowledge with others. He is now a 'Model Farmer' and a resource person. Says Ram Bilas, who believes in learning by doing, says "My farm is my home, my religion".

He makes and uses organic pesticides and fertilizers by methods taught to him during training. He is happy to write off the marginal damage done by pests. "How much will these insects eat, anyway?" he asks. The Farmers Field Schools have revived a lot of traditional knowledge that farmers used at one time but had forgotten over the years. Ram Bilas, for example uses diluted goat's milk as a spray for better fruiting and flowering of plants. He sells his vegetables by setting up a stall by the roadside. These are in demand, as they are chemical free and of superior quality. He now boasts of a fixed clientele.

He is passionate about his vegetable farming, which is evident from the enthusiasm he shows when he talks about it.

The impact of sustainable low input farming appears in terms of shifting from low diversity to higher diversity. In five years there has been a remarkable attitudinal and behavioral change amongst farmers.

The analysis below indicates that adoption of practices have made following major changes for Ram Bilas:

Aspect	Farmer Ram Bilas	
	2011-12	2014-15
Field (Species)	15	20
Livestock (Species)	01	01
Composting (Type)	01	02
Perennial tree(Species)	03	05
Kitchen garden(Species)	0	02

Annual input 2014

INR 12,356/-

Annual output 2014

INR 36,312/-

Net annual profit seasonally

INR 23,956/-

Resource flow

Criteria	*2011-12*	*2014-15*	*Changes*	*Remark*
No. of Sub system	03	04	33 %	Increase
No. of linkages	01	03	200%	Increase
Mkt. dependency	74%	41%	44%	Decrease

7. GENDER EMPOWERMENT THROUGH FARMING

Chanda Devi and her family from village Sanjhai own 1.2 acres of land on which they farmed wheat. Wheat cultivation never quite reached its desired potential due to changing weather patterns that fluctuated between drought, floods and extreme temperatures. Chanda sold grass, tried her hand at vegetable farming, while her husband worked as a mason to supplement their income. But the crop was impacted by pests, frost and extreme heat, and the yield was never significant enough to sell in the market. Then in 2012, Chanda attended the Farmers Field School and learnt about mixed vegetables farming and LEISA techniques. She and her husband decided to give this a try. Their learning paid off, and their returns were significantly higher. A beaming Chanda confesses, "Once we got a higher return on our produce, we had the urge to learn more about these techniques".

Now for each season, there is an elaborate plan of what is to be planted where and in how much area. A record is maintained on the input and subsequent yield. The substantial increase in the income of the family from the sale of vegetables has enabled them to purchase a shop where they sell provisions. They have also bought a tractor and a trolley that they loan out to other villagers. They have thus been able to diversify their income sources, gradually moving towards a better and more secure future. Chanda now has the confidence to experiment with other crops and is even growing rice, something that she did not do earlier. Training in mushroom cultivation has motivated her to try her hand at this too. At present, mushrooms are grown only for the consumption of the family. Besides income, there is better food security for the family and hence improved health and nutrition conditions.

Chanda is now a Model Farmer and a Master Trainer, active in the Farmers Field School and at the Agro Service Centre. She has traveled to many other cities in the state to share her experiences with other farmers, and also been interviewed on the local television channel.

She, along with 80 other women, sell their vegetables at the alternate day market nearby. These women then went a step further and decided to get a designated place in the market. They approached the contractor and their consolidated effort succeeded in them getting a place. Now a board proudly proclaims who they are in the market.

Seasonal Input and Output with number of crops grown in each season.

Annual input (per acre)

INR 12,695/-

Output per year/acre

INR 40,756/-

No. of crops in a year

45

Net profit per season per acre

INR 28,061/-

Resource flow of Chanda Devi *(in Rs.)*

Criteria	*2011-12*	*2014-15*	*Changes*	*Remark*
No. of Sub system	02	03	50%	Increase
No. of linkages	02	04	100%	Increase
Mkt. dependency	82%	64%	23%	Decrease

Average per acre income *(in Rs.)*

Aspects	*2011-12*	*2014-15*	*% Enhanced*
Per acre crop profit	21,831	28,061	6230 (29%)

8. PROMOTING SUSTAINABLE AGRICULTURE

Shubhavati from village Sanjhai, was a regular user of chemical fertilizers and pesticides on her 1.10 acre field. She was cognizant of the costs of these external inputs but did not know that there could an alternative. Infact, she was not even aware of the negative impacts of these on her produce or farm, till like many other farmers, she undertook training in LESIA techniques, through the Farmers Field School.

Today she is an avid follower and promoter of these techniques. She makes her own biopesticides such as the *matkakhad* wherein readily available ingredients such as cow dung, cow urine, jaggery and gram flour are prepared in an earthen pot. When this is sprayed on crops, it is effective both as a fertilizer as well as a pesticide.

She also makes her own compost through various methods. She has a pit where she demonstrates the Nadep method of making compost where different type of compostable material is layered in a mud-sealed structure, built with brick and mud. Rapid decomposition converts the organic material into rich compost. She, along with other farmers in the region also promotes vermicomposting. Earthworms are capable of consuming a range of organic matter, In fact they can eat an equivalent of their own body weight per day. The excreta (castings) from these worms is rich in many elements such as nitrate, calcium, potassium, calcium and magnesium. Also the passage of soil through the earthworms promotes growth of bacteria, also beneficial for agriculture. The Cow Pit Pat (CPP) manure is another method that she is uses.

Besides using these techniques in her own field, she also teaches other women farmers about this green technology. 200 women have benefited from her training programmes. Shubhavati shares her thoughts, “I feel so empowered by teaching these techniques to other women and would love to learn new techniques”. Personally for her there has been a considerable reduction in external inputs on her land, which has also brought down the cost of agriculture. Not only does she sell her vegetables in the market but ensures her family eats the same, thus securing their better nourishment..

"I feel so empowered by teaching these techniques to other women and would love to learn new techniques"

External cost dependency

Aspect (Approx)	***External cost Dependency***		***Reduced outside dependency (Approx)***
	2011-12	2014-15	
Fertilizer	Urea, DAP, Potash, Zink	CPP, NADEP, Vermi Compost, Matka compost (64%)	21%
Pesticide	Indosulfan,Cyper, D-N-45 etc (100%)	Cow urine, Ash, Kerosene oil, ITK practices (80%)	20%

9. INNOVATION IN FARMING: COMBATING FLOODS

Floods in Gorakhpur region are a common occurrence. These floods have an adverse impact on agriculture, the primary source of livelihood for people living here. They also cause large-scale destruction of property and rural infrastructure leading to the disruption of local community lives. Torrential rains cause severe water logging in the low-lying areas, causing further stress to the farmer community. However, innovations in agriculture through peri-urban programmes have helped these farmers cope with such unwarranted situations and are proving to be beneficial.

Mithai Lal, owner of 1.1 acre land, is a small farmer from Sanjhai village. The agricultural produce from his land was very poor in comparison to the inputs. He was unable to grow vegetables during the monsoon due to water logging, and had to resort to labour work during this season for the lack of any other skills. His dependence on the market was significant for seeds, chemical pesticides and fertilizers. Nor was he equipped with any know how or technical knowledge on the basis of which he could bring about improvement in agriculture. Fortunately, in 2012, he was introduced to a range of techniques through the Farmers Field School.

One of the methods to grow vegetables even during the floods appealed to him and he decided to give it a try. So now, he practices platform farming on his terrace, particularly during the flooding season. He has developed nurseries on bamboo platforms. Seedlings are nurtured on top of the platform and either continues to grow there or are transplanted to another area when the floods recede. Through this method Mithai Lal now successfully grows vegetables, uninterrupted by the monsoon season. As he says, “At least my family has enough to eat during monsoon”. He also sells the seedlings raised in his nursery, and his annual income from their sale ranges from INR 300-1500/-. Mithai Lal now shares his expertise with other farmers, and more than 16 farmers have adopted these practices, and made their farming more monsoon proof.

Annual input

INR 8,963/-

Annual output

INR 36,859/-

New annual profit

INR 27,896/-

"Now at least my family has enough to eat during monsoon"

10. THE SEED MAN

Growing and consumption of vegetables is a step towards better nutritional security for a farmer and his/her family. But for successful vegetable production, there is a need for better seeds, improved cultural practices and superior plant protection methods. Among all these inputs, the seed is a key component. It is estimated that the quality of seed accounts for 20-25% of productivity. Significance of quality seeds has been recognized over centuries, and even the Rigveda, our ancient scripture says," A good seed in a good field will win and prosper".* An age-old common practice among the farming community is to save a portion of the of produce as seeds, for the next cropping season; And farmers in Gorakhpur area do the same for cereal crops. However, since commercial vegetable farming is a relatively recent initiative, farmers have now begun to save vegetable seeds also.

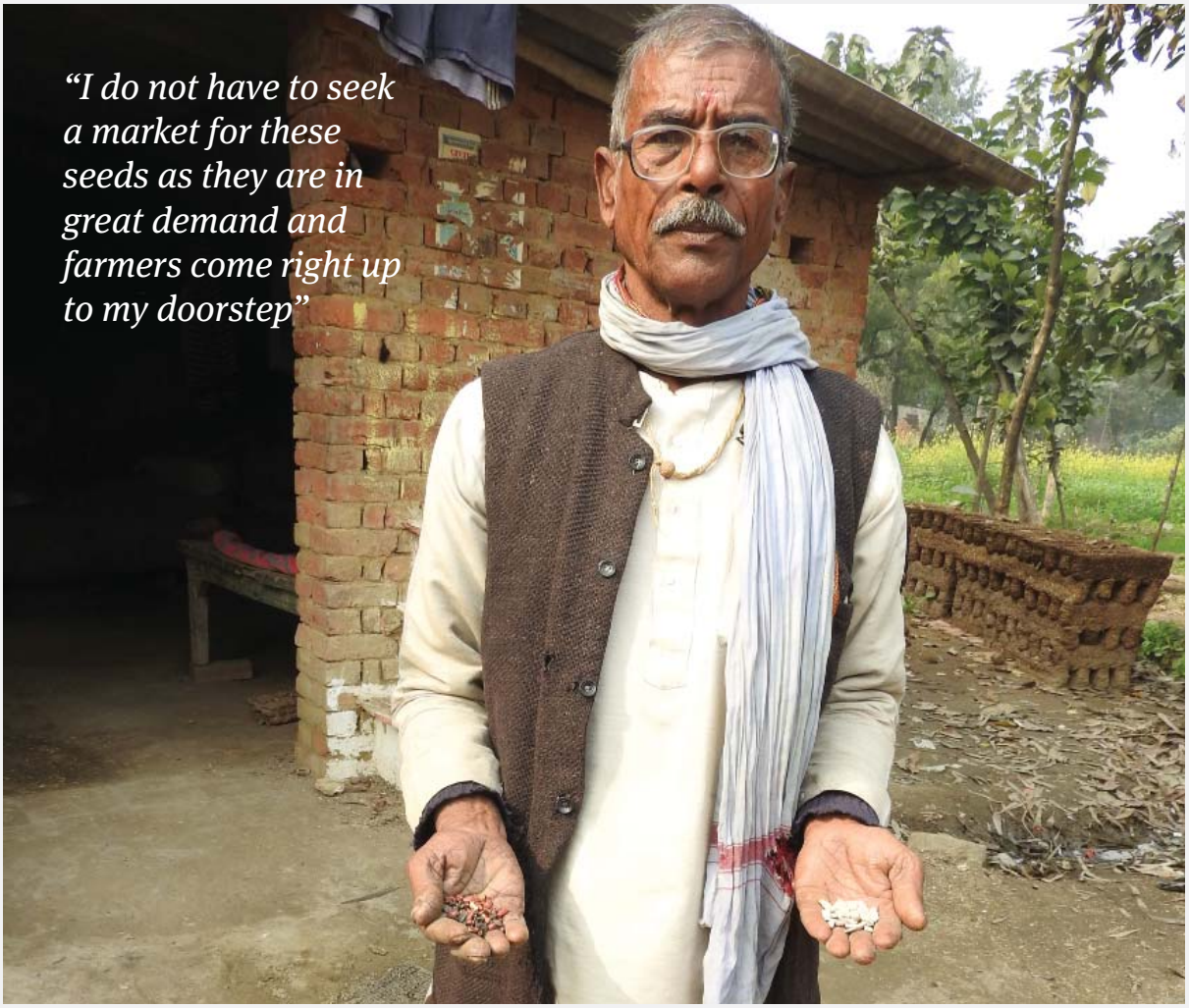
Ram Nagina, farmer with 3 acres of land from the village Nuruddin Chak, heads a joint family of 24 members. Though essentially a farmer, he keeps buffaloes and derives an income from dairy products too. Besides the traditional cultivation of wheat, he practiced LEISA techniques, and began mixed farming of vegetables as well as floriculture.

What separates Ram Nagina from other farmers is that he cultivates vegetables for seeds. He has established nurseries on his terrace, using seeds that have been collected and dried for the next season of planting. He also sells the seeds to other farmers in the neighborhood and his annual income from seeds sale last year, was INR 4,050/-. He does not have to seek a market for these seeds as they are in great demand and farmers come right up to his doorstep to buy them. His seeds prices are comparable to the market rate, easily available and of assured quality. Ram Nagina has also shared his techniques of seed cultivation with other farmers, and has trained 14 people till date.

Price list of Seeds Sold by Ram Nagina
(in Rs. per kg)

Bottle gourd	125
Better gourd	215
Radish	48
Beans	115
Chilli	500
Lady finger	95

* http://www.ciks.org/4.%20Seed%20Production%20Techniques%20for%20Vegetables.pdf



Resource flow

Criteria	*2011-12*	*2014-15*	*Changes*	*Remark*
No. of Sub system	04	07	75%	Increase
No. of linkages	03	06	100%	Increase
Mkt. dependency	72%	63%	12%	Decrease

Average per acre income *(in Rs.)*

Aspects	*2011-12*	*2014-15*	*% Enhanced*
Per acre crop profit of Ram Nagina from crops cultivation	12,348	20,312	7,964 (65%)

Change in Diversity of Farm System

Aspect	*Farmer Ram Nagina*	
	2011-12	2014-15
Field (Species)	15	23
Livestock (Species)	04	06
Composting (Type)	01	03
Perennial tree (Species)	03	07
Kitchen garden (Species)	0	12

11. THE WEATHERMAN

Climate change is indeed manifesting itself in the Gorakhpur region. What was earlier continuous low intensity rain has now become incessant rain in the monsoons. Though in the past, the river Rohini doubled or tripled in volume due to heavy rains in Nepal, but that was expected. Heavy rains now result in flash floods followed by long dry spells. Routinely, monsoons commenced in June and continued until September. Now, they often begin in the last week of May, followed by floods in June. There is increased flooding and water logging, and where once water receded within a week, now water logging persists for over a month, destroying the kharif (monsoon) crops. It is predicted that the frequency and intensity of rainfall events in Gorakhpur will intensify, exacerbating flooding.

This unpredictability and extreme climate conditions have greatly impacted the farmers in this region. It is difficult to predict when to plant and when to harvest crops. Sakol Prasad, from village Shekhpurva, has helped address this grave issue of unpredictable weather patterns. A chance visit to Gorakhpur and an encounter with the weather scientist, Shri Kailash Chand Pandey at GEAG changed his life. He agreed to become the point person to receive weather updates on his mobile phone. His responsibility was to pass this essential information on to other farmers. Earlier, farmers came and asked him for updates, but Sakol has since then installed a black board outside his home, where he posts regular weather updates, for everybody to read and react to.

In October 2014, there was a weather update indicating that the cyclone Hudhud, was about to hit the eastern coast of the country. In Gorakhpur region, it was the time to harvest paddy. Based on these weather updates, farmers here managed to harvest paddy in record time and store it safely. This timely warning through mobile update saved over 15 acres of paddy in village Shekhpurva. Again in December 2014, there was a mobile warning about a drastic fall in temperature that helped the farmers take adequate measures in time to prevent frost attack on their crops. Sometimes there are specific weather updates about approaching dust storms, whereby farmers are advised to store the grain in a protected space and other times the updates address

"SMS-based weather information has helped in reducing farming input costs of my fellow farmers"

more mundane agriculture issues, like solutions to specific crop pests. For the farmers in this village who were often in a dilemma about whether to irrigate their crops or wait for the rains, these mobile updates are a boon.

Sakol Prasad is now a much sought after individual in the village. The responsibility bestowed on him has given tremendous confidence. He also manages a small library in the village where he ensures that all new and relevant information on agriculture is available for the farmers. He is active in also promoting LEISA activities in the village and also helps in the Agro-service Centre of the village. For him and other farmers here, the use of mobile phones for regular updates is a positive step towards climate smart agriculture.

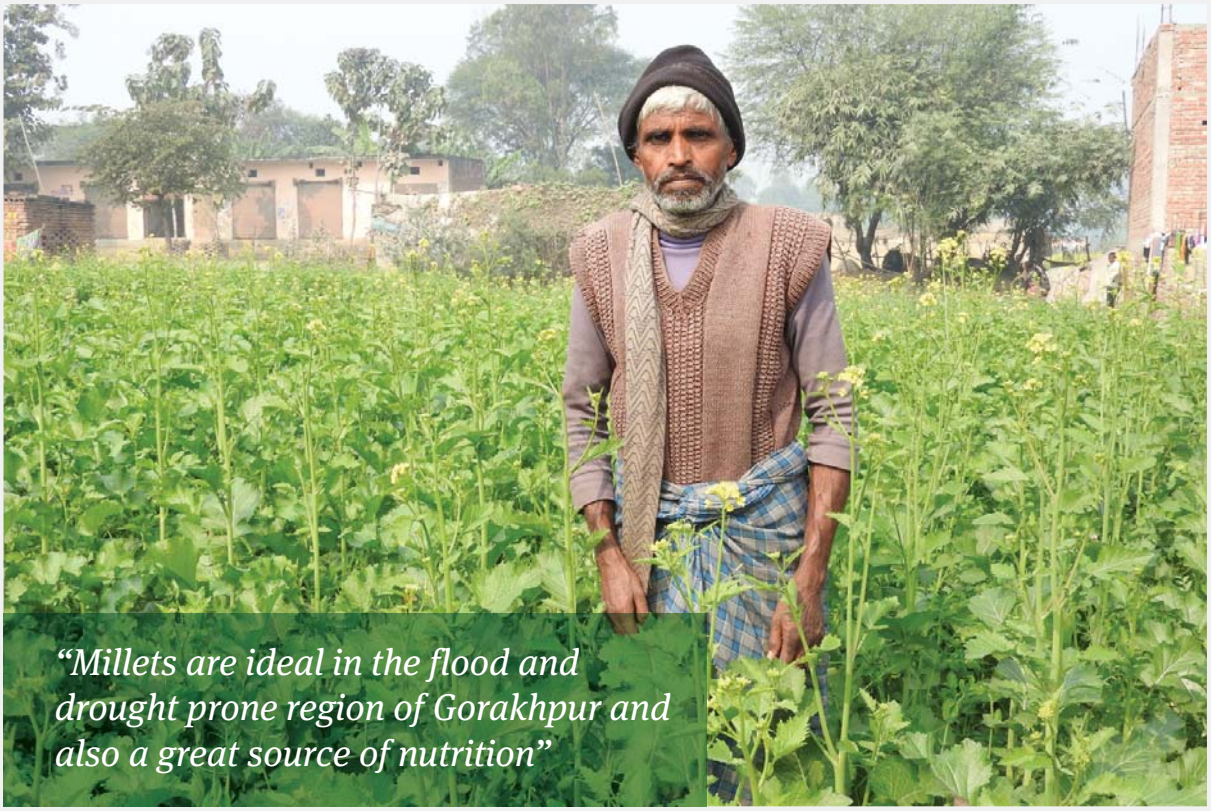
12. PROMOTING MILLETS

'The rice eater is weightless like a bird; the one who eats Jowar is strong like a wolf: one who eats Raagi remains 'nirogi' [illness free] throughout his life', is an old Kannada saying . Millets have been grown in India for centuries and are perhaps some of the oldest growing cereals in the country. India is not only the largest producer of millets in the world but also the largest consumer, accounting for more than 40% of the world's millet consumption. However, over the years millet cultivation has suffered a setback. One of the primary reasons is the taking over of wheat and rice cultivation and their promotion in the Public Distribution System (PDS).* What is forgotten is that millets are rich in nutrition and could enhance nutritional security, especially of the small and marginal farmers. These are hardy crops, capable of fighting climate change. They are known to withstand excessive, low and even erratic rainfall. Despite a low demand for millets in the market, traditionally farmers in Gorakhpur region have continued to grow millets for their own consumption. Given the drastic weather conditions, this may well be the ideal crop.

Rajendra Prasad from Shekharpurva village, traditionally grew millets, but only for his family's consumption. He attended the Farmers Field School where he understood the significance of millets better and took up millet production on a larger scale. Says Rajendra Prasad, "We grew millets, but the children were unused to the taste and thought it was inferior to eat millets. We have now started cooking millets at home and the children have begun to appreciate its taste". He believes that besides nutrition, millets also help build better immunity, and thus wants to encourage his family to consume more. Earlier he found it difficult to procure seeds for millet cultivation, but now manages to do so through the Farmers Field School.

Rajendra Prasad now convinces other farmers to grow millets too, by explaining how they are source of nourishment, for both humans and cattle. He talks of how millets are ideal in the flood and drought prone region of Gorakhpur, and with fewer inputs, give better returns. He is yet to start the marketing of millets, but he is happy to share seeds and his acquired knowledge with fellow farmers.

* ddsindia.com/www/PDF/Milletising%20India.pdf



"Millets are ideal in the flood and drought prone region of Gorakhpur and also a great source of nutrition"

His wife Anarpi, helps out in the mixed farming of vegetables that they do on their 0.8 acre plot of land, along with millets. Having also attended the Farmers Field School, she has expanded from growing 2-3 crops to over 20 different kinds of crops over the year. She has one of the four low tunnel poly houses in the village to grow vegetables for seeds that they barter with other likeminded farmers. They hope to have enough seed production for sale in the near future.

23 FARMERS
growing millet because of him

0.50 ACRE
Area under millets/ kind of millets and total yield

1.2 QUINTAL
Total yield of tagun, kodo, sanwa and bajara

INR 3,500/-
Extra income from millets crops and input minimum

13. DIVERSIFYING FARMING THROUGH POULTRY

Backyard poultry production is an age-old practice in rural India. For small and marginal farmers, this activity is usually a lucrative enterprise because of low-cost investment and high economic returns. With an unpredictable financial market, particularly in this vulnerable region, the sale of birds helps cover minor expenditure, such as school fees or even unexpected costs such as medical fees. Investment in poultry farming thus enhances nutrition as well as reduces the vulnerability of these small and marginal farmers.

Raj Kishore, a farmer from village Shekharpurva, decided to delve in the poultry enterprise. He followed mixed farming of cereals and vegetables on his 2-acre farmland. Though he had dabbled in some backyard poultry production in the past, the technical knowledge that he got after attending the Farmers Field School, helped him combat issues of poultry mortality and increase his production. For the past four years, he has increased the scale of his poultry business, with about 1000 chicks in summer and 1200 in winters. The most significant fallout of this venture has been the use of chicken manure as fertilizer. This manure is very high in nitrogen and contains a good amount of potassium and phosphorus, and thus is particularly effective for vegetable farming, once composted. Now he sells this rich manure to other farmers at the rate of INR 1,000/- per trolley, and has a clientele of almost 50 farmers from the surrounding villages.

Besides this, he also liaisons between various relevant government agencies and the village farmers. In the past, he and his fellow farmers had been deprived of extension services. Having experienced this, Raj Kishore took the initiative of participating in district level meetings to learn how best he could help his village. So now he also facilitates farmers to link with subsidies and government grants. He has also gone ahead and helped with the organization of two cattle vaccination camps and helped 19 farmers get Kisan Credit Cards* too.

* A Kisan credit card is intended to provide affordable credit for farmers in India without going through time-consuming bank credit screening processes. Repayment can be rescheduled if there is a bad crop season, and extensions are offered for up to four years. The card is valid for three years and subject to annual renewals

"significantly, poultry farming has resulted in the use of chicken manure as fertilizer"

INR 1,50,000/-

Extra annual income from poultry production is

INR 2,000/- ANNUAL SAVINGS

from not buying chemical pesticides and fertilizers

Pre-intervention output

12-14 QUINTAL/ACRE

Post-intervention output

15-16 QUINTAL/ACRE

14. TREES SAVE LAND & FARMER

Historically, trees have been part of farming systems in several parts of India and in recent times constitute an important component of LEISA. Trees are usually planted in conjunction with other crops, many a times on bunds or between rows of crops. They provide required fuel, act as wind barriers, build soil fertility or simply generate cash through sale of timber in the market. With depletion of agricultural land, lack of agriculture and unpredictable weather patterns, tree plantations can be the insurance that the farmer needs in this peri-urban landscape. Further on, tree farming cuts down on overheads like labour, fertilizers and pesticides. Teak plantations too are popular wherever viable, as they give a better return in the market compared to any other commercial tree. A mature teak tree yields approximately 10 to 12 cubic feet wood, with per cubic feet teak wood fetching INR 2,500/- in the Indian timber market.*

Harichandra, a retired railway employee from village Shekharpurva owns 0.12 acres of land, where he has planted teak. Says Harichandra,"This is my investment that will yield income for my children and for the generations to come". He recognizes that the returns he will get from the plantation once the trees mature are significant. He also admits that he is too old now to start with farming. Importantly, the tree plantation ensures that his land will not be sold but will remain with the family and still ensure a sound economic return.

* http://www.sagwanfarming.com/

"This is my investment that will yield income for my children and for the generations to come"

15. ENHANCING AGRICULTURAL YIELD THROUGH MULCHING

In the peri-urban region of Gorakhpur, farmers face both extreme drought and flooding, and the challenge is to maintain good micro-flora and a balance of micro-organisms in the soil. How do they conserve moisture in the soil and also control weeds? Under LEISA techniques, the answer lies in mulching. The method involves making a protective cover of organic matter (leaves and straw etc) and placing it over and around plants to prevent evaporation of moisture and growth of weeds. It also prevents runoff and soil loss thus reducing plant deterioration. With the advent of drastic temperatures, mulching helps control temperature fluctuations in the soil, improves the physical, chemical and biological properties of soil and also adds nutrients. The overall effect is an increase in plant growth and yield. Mulching is reported to have increased the yield by 50-60% over no mulching in rainfed areas.*

In the village Sanjhai, Biddo attended the Farmers Field School and decided to try mulching specifically to improve the yield of ginger in her 0.01 acre field. Both the quantity and quality of ginger improved. Now she also saves considerable time, as she does not have to weed her field. Previously, she was selling garlic at INR 20/kg and after mulching, the garlic sold for INR 120/kg. The considerable jump in her income has helped her family repay loans.

Today, Biddo has inspired 30-40 women to use mulching in their farming. It has been three years since she started using this technique for garlic farming. Besides this she also uses other techniques such as gunny bag, terrace farming and is happy to learn new techniques of making organic pesticides and fertilizers.

* http://www.isca.in/AGRI_FORESTRY/Archive/v1/i3/5.ISCA-RJAFS-2013-023.pdf

"The considerable jump in my income has helped my family repay loans"

16. DAIRY FARMING

Livestock rearing and sale of dairy products is one of the livelihood options for the people living in the peri-urban area of Gorakhpur. Most of the people have livestock and use the products for their own consumption. Shobha Devi and her family of twelve live in the village of Sanjhai, and own 7 buffaloes and 4 cows. Traditionally they have always sold the surplus milk in the town of Gorakhpur. However, after their association with the Farmers Field School, they become aware of many new aspects relating to dairy business, like the benefits of cattle vaccination programme.

A new concept that they are now associated with is that of collective selling of milk, wherein 48 people are linked. Seven households sell their milk to Shobha's family at INR 40/, who in turn sell a combined quantity of 50 litres milk daily in the market for INR 50/-.

Shobha proudly points at her house and says that they have been able to renovate it as a result of the extra income from the diversification of products and selling milk through the collective. She is also happy that the additional income ensures a good education for the children in her family.

"The house renovation is a result of the extra income from the diversification of products and selling milk through the collective"

INR 16500/-
AVERAGE INCOME/ MONTH

Includes:

INR 6000/-
per 1000
DUNG CAKE

10KG
@INR 300 per kg
PANEER
Cottage (cheese)
DAILY

5-6KG
@INR 600 per kg
GHEE
Cottage (cheese)
DAILY

17. HEARING LESSER KNOWN VOICES: LAGHU SEEMANT KRISHAK MORCHA

Women of village Shekharpurva were distressed by the illicit liquor manufacture, consumption and trade. They decided to get organized and take out a protest march, destroying all the illicit liquor brewing units. They also protested against the illegal soil mining happening in their village that was causing irretrievable degradation of the soil. Both, mining and illicit brewing of liquor, brought undesirable men into the village, causing the women concern for their young daughters. In 2014, the women approached the District Magistrate and the Police Station Officer to put a stop to all the illicit liquor units.

The success of this collective has given a voice to the women and other under privileged members of the village. They and many other farmers are now linked to the already existing Laghu Seemant Krishak Morcha (LSKM). This provides a platform to the small and marginal farmers in their struggle for empowerment and equity in natural resource management. It was registered as a union after numerous consultations held across the state of Uttar Pradesh, and has at present 1,50,000 members to work on issues of small land holding and sustainable farming. In the peri-urban scenario LSKM works in promoting LEISA at various levels.

A result of the community mobilization was an event in May 2015 where over 200 community members came together to call for an end to illegal encroachments and overall protection of agricultural lands, particularly to secure livelihoods of small and marginal farmers.

"The Laghu Seemant Krishak Morcha is collectively advocating for protection of common property resources"

CONCLUSION

The few glimpses of climate resilient actions adopted by the peri-urban small and marginal farmers in Gorakhpur are a testimony to the fact of building resilience sustainably. By doing so, they are not only protecting the land-use patterns and conserving the open and green spaces which are critical for building urban resilience but also making a profitable and resilient livelihood for themselves. Protecting ecosystems and ecosystem services in peri-urban areas is essential to the survival of the poor. These services also enhance the city's resilience. For instance, a critical ecosystem service provided by 'open spaces' like orchards and fields that act as buffers can enhance Gorakhpur's resilience to flooding. Construction that usurps these spaces reduces the resilience of the city. This has been proved through the innovative initiatives of the farmers in the peri-urban areas of Gorakhpur.

As the Gorakhpur city is constantly expanding under the effects of rampant urbanisation, the land-use patterns are also changing which is a growing threat for food production and supplies. Water bodies are being increasingly encroached on or polluted, impacting on the lives and livelihoods of people. Gorakhpur's solid wastes and sewage are dumped in the peri-urban areas while infrastructure measures to reduce urban flooding are creating waterlogging. Together, it is impacting the lives of many people. The examples put forward by the peri-urban farmers helps in explicitly recognising the ecosystems approach and realising the importance of ecosystem services which is needed if both urban and peri-urban areas are to be developed sustainably and inclusively.

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Gorakhpur Environmental Action Group (GEAG) is a voluntary organization working in the field of environment and sustainable development since 1975. Ever since its inception, GEAG has been actively engaged in implementing several development projects addressing livelihood issues of small and marginal farmers, particularly women, based on ecological principles and gender sensitive participatory approach. Besides, GEAG has accomplished several appraisals, studies, researches at the micro and macro levels as well as successfully conducted a number of capacity building programmes for various stakeholders including women farmers, civil societies groups and government officials etc.

Today, GEAG has established its identity in North India as a leading resource institution on sustainable agriculture, participatory approaches, methodologies and gender. Acknowledging its achievement, efforts and expertise, United Nation's Economic and Social Council (ECOSOC) accorded GEAG Special Consultative Status in the year 2000. GEAG was recently awarded with the Lighthouse Activity Award by UNFCCC in 2013.

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