THE Rockefeller Foundation

MONITORING & EVALUATION OFFICE

FORMATIVE EVALUATION

Enhancing climate resilience of Gorakhpur by buffering floods through climate-resilient peri-urban agriculture

May 2016

GORAKHPUR ENVIRONMENTAL ACTION GROUP

·I·C·L·E·I Local Governments for Sustainability

RUAF Foundation
RESOURCE CENTRES ON URBAN AGRICULTURE & FOOD SECURITY

Supported by

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About the GEAG

Gorakhpur Environmental Action Group (GEAG) is a voluntary organization that has been working in the field of environment and sustainable development since 1975. Since its inception, GEAG has implemented development projects addressing the livelihood challenges of small and marginal farmers, particularly women, based on ecological principles and gender sensitive participatory approaches. Today, GEAG is recognized in north India as a leading resource institution on sustainable agriculture, participatory approaches, and gender. GEAG was granted Special Consultative Status by the United Nations (UN) Economic and Social Council in 2000, holds Observer Status to the Green Climate Fund, and in 2013, GEAG was awarded the UN Framework Convention on Climate Change Lighthouse Activity Award.

About the ICLEI

ICLEI is a leading global association of over 1,500 cities, local and metropolitan governments committed to building a sustainable future. ICLEI Members include local and regional governments of all sizes, municipalities, towns, cities and counties, mega-cities, prefectures, provinces, regions and city-states. By helping our Members to make cities and regions sustainable, low-carbon, resilient, ecomobile, biodiverse, resource-efficient and productive, healthy and happy, with a green economy and smart infrastructure, the association impacts over 25 percent of the world's urban population.

About the RUAF

RUAF is a Global Partnership on Sustainable Urban Agriculture and Food Systems, involving several municipalities, research institutes, and NGOs. RUAF is a not-for-profit organisation in operation since 1999 that seeks to contribute to the development of sustainable cities and city regions through awareness raising, knowledge generation and dissemination, capacity development and technical advice, research, policy design and action planning for resilient and equitable urban food systems. Its focus areas include Food security and social inclusion, Short food chains and local economy, Planning resilient urban food systems, City adaptation to climate and Productive reuse of wastes and wastewater.

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Enhancing climate resilience of Gorakhpur by buffering floods through climate-resilient peri-urban agriculture

May 2016

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Acronyms

ACCCRN	Asian Cities Climate Change Resilience Network
ASC	Agro-service center
CPP	Cow pit pot
CPR	Common property resource
DEWATS	Decentralized wastewater treatment system
FFS	Farmers field school
GEAG	Gorakhpur Environmental Action Group
INR	Indian rupee
IPM	Integrated pest management
LEISA	Low external input and sustainable agriculture
LSKM	*Laghu Seemant Krishak Morcha* (farmers' union)
NABARD	National Bank for Agriculture and Rural Development
RUAF	Global Partnership on Urban Agriculture and Food Security
ToC	Theory of change

Preface

Launched in 2008, The Rockefeller Foundation's Asian Cities Climate Change Resilience Network (ACCCRN) initiative aimed to catalyze attention, funding, and action for building the climate change resilience of vulnerable cities and people in Asia. Based on current estimates that about 55 percent of Asia's population will be living in urban centers by 2030, the premise of the ACCCRN initiative is that cities can take actions to build climate resilience – including drainage and flood management, ecosystem strengthening, increasing awareness, and disease control – which can greatly improve the lives of poor and vulnerable people, not just in times of shock or stress, but every day.

At the time the initiative was launched, the concept of urban resilience and models for implementing it were nascent and emergent. ACCCRN proved to be an important experiment and "learning lab" for The Rockefeller Foundation and its grantees and partners in strengthening the capacity in cities to better understand and implement practical measures to build resilience to the often devastating shocks and stresses of climate change. Initially active in 10 cities in India, Indonesia, Thailand, and Vietnam, ACCCRN later expanded to an additional 40 cities, including in two new countries: Bangladesh and The Philippines.

One of the ACCCRN "learning lab" projects in the city of Gorakhpur, India, was implemented by the Gorakhpur Environmental Action Group (GEAG) in less developed parts of the city. The project supported peri-urban agriculture as a flood buffer, an important measure given changing rainfall patterns and rising flood risk potential resulting from climate change and urban development.

As part of the Foundation's commitment to learning from its work, the project was evaluated in 2016 by the Resource Centres on Urban Agriculture and Food (RUAF) Foundation, in collaboration with ICLEI - Local Governments for Sustainability, South Asia. The evaluation has provided a valuable opportunity for the Foundation and GEAG to learn from this work and to contribute to the broader learning process in the field of urban resilience.

We are pleased to see that the project has had a tangible and demonstrated impact on farmers with the average agricultural income of model farmers more than doubling. Furthermore, the findings on what more the project needs to do to strengthen climate change resilience are instructive. We congratulate GEAG on its leadership in implementing this project and in putting in place a theory of change and baseline data collection early in the project to enable learning and an assessment of its progress. Too few projects have the foresight to do this. We are grateful to Marianne Meijboom and Marielle Dubbeling from the RUAF Foundation, and Sunandan Tiwari from the ICLEI World Secretariat for the collegial spirit in which they worked with Shiraz Wajih and his GEAG team to conduct this formative evaluation. In doing so, GEAG is a stronger organization, and both the Foundation and GEAG have learned valuable lessons – true measures of a worthwhile investment in evaluation.

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Executive summary

The project "Enhancing climate resilience of Gorakhpur by buffering floods through climate-resilient peri-urban agriculture" is part of the Asian Cities Climate Change Resilience Network (ACCCRN). Funded by The Rockefeller Foundation, it was implemented by the Gorakhpur Environmental Action Group (GEAG) from June 2012 to May 2016 to demonstrate the importance of ecosystem services – such as the flood buffering provided by peri-urban agriculture – in addressing climate change impacts in Gorakhpur.[1] The project aimed toward four interlinked objectives:

- develop models of climate-resilient integrated agriculture-horticulture-aquaculture-livestock systems in small, marginal landholdings in the peri-urban context, employing a diversity of water systems
- enhance the income and food security of the poor and vulnerable populations
- ensure the sustainability of peri-urban agricultural lands through different regulatory and incentive mechanisms
- enhance the flood buffering capacity of the city as it expands, through the institutionalization and replication of sustainable management of agricultural ecosystems.

The RUAF Foundation, in collaboration with ICLEI South Asia, undertook a formative evaluation of this project in April–May 2016, at the request of The Rockefeller Foundation. The objectives of the formative evaluation were to:

- articulate clearly the Theory of Change (ToC) of the project and a related indicator framework
- assess the quality and extent of the baseline data and recommend how best to use this data in assessing the progress, outcomes, and eventual impact of the project interventions
- analyze the "types" or typology of peri-urban interventions that are emerging from the project, such as models for peri-urban land use management that combine one or more of the project strategies
- assess the progress of the project and make recommendations with regard to its ongoing management and sustainability, and for scaling to other areas.

Evaluation results

Theory of Change

The evaluation helped the GEAG team review and improve the presentation of its ToC. In the original project document, linkages between outputs and impacts were incomplete or missing. It was agreed that the major aim of the project - to enhance the resilience of Gorakhpur through maintaining peri-urban agricultural lands - would best be realized by ensuring that agriculture remains the preferred peri-urban land use option of both farmers and policymakers. The revised ToC expresses the hypothesis that farmers will continue farming and not sell their land if they can make a good living out of agriculture, and that this land use, in turn, will contribute to buffering Gorakhpur from floods.

[1] Gorakhpur, a city located in eastern Uttar Pradesh, is the administrative headquarters of Gorakhpur District. In this report, Gorakhpur refers to the city, unless otherwise designated as the district of Gorakhpur

Some of the original outcomes were rephrased. For example, the outcome "conservation of agricultural land in peri-urban areas enhancing flood buffering capacity of the city, on the whole" was re-cast as the project's long-term impact. The outcome "enhanced food security of the urban poor" was reformulated as "contribution to food security of urban citizens," in order to acknowledge that the project could only make a small contribution to the food security of the urban population.

Project activities also were reviewed, to determine the actual work implemented. In reality, the project worked in more areas than outlined in the project document. Some were subsumed in other activities, but in fact deserve to be mentioned separately. The formative evaluation recognized 10 sets of activities or work packages, namely: farm models, institution building, weather and agro-services, common property resource management, market linkages, awareness and cross-learning visits, research, advocacy, documentation, and establishment of linkages and networking.

Baseline data and indicator framework

The indicators presented in the original project document were mostly meant to measure achievements at the output level, while indicators to assess progress at outcome and impact levels were missing to a large extent. Although the project established a good monitoring and evaluation system for measuring progress and impacts in the intervention villages, it lacked general baseline and monitoring data to measure overall progress beyond the project villages and towards its envisaged impacts. During the evaluation workshops, the indicators were discussed and reviewed in relation to the revised ToC, and missing indicators – as well as available baseline and end-line data – were added.

Types or typology of peri-urban interventions

The typology of the peri-urban interventions at the farmers' level has four major components: i) farm models with low external input and sustainable agriculture (LEISA) and climate-resilient practices, ii) local institutions that were formed, such as farmer clubs, farmer field schools, and *laghu seemant krishak morcha* (LSKMs) which are farmers' unions that are part of a national LSKM network, iii) the weather and agro-services provided by SMS, and iv) established linkages with government line departments and GEAG.

The project introduced a host of LEISA and climate-resilient practices including use of: composting, trichoderma fungus, bio-pesticides, oil cake, plantation, mixed farming, seed production, integrated pest management (IPM), kitchen gardening, loft farming, bag or "thermocol" farming, low tunnel polyhouse, permanent raised beds, and relay cropping. These practices, which complement but also partially overlap each other, are primarily targeted at increasing farmers' income. The practice of composting, with or without adding trichoderma to improve the soil, followed by mixed or relay farming with a variety of vegetables and fruits, and the application of bio-pesticides in case of diseases and pests, proved very successful, allowing farmers to harvest three crops a year instead of one or two. Practices such as thermocol farming and loft farming have helped farmers grow saplings during the flood season that can be planted into the fields once the water recedes. In addition, marginal farmers are now able to rent needed equipment from the agro-service centers to irrigate their fields during water shortages.

The implementation of the LEISA and climate-resilient practices has been further supported by the farmer clubs, farmer field schools, agro-service centers, and LSKMs formed by the GEAG project. Providing weather and agro-services through SMS and using notice boards supported farmers in making informed decisions about their agricultural practices. In addition, establishing linkages to line departments and GEAG has helped farmers access better supportive information from experts and also provided access to government subsidy schemes.

Assessment of project progress

Effectiveness

The project was able to reach its original targets and indicators for the various planned outputs and, to some extent, outcomes. The greatest achievements of the project were at field level:

- establishment of functional model farms showcasing a variety of LEISA and climate-resilient practices
- adoption of LEISA and climate-resilient practices by link[2] farmers
- introduction and support of self-reliant farmer clubs, farmer field schools, and agro-service centers to support farmers in their agricultural endeavors
- introduction and support of self-reliant LSKMs to help farmers bring their issues to the attention of policymakers, and connect them to other smallholder and marginal farmers in the state
- provision of weather and agro-services through SMS and on notice boards
- establishment of linkages to government line departments, which increased the number of farmers benefiting from government subsidy schemes.

While the project also delivered good results in documenting support of advocacy for peri-urban agriculture, its achievements in the uptake of its advocacy efforts have not been as well established. Although peri-urban agriculture has always existed, the concept itself has not been formally recognized, and therefore finds little traction among policymakers. Thus, although the project has convincingly demonstrated the benefits of LEISA and climate-resilient practices for the peri-urban farmers who adopt them, it has not been able to clearly show how these practices could contribute to reducing climate vulnerability of Gorakhpur. However, a critical first step has been taken that needs to be built upon in order to change policy and practice at a larger scale.

Impact

The project has had a tangible and demonstrated impact on model and link farmers. The average agricultural income of model farmers has more than doubled due to reduced input costs, crop diversification, crop intensification, expansion of agricultural land under cultivation, and reduced crop loss due to natural hazards such as floods. Income also increased because of better market linkages and better prices for products. During the evaluation visits in the three villages, farmers estimated that 50–80 percent of the farmers in the intervention villages had adopted one or more practices, while the adoption rate

[2] The term "link" or "outreach" farmers refer to those farmers that were "linked" to the project through the farmers clubs, farmer field schools, model farmers or otherwise.

in neighboring villages was estimated at 10–30 percent. By demonstrating improved practices and increased income, the project has renewed people's interest in farming in the peri-urban areas. As a result, according to a project sample study, the sale of agricultural land decreased substantially in the eight project intervention villages.

The local institutions formed by the project have evolved into self-reliant organizations. Farmers have experienced the benefits of having farmer clubs, farmer field schools, agro-service centers, and LSKMs, and these benefits have motivated them to continue their operation.

Within the participating villages, the project activities have contributed to the conservation of common property resource (CPR) areas, such as open land, water bodies, forests, and pastures. Farmers successfully brought their concerns about encroachment on remaining CPR areas and pollution of water bodies to the attention of local decision makers through the formed LSKMs. As a result, a 23,980 sq ft water body has been conserved and 23,150 sq ft of community land have been demarcated and conserved. Also, 3.5 acres / 1.42 ha of open land has been conserved through the establishment of a tree plantation, and two decentralized wastewater treatment systems (DEWATS) have been installed, which will help farmers in two project villages access clean irrigation water.

The impact on relevant government institutions is somewhat mixed. Many of the government line institutions are not yet convinced of the importance of maintaining peri-urban agricultural lands in relation to buffering floods in Gorakhpur. The line departments, such as horticulture and agriculture, have a traditional focus on rural areas and still pay little attention to peri-urban farmers and agriculture areas. However, government institutions are convinced of the importance of conserving water bodies in the peri-urban areas to buffer flood risks, and have issued instructions to conserve a water body in the Maheva area.

The project's contribution to its overall goal of buffering floods in Gorakhpur has not been clearly established. The project implementation was only in eight villages of the 170 in the peri-urban agricultural area – a scale too small to have a tangible impact on buffering floods. Moreover, the production interventions and typology promoted by the project were oriented toward reducing climate change impacts on agricultural production and income – rather than toward reducing climate change impacts on the city through preservation and improved management of agricultural land areas.

More evidence is required as to which ecosystem services are provided by peri-urban agriculture and how they, in turn, contribute to buffering floods in Gorakhpur. This would require further research on the hydrological functions of peri-urban agriculture land areas and further understanding of the role played by peri-urban agriculture in flood buffering (e.g water infiltration and reduction of storm water flows) compared to other flood reduction strategies as well as comparison and monitoring of flood buffering capacity in (partially) built-up versus agricultural watersheds. Research conducted by the project partner determined the need to improve the drainage system, recognizing that buffering floods in the city and surrounding areas will only be possible with a good functioning drainage system in the city, proper maintenance and management of existing water bodies, and preservation of peri-urban agricultural land areas.

Sustainability

The outcomes and impacts at project village level are very likely to be sustainable. Both model farmers and link farmers mentioned their interest in continuing to implement LEISA and climate-resilient agricultural practices because of their demonstrated and tangible benefits. Also, the farmer clubs, farmer field schools, agro-service centers and LSKMs have become self-sustaining organizations (as detailed in the above Impact section). The sustainability of project outcomes in neighboring villages is less established, although, 10 to 30 percent of the farmers interviewed during the evaluation estimated an uptake of LEISA and climate-resilient practices.

Advocacy efforts to draw attention to the issues and importance of the preservation of peri-urban lands need to be sustained. The project has raised awareness of the need to preserve and support agriculture in peri-urban areas, but this awareness has not yet transformed into the needed action or regulation.

In summary, there is a great level of expected sustainability in project villages, limited sustainability in other villages in the peri-urban area of Gorakhpur, and unclear sustainability in terms of policy uptake at city level and beyond.

Replication

There is a huge scope for replication of the LEISA and climate-resilient practices in other villages in the peri-urban areas of Gorakhpur. At present, this has happened naturally through beneficiary farmers exchanging with relatives and acquaintances living in other villages. The described typology of LEISA and climate-resilient interventions provides an indicative approach for further out-scaling. This typology, which is more streamlined and potentially less resource intensive than the approach adopted by GEAG, should be further applied and revised for different contexts.

The project's scope for replication at city and district level and beyond would require continued advocacy work. In this respect, it is important to continue to build alliances, including with the private sector, to have a stronger voice. Another important step in this direction would call for facilitating inclusion of a chapter on peri-urban land management in the District Disaster Management Plan by: i) targeting the district governing body, and ii) supporting the development of such a chapter. The District Disaster Management Authority has indicated its willingness to include such a chapter in its plan which is revised and updated every year.

Conclusions

The "Enhancing climate resilience of Gorakhpur by buffering floods through climate-resilient peri-urban agriculture" project is having a great and potentially lasting impact on the involved marginal farmers in the peri-urban areas. Farmers have been able to increase their income, as well as food and nutrition security, because of: i) reduced input costs and market dependency, ii) increased crop diversity, iii) improved ability to cultivate crops despite floods during the summer, enabling them to maintain three crops a year instead of one or two, iv) cropping intensification, and v) expansion of areas under cultivation.

The project's activities have also resulted in greater resilience of farmers based on:

- increased resourcefulness (due to better access to needed equipment through the agro-service centers), resources (such as capacity building and finances), and services (such as government programs)
- increased access to information due to its provision, discussion, and dissemination through farmer clubs, farmer field schools, and LSKMs, and GEAG's provision of weather and agro-services data to help them make more informed decisions
- increased responsiveness, due to their increased abilities to respond and adapt to their situations. Farmers also reported feeling capable of addressing issues themselves due to the increase in self confidence that has come with their forming farmer clubs and LSKMs, their access to weather and agro-services, and their establishing linkages to experts.

Farmers' greater resilience has also reduced their vulnerability. This has been clearly demonstrated by a strong decline in the sale of agricultural lands for non-agricultural uses in the eight intervention villages. Because of the tangible benefits of LEISA and climate-resilient agriculture, these agricultural practices are also applicable in and beyond the targeted villages, and in other peri-urban areas facing similar challenges. The typology of LEISA and climate-resilient interventions used by the project provides an indicative approach for further out-scaling.

Despite these important results in the project intervention villages, the project's contribution to the intended impact of buffering floods in Gorakhpur is promising but not clearly established. The fact that the project demonstrated a reduction in the sale of agricultural land is truly a remarkable impact. However, the impact of agricultural land preservation on actual buffering of floods has not yet been demonstrated because determining this would require, inter alia, monitoring over a longer period of time. The project recognized that implementing peri-urban agriculture to buffer floods is only part of the solution. Other parts of the solution, such as attention to the city's poor drainage and introduction of holistic planning, would call for controlling city expansion and development, establishing proper drainage systems, and ensuring conservation and proper management of open spaces, water bodies, and agricultural lands in peri-urban areas and beyond.

However, as stated, the actual contribution of peri-urban agriculture on actual changes in flood risks and incidences has not yet been demonstrated. The project's advocacy efforts have somewhat increased understanding among government line departments, policy and decision makers, the private sector, and the public about the importance of maintaining peri-urban agriculture lands. However – and probably due to lack of more specific impact data – this increased awareness has not been sufficient to transform into the needed action in many instances.

Recommendations

General recommendations with the aim to buffer flooding in Gorakhpur

- Design a targeted approach to buffering floods based on a good understanding of the causes, frequency, and location of occurrence of water flows and floods in Gorakhpur and surrounding areas.

- Conduct comparative research on the role of ecosystem services from peri-urban agricultural land in buffering floods by, for example, comparing built-up areas and watersheds to agricultural areas and watersheds, in order to provide further evidence that maintaining peri-urban agricultural land is a flood risk reduction strategy.
- Conduct more and new research in order to design and test production and agricultural land management models that contribute to reducing flood risks, and apply currently developed models to contribute to reducing impacts of floods on agricultural practices and livelihoods.
- Develop a holistic land-use and city development plan. This plan should address: controlled city expansion and development, proper management of drainage systems, conservation and proper management of open spaces, water bodies and agricultural lands in peri-urban areas, and introduction of new agricultural production and management models.

Recommendations directly targeted at GEAG

- Support and facilitate the inclusion of a chapter on peri-urban land management in the District Disaster Management Plan (the District Disaster Management Authority has already expressed interest in including such a chapter).
- Continue advocating and lobbying for recognition of the importance of maintaining peri-urban lands and in support of the general recommendations stated above.
- Build further alliances and partnerships, including with the private sector, to support lobbying and advocacy work.
- Develop a further communication strategy, formulate key messages for specific audiences, and employ appropriate communication channels for reaching them. Identify and base dissemination on the communication needs of line departments, policy and decision makers, the private sector, and the general public.
- Find funds to cover costs and conduct targeted out-scaling of LEISA and climate-resilient practices to key villages in the peri-urban areas in order to benefit from the current dynamic and positive results generated by the project.
- Prepare case studies covering the typology of LEISA and climate-resilient interventions as a tool to disseminate the project results.


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Introduction

Background and project description

"Enhancing climate resilience of Gorakhpur by buffering floods through climate-resilient peri-urban agriculture" is part of ACCCRN and financed by The Rockefeller Foundation. Initiated in December 2012 and completed in June 2016, the project was active in eight villages, had outreach plans for over 50 surrounding villages located in the Gorakhpur Development Area, and targeted 30 model farmers.

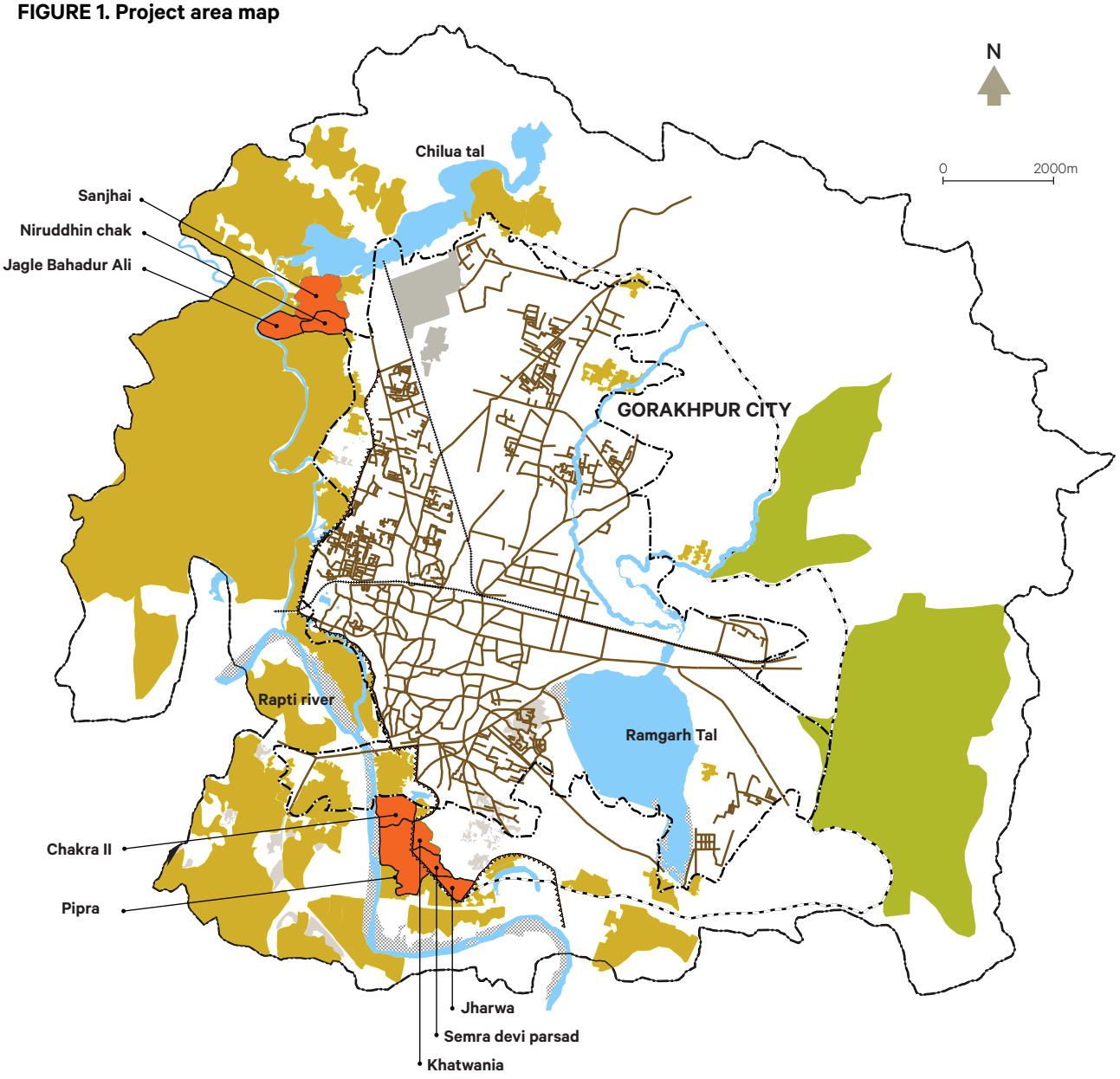
Unplanned urbanization and climate variability are two major impediments for sustainable development of cities. Peri-urban agricultural lands contribute to sustaining urban settlements by providing vital food and ecosystem services. Large-scale conversions of agricultural land to non-agricultural uses have caused problems in cities. For example, drainage systems of built-up areas have less storm water infiltration than agricultural areas, and cities, especially those prone to flooding, deal with disruption of drinking water supply, sanitation, and allied services. Therefore, it is of great significance to conserve peri-urban agricultural land areas, as they serve to climate-proof cities and build resilience.

Objectives

This project was designed to demonstrate the importance of ecosystem services such as flood buffering provided by peri-urban agriculture for addressing climate change impacts in Gorakhpur. Specifically, it set out to demonstrate flood risk mitigation through the preservation and improved management of open spaces by strengthening agriculture-based livelihoods in peri-urban areas, working toward the following set of interlinked objectives:

- develop models of climate-resilient integrated agriculture-horticulture-aquaculture-livestock systems in small, marginal landholdings in the peri-urban context employing a diversity of water systems
- enhance the income and food security of the poor and vulnerable population
- ensure the sustainability of peri-urban agricultural lands through different regulatory and incentive mechanisms
- enhance the flood-buffering capacity of the city as it expands, through institutionalizing and replicating the sustainable management of agricultural ecosystems.

FIGURE 1. Project area map



Legend

- Gorakhpur Development Authority
- Gorakhpur Municipal Corporation
- Projected growth boundary
- Tals / lakes /River
- Roads
- Railway
- Embankment
- Protected forest
- Direct benificiaries (Approx 18 000 population, 450 hactare land)
- Indirect benificiaries (Approx 80 000 population, 7 000 hactare land)

Map prepared by GEAG Projection: Marcator Datum: WGS84
Date: 17.4.2011

Source: GEAG, 2016.

TABLE 1. Project area data

City population	673,446
City area	91.3 mi^2 (147 $km^{2)}$
Peri-urban area	146 mi^2 (235 km^2)
Peri-urban population	128,478
Main occupation	Agriculture, agricultural labor
Flood-prone areas	21,965.2 acres (8,889 ha)
Proportion of small and marginal farmers	70%
Open space	2,462.8 acres (997.47 ha)
Forest & agricultural land	28,560.9 acres (11,558.17 ha)
Rivers	Rapti and Rohin
Number of peri-urban villages	170
Pumping stations	40 stations pump 320 cubic feet (1,993.2 imperial gallon) per second

Source: GEAG, 2016.

Outcomes

The project proposal[3] identified the following expected project outcomes:

- conserve agricultural land in peri-urban areas to enhance flood buffering capacity of the city, on the whole
- establish sustainable and climate-resilient models for agriculture-horticulture-aquaculture-livestock systems in marginal land holdings in peri-urban areas by promoting LEISA practices
- reduce inputs and enhance net gains for smallholder, marginal, and women farmers
- enhance livelihood security of vulnerable groups in peri-urban areas and the food security of urban poor
- publish and disseminate communication products and articles to share experiences in regional and international platforms, and in peer-reviewed international journals
- institutionalize and replicate project approaches and learning.

ACTIVITIES TO REACH OUTCOMES

The project document initially listed a number of activities to reach these outcomes: i) baseline survey, ii) field interventions: developing farm models and common property resources management, iii) climate-resilient extension system, iv) adoption of practices, v) research, and vi) advocacy. During the project's lifetime, these activities gradually changed into eight components: i) farm models, ii) institution building, iii) weather and agro-services, iv) common property resource management, v) market linkages, vi) awareness and cross learning visits, vii) research and documentation, and viii) advocacy.

Fieldwork of the project was concentrated in eight villages located in two clusters of two river catchments, one in the north and one in the south of Gorakhpur, covering an area of about 1,112 acres (450 ha, brown areas of the map).

[3] GEAG, 2011. Enhancing Climate Resilience of Gorakhpur by Buffering Floods in Gorakhpur through climate- resilient peri-urban agriculture. Project proposal submitted to ACCCRN.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2

Purpose of the formative evaluation

Scope and focus

RUAF Foundation, in collaboration with ICLEI South Asia, undertook a formative evaluation of GEAG in April–May 2016, at the request of The Rockefeller Foundation. The objectives of the evaluation were to:

- articulate clearly the ToC of the project and a related indicator framework
- assess the quality and extent of the baseline data and recommend how best to use this data in assessing the progress, outcomes, and eventual impact of the project interventions
- analyze the types or typology of peri-urban interventions that are emerging from the project, such as models for peri-urban land use management that combine one or more of the project strategies
- assess the progress of the project and make recommendations with regards to its ongoing management, sustainability, and scaling to other areas.

The scope and focus of the formative evaluation was to support GEAG in organizing, analyzing, and assessing the results and learning of the project. Therefore, during a two-day workshop, the evaluation team started to work with the project team in clarifying its ToC and indicator framework, analyzing the results, and learning and developing types or typologies of peri-urban production and management interventions that were emerging from the project. After the workshop, field visits were made to three of the eight selected project villages, and meetings were held with key stakeholders from the Gorakhpur area to get a better understanding of the project's progress. The assessment of the project's activities was not carried out in detail. Rather, it sought to provide some insights in the project's progress based on the following criteria and main questions, to the extent this information was available.

Effectiveness

- To what extent has the project achieved its outputs and outcomes as stated in the project document?
- What were the factors influencing the achievement or non-achievement of these outputs and outcomes?

Impact

- Have the project activities contributed to reaching the objectives? What is the impact of the project activities on the beneficiaries, different target groups, or those affected? In this respect, special attention will be given to the following stakeholder groups:
  - targeted model farmers
  - outreach farmers
  - farmer clubs, farmer field schools, and agro-service centers

- village- and city-level organizations, and governments responsible for land use, land use planning, and agricultural development.
- What are the future likely impacts?

Impact assessment will build on available baseline and end-line data, further complementing them with a qualitative assessment that indicates perceptions and personal observations.

Sustainability

- Are the impacts (expected to be) sustainable?
- How sustainable were the interventions?
- Which outputs and outcomes show the best prospect of being sustained and why?
- To what extent are the different stakeholders committed to sustaining project activities and facilitating their further uptake or replication?

Replication

- What is the scope for replicating the project among a larger number of farmers in other areas in Gorakhpur and beyond? Which activities have the best scope for replication?
- Under what conditions can the project be replicated?
- How can the project be out-scaled and up-scaled? i) Have project approaches and proposed agricultural models and LEISA practices been taken up by non-directly targeted farmers and villages? ii) Have project approaches and recommendations been institutionalized by a wider group of targeted organizations, as well as those not directly targeted (such as village councils, research or support institutes, or government institutes)?

It should be noted that the formative evaluation provided a general overview of progress without going into great detail. It also did not foresee the collection of new or additional end-line data for the project. It rather analyzed available data and assessed their quality and extent. Based on this, it recommends how best to use this data or what additional data the project should collect to further assess the progress, outcomes, and eventual impact of the project interventions.

3

Methodology of the formative evaluation

Information across stakeholders and scales

The formative evaluation collected information across stakeholders and at different scales. Figure 2 provides the sources of information on which this evaluation is built.

The methodology for the evaluation included a desk review, project workshop, field visits, feedback and closing workshop, and reporting. They are explained below.

Desk review

Relevant background reading made available by the project was studied by the evaluators. These documents included: the project proposal; project work plans, annual reports and project progress documents; technical reports, activity reports, meeting minutes, baseline and end-line data; other project documents; and other relevant documents, such as the Gorakhpur Master Plan 2021.

Project workshop

The evaluation started with a two-day workshop with project staff to articulate the ToC and related indicator framework, and to analyze the types or typology of peri-urban interventions that are emerging from the project.

Field visits (4 days)

The evaluation team made field visits to selected farms and villages in order to ensure coverage of the various management and production models for peri-urban land management. Furthermore, it met with key stakeholders in order to collect further information needed to assess progress of the project and to highlight recommendations, seek counterfactual results and opinions, and assess the scope for project replication. A combination of focus group discussions and in-depth semi-structured interviews was used during meetings with the project team members, implementing partners, key stakeholders, and representatives of relevant programs in the area.

Feedback and closing workshop

At the end of the field mission, the evaluation team presented its preliminary findings to the project team and held discussions seeking further feedback and guidance on particular areas of attention needed for the further development of the draft evaluation report.

FIGURE 2: Sources of information for the formative evaluation

Reporting

A draft formative evaluation report was compiled based on the data collected during the desk study and the field mission, and guided by the feedback and comments of the project team members. This draft was shared with the project team, key stakeholders, and The Rockefeller Foundation for further comments and suggestions. The final formative evaluation report submitted by the evaluation team includes:

- a consolidated ToC and indicator framework
- an assessment of the quality and extent of the baseline data and recommendations for how best to use this data in assessing the progress, outcomes, and eventual impact of the project interventions
- a description of the peri-urban land use management, production types, and typologies (combining one or more of the project strategies)
- an assessment of the progress of the project, and recommendations for their ongoing management, sustainability, and scaling to other areas.

The itinerary of the formative evaluation and a list of all the people and organizations met is included in Annex 1.

4

Results of the formative evaluation

Theory of Change

The clear articulation of the project's ToC was the first objective of this evaluation. The following compares the project's ToC with the initial ToC described in the project document.

Linkages between outputs and impacts were incomplete or missing

The initial ToC lacked clarity on how project outputs would lead to project outcomes, and in turn, how project outcomes would lead to impacts. This was clarified in the revised ToC.[4] The major aim of the project "to enhance the resilience of Gorakhpur through maintaining peri-urban agricultural lands" is now understood to be realized by ensuring that agriculture remains the preferred land use option by farmers as well as policymakers. It expresses the hypothesis that farmers will continue farming and not sell their land if they can make a good living out of agriculture and that this, in turn, will contribute to buffering Gorakhpur against floods. Furthermore, the project's advocacy efforts should increase awareness among decision and policy makers of the importance of maintaining and preserving peri-urban agricultural land areas. As a result, such awareness will lead to protecting peri-urban agriculture areas from urbanization or industrialization, and to avoiding changes in the designation and zoning of agricultural land in city land-use and development plans, now and in the future. It was assessed that these impacts could be best achieved in a temporally phased manner, and therefore, they have been categorized in terms of short-, medium-, and long-term impacts.

Some changes in the original outcomes were required

In the original project document, "Conservation of agricultural land in peri-urban areas enhancing flood buffering capacity of the city, on the whole" was considered a project outcome. However, it has now been re-cast as a long-term impact. Another outcome, "enhanced food security of the urban poor," has been scaled down and reformulated as "contribution to food security of urban citizens." This acknowledges that the project could only make a small contribution to the food security of the urban population by improving the agricultural productivity of a limited number of farmers selling their products in the city's local markets. It also recognizes that there are many external factors influencing urban food security, such as changes in urban incomes, changes in food prices, and consumer awareness.

[4] The revised ToC was developed based on the logic of the "if-then" (causal) relationships between the different elements of the program, with activities leading to outputs, outputs leading to outcomes, and outcomes leading to impacts.

Activities were reviewed to represent actual work implemented

The project initially distinguished eight components or "work packages": i) farm models, ii) institution building, iii) weather and agro-services, iv) common property resource management, v) market linkages, vi) awareness and cross learning visits, vii) research and documentation, and viii) advocacy. In reality, however, the project also worked on additional areas that were subsumed, not always very clearly, in these eight components, but which in fact deserved to be mentioned separately. The project put a lot of effort into establishing linkages with government departments and programs to help farmers in the intervention villages to access subsidy schemes and program support. Also, the project put a lot of effort and care in preparing documents and reports for their advocacy work, and awareness- and capacity-building activities – producing knowledge products that document more than solely the results from the research. Therefore, it was suggested to add two more components or "work packages": ix) establishment of linkages and networking, and x) documentation.

The revised ToC is depicted in form of a results chain in Annex 2.

Indicator framework and baseline data

The indicators established in the original project document mostly were to measure achievements at the output level, while indicators for assessing progress at the outcome and impact levels were missing to a large extent. Nonetheless, the project established a good monitoring and evaluation system, especially for measuring progress in the participating villages. Every trimester, the project collected monitoring data such as income, input costs, market dependency, crop diversity, cropping intensity, and areas under cultivation from the model farmers. This provided good information and insight on how introducing LEISA and climate-resilient production practices impacted famers' livelihoods. Also, data on the functioning of farmer clubs, farmer field schools, agro-service centers, and LSKMs were collected quarterly – ranging from information on the equipment rented out by the agro-service centers to describing the issues discussed in the farmer field schools and the results of the LSKMs'[5] lobbying efforts. Information was also collected on the implementation of LEISA and climate-resilient practices by link farmers in the intervention villages. It can be concluded that the project collected very good baseline data and established a well-functioning monitoring system to measure progress and impacts in the project villages, but lacked general baseline and monitoring data to measure overall progress beyond the project villages and towards its envisaged impacts.

The indicators were discussed and reviewed in relation to the revised Theory of Change during the evaluation workshops. Missing indicators were added as was available baseline and end-line data. The revised framework with indicators, baseline data, and end-line data is included in Annex 3.

Typology of peri-urban interventions at field level

The development of a typology linking the different LEISA and climate-resilient production practices with the other project interventions proved difficult. First efforts tried to categorize the LEISA and climate-resilient practices according to their contributions to climate resilience at village level or their contributions to buffering floods in the city. Unfortunately, this did not work, because the LEISA and climate-resilient practices are directed primarily at the generation of farmers' income, and improving and increasing resilience of farmer livelihoods, rather than at increasing the city's resilience to climate change (note: Annex 4 charts linkages between project interventions and impacts across scales).

[5] LSKMs can be considered as farmer unions and are part of the national LSKM system

A typology of project interventions at field level was developed based on the evaluation meetings in the field and discussed in the final workshop. As shown below, the typology consisted of four components: i) farm models introducing a number of LEISA and climate-resilient production practices, ii) institution building, iv) weather and agro-services, and iv) establishment of linkages and networking.

Component 1: Farm models

The project introduced a number of LEISA and climate-resilient production practices through farm models, with the underlying idea of "seeing is believing." These practices included:

- compost: introducing several different composting forms
- trichoderma: introducing this fungi strain which enhances plant and root growth
- bio-pesticides: mostly made from locally available resources to deter pests
- oil cakes: mostly using locally available mustard oil and neem as additional fertilizers
- plantation: establishing tree plantations of teak but also other species such as guava
- mixed farming: growing more crops (mostly a variety of vegetables) on the same piece of land during a single growing season
- seed production: producing seeds on farm or buying them
- IPM: promoting the lowest possible use of pesticides and only using chemical pesticides if bio-pesticides did not have sufficient effects
- kitchen gardening: gardening for home consumption
- loft farming: farming on a loft or roof
- bag or thermocol farming: planting seeds in thermocol or jute bags, and hanging them on poles above waterlogged or inundated land
- low tunnel polyhouse: raising early nurseries and vegetables in tunnel greenhouses
- permanent raised beds: raising beds, so that they remain above waterlogged soil during the monsoon season
- relay cropping: starting a second crop amid the first crop before it has been harvested.

The project offered and demonstrated all of the above practices. However, the package of composting, thermocol farming, loft farming, low tunnel polyhouse, mixed farming, relay farming, and the use of bio-pesticides and IPM techniques was found to form a suitable combination to address flooding of agricultural lands. Composting was the most adopted agricultural practice by the targeted model and link farmers; the project documented 662 households adopting this practice. Compost with or without trichoderma was put in bags (mostly jute rather than thermocol boxes) and planted with seeds that could be produced by farmers themselves or bought. In case of a flood, these bags can be placed at different levels along a pole above the submerged soil (a kind of loft farming).

In several cases, poles were made from Dhaincha (*Sesbania* spp.), a shrub species introduced to the farmers by the Department of Agriculture as green manure. Low tunnel polyhouses are used to grow the saplings. A master trainer in Semra Devi Prasad Village developed nurseries to sell the saplings, and at least seven farmers in his village have followed his example. The saplings are planted directly in the field, either in mixed or relay farming. By developing such nursery activities, farmers can continue working and producing during floods when their lands are submerged or waterlogged. As soon as the water recedes, the saplings can be planted in their fields. Farmers use mostly bio-pesticides to control pests and plagues during the growing season which increases food safety, reduces input costs, and improves soil quality.

In relation to climate change, the major advantage of this system is that time is saved, available space (especially vertical space) is used optimally during the flood season, and farmers are capable of growing three crops a year instead of only one or two. During dry seasons, as has been the case over the last two years, access to agricultural equipment from the agro-service centers

(see below) at rates lower than those in the open market has allowed farmers to irrigate their fields using ground and surface water, and to continue cultivating crops throughout the year. In addition, crop diversification and the ability to grow crops during flood or dry seasons has contributed to increased income, and food and nutrition security among the involved farmers.

Component 2: Institution building

The implementation of the LEISA and climate-resilient practices described above were further supported by the farmer clubs, farmer field schools, agro-service centers, and LSKMs formed by the GEAG project. The farmer clubs and farmer field schools facilitated exchange of information among farmers and increased their confidence in implementing the newly learned practices. The agro-service centers provided agricultural equipment, such as diesel-powered water pumps, irrigation pipes, and materials for preparing nurseries and constructing polyhouses, on a rental basis. The LSKMs have proven essential for farmers to lobby and stand up for their rights. These organizations have been crucial in supporting and facilitating both model and link farmers in the implementation of the introduced LEISA and climate-resilient production practices.

Component 3: Weather and agro-services

The project provides weekly weather and agro-services via SMS. This information is also written on notice boards for people without mobile phones and communicated during farmer field school meetings. These services are appreciated by farmers as an additional source of information to make informed decisions about their agricultural practices.

Component 4: Establishment of linkages and networking

The project facilitated the establishment of linkages and connections between farmers and GEAG experts, and also between farmers and government line departments through the formed farmer clubs. These established linkages give farmers access to improved information from experts but also access to subsidy schemes from government line departments. Linkages were established with the National Bank for Agriculture and Rural Development (NABARD) which has a program to support farmer clubs financially for a period of three years. During the evaluation, farmers recognized the importance of these linkages and the formed institutions, expressing that they felt they had become better able to solve their own problems.

Figure 3 provides a schematic overview of the typology of project interventions that were re-categorized during the evaluation meetings. It illustrates an indicative and streamlined approach that could be considered for further out- and up-scaling. This package of LEISA and climate-resilient practices combined with supporting interventions and services is now available to the project farmers and contributes significantly towards making their agriculture, and therefore their livelihoods, more resilient to the impacts of climate change.

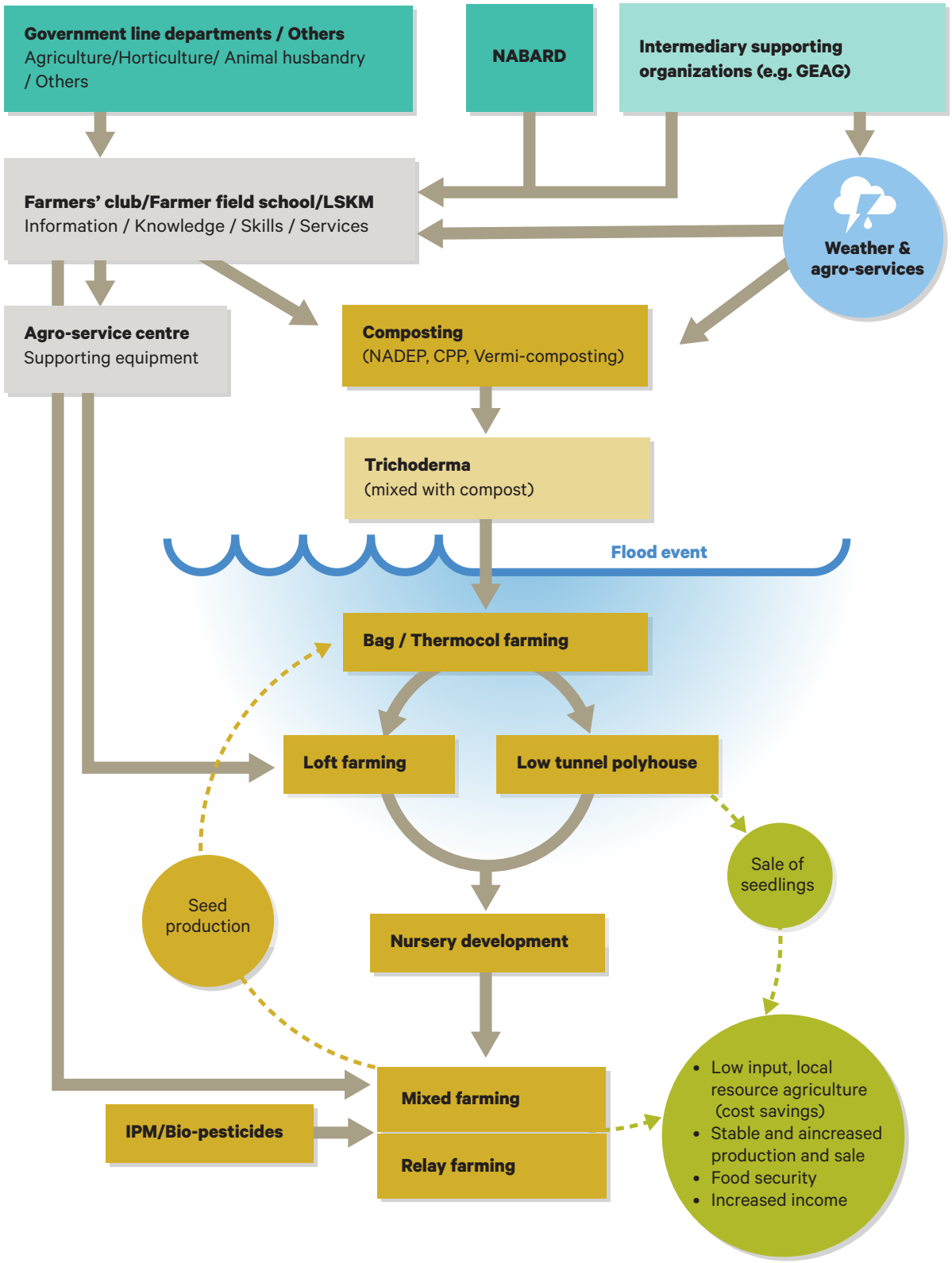
Assessment of project achievements

Effectiveness

QUANTITY AND QUALITY OF OUTPUTS AND OUTCOMES

The quantity and quality of the outputs produced by the project are outstanding. According to the revised ToC and the monitoring framework (see Annexes 2 and 3), the project was systematically able to reach the originally set targets and indicators for the various planned outputs and, to some extent, outcomes. The collected end-line data (shown in Annex 3) clearly demonstrates the excellent results of the project, especially in the eight intervention villages. In the short project period, the project team and partners even achieved consolidated outcomes in the areas of increased income and food security of model farmers and link farmers, through the successful demonstration of the benefits of LEISA and climate-resilient practices. The formed farmer clubs, farmer field schools, and agro-service centers, and the established linkages with

FIGURE 3: Typology of project interventions



in-line government departments and other experts gave farmers the confidence to implement the introduced LEISA and climate-resilient practices, to ask for required support, and to stand up for their rights. The formation of LSKMs also led to increased conservation of common property resources and decentralized wastewater treatment systems (DEWATS) were installed in two of the intervention villages by raising additional funds. The farmer clubs, farmer field schools, LSKMs, and agro-service centers have become largely self-reliant civil society organizations formed by and in support of the farmers, because they benefit the collective as well as the individual, and there is a demonstrated demand for the services they provide. Furthermore, farmers now have access to weekly weather and agro-services provided by mobile SMS that are transcribed on prominently displayed notice boards thanks to the project. Farmers claim to use this information in making informed decisions about their agricultural activities. The project also put a lot of effort into documentation and research, with the major aim of informing a wider group of stakeholders and validating the advocacy work.

The greatest project achievements of the project can be seen at field level. They include:

- establishment of functional model farms that showcase a variety of LEISA and climate-resilient practices
- adoption of LEISA and climate-resilient practices by link farmers
- initiation of self-reliant farmer clubs, farmers field schools, and agro-service centers to support farmers in their agricultural endeavors
- initiation of self-reliant LSKMs to help farmers bring their issues to the attention of decision and policy makers, and connect them to other smallholder and marginal farmers in the state through this federated institution
- provision of weather and agro-services by SMS and on notice boards
- establishment of linkages to government line departments which has led to an increasing number of farmers benefiting from government subsidy schemes.

The project also delivered good results in publication of advocacy documents and ecosystem services research. These included the following:

- Documentation and publications in support of advocacy for peri-urban agriculture. The project has developed numerous documents, including research publications, issue briefs, and evidence from the field (listed in Annex 3) to support the advocacy work.
- Of note, the project could have worked on technical leaflets and fact sheets in support of disseminating the different LEISA and climate-resilient practices. However, the project document did not foresee these needs.
- Research to gain insights in the drainage system of the city and importance of peri-urban land's ecosystems services.

Of note, the ecosystem services research concentrates on open spaces in the peri-urban area and does not sufficiently take into account the ecosystem services from agricultural land itself. In addition, the research results did not become available until the end of the project and could only be taken up in the advocacy work to a limited extent.

The project's achievements in the uptake of its advocacy efforts are less established. Bringing systemic change through advocacy efforts is tremendously challenging. It is often only through emerging windows of opportunity due to changing situations that shifts in policies and practices at higher levels of governance can be realized. Advocacy efforts have not found a strong foothold for a variety of reasons, including the facts that "conservation of *peri-urban* agriculture" is not a particular mandate of any department, there are far more powerful interests at play in converting the land use, rules are not enforced as they should be, and at times there is the lure of an "improved" urban life for the farmers. This can clearly been seen from the implementation of the master plan for the development of Gorakhpur area 2021. Although this plan recognizes the importance of maintaining the agricultural lands around the city,

especially in the floodplains, it is not adequately enforced. As a result, city expansion has continued, even in the floodplains.

Although peri-urban agriculture has always existed, the concept itself has not been formally recognized, and therefore, finds little traction among policy and decision makers. This project convincingly demonstrated the benefits of LEISA and climate-resilient practices for the peri-urban farmers who adopted them, but has not been able to clearly show contributions to reducing climate vulnerability of Gorakhpur. Critical first steps have been taken that now need to be built on to change policy and practice at a larger scale. For example, government institutions have become more aware of the importance of conserving water bodies in the peri-urban areas to buffer flood risks, and have passed and issued instructions to conserve a water body in the Maheva area.

INFLUENCING FACTORS

There are a number of underlying reasons for the overall excellent output and outcome results. They include:

- buy-in from communities, especially from communities that had already experienced impacts of natural hazards and climate changes
- relevant project interventions, such as the basket of LEISA and climate-resilient practices introduced to cover the agricultural cycle, provided options and have helped farmers to diversify their crops and increase their income, while the building up of the civil society organizations has helped farmers access information, build confidence, and stand up for their rights
- effective project structure and design, which called for model farmers, master trainers, and project supervisors, created a stimulus for targeted and link farmers to adopt LEISA and climate-resilient practices through a system of "seeing is believing"
- good rapport with the community: GEAG's project team established very good relations with the villagers characterized by mutual trust
- capable and dedicated project team: GEAG's project team had long-term presence and a good reputation in the area
- good relations with government line departments and key stakeholders.

GENDER

The project gave special attention to the inclusion of women and gender aspects. Twelve of the 30 model farmers were women, as were 11 of the 25 master trainers. In this way, women link farmers could ask female model farmers or female master trainers for support, while men could ask their questions to male model farmers or master trainers. This system has been very fruitful. During the focus group discussion with link farmers, women were very vocal and expressed their opinions and views with great confidence. One woman from Sanjhai village, who had little formal education, was invited to a national workshop, organized by GEAG in Delhi, to share her experiences with experts and other practitioners. She has been an inspiring example to other women in the area.

Traditionally, agricultural activities are divided along gender lines, with men making most of the decisions related to monetary investments, and women making those related to locally available resources. This division of labour persists. By reducing the input costs through the introduction of LEISA practices, the project has, in a sense, enhanced the decision-making role of women farmers at the household level. Further, by providing a range of interventions that covered activities that are traditionally the responsibility of both men and women farmers, the project was gender inclusive. According to the GEAG project team, women were shy at the start of the project implementation, but this clearly changed.

Impact

IMPACT ON MODEL FARMERS

The project reached – or even surpassed – its intended impacts on model farmers. A comparison of the project baseline and end-line data showed the average agricultural income of model farmers had more than doubled. During the evaluation visits, farmers

confirmed their increase in income resulted from project interventions that led to reduced input costs, crop diversification, crop intensification, expansion of agricultural land under cultivation, and reduced crop loss due to natural hazards and floods, but also better market linkages and better prices for products (the latter because of limited use of external inputs).

The nine model farmers met during the evaluation (seven men, two women) were all very enthusiastic about their new agricultural practices and very proud to show their fields. Apart from the impact on income and food security, model and link farmers had also become more confident and vocal due to their improved practices as well as to the effect of the local institutions they had formed and participated in, such as farmer clubs, farmer field schools, and LSKMs.

IMPACT ON LINK FARMERS

In monitoring the agricultural practices adopted by link farmers, the project found they had implemented composting, bio-pesticides and IPM, plantation, and kitchen gardening. According to the project data, 1,247 link farmers had adopted one or more of these practices. During the evaluation in three villages, composting, bio-pesticides, and mixed and relay cropping were frequently mentioned as the most adopted practices.[6] The concept of IPM was not clear to the farmers, though they did implement components of it. Farmers stated that composting and bio-pesticides reduced their input costs significantly while improving the quality of the produce. Mixed and relay cropping enables diversification and helps farmers hedge risks of crop loss and provided opportunities for increased income. All of these, in turn, improve soil health. During the evaluation visits in the three villages, farmers estimated that 50 to 80 percent of the farmers in the intervention villages had adopted one or more practices, while the adoption rate in neighboring villages was estimated at 10 to 30 percent.

[6] Thermocol/bag farming and loft farming as mentioned in the typology of project interventions is only practiced in times of floods. It is most suitable for farmers with small landholdings in areas that are submerged for longer periods.

With the improved practices and increased income, the project has renewed people's interest in farming in the peri-urban areas. When farmers were asked if they thought of selling their agricultural land, most of them were appalled. The question evoked reactions such as: "Selling land is like cutting off my legs." Farmers are very aware that if they sell their land, they lose their source of income and livelihood, while the money they receive for their land will not last long. However, it was also mentioned that in case of urgent need for money, people will sell some small parts of their land or even soil which then is replenished with the next flood. A study conducted by the project, which sampled 166 farmers in the northern cluster and 108 farmers in the southern cluster of the eight project villages, documented the increased interest in agriculture and the decreased interest in selling land. The study found that in 2010, 1.83 acres / 0.74 ha of land were sold in the northern cluster, but only 0.66 acres / 0.27 ha of land were sold in 2015. In the southern cluster, it was even more apparent, with sale of land decreasing from 6.9 acres / 2.8 ha in 2010 to 0.2 acres / 0.1 ha in 2015. It is very likely that the decline in land sales in the project intervention villages can be attributed to the project. For example, farmers of Shekpurva Village mentioned that many builders still come to their area to inquire if there is land for sale. In addition, prices have gone up tenfold over the last years while prices of land near the road have gone up 15-fold. The same farmers mentioned that farmers, in general, do not sell their land anymore.

IMPACT ON LOCAL INSTITUTIONS: LSKMS, FARMER CLUBS, FARMER FIELD SCHOOLS, AGRO-SERVICE CENTERS

The local institutions formed by the project have evolved into self-reliant organizations. Farmers who experienced the benefits of the farmer clubs, the farmer field schools, agro-service centers, and LSKMs are therefore interested and motivated to continue their operations. Farmers appreciate that they can rent equipment such as diesel-powered water pumps, irrigation pipes, and other small equipment in the locality and for lower prices than in the city market. The farmer clubs and field schools are instrumental

in sharing information and discussing solutions for agricultural problems that may arise. This has helped farmers improve their practices and increase their confidence in what they are doing. The farmer clubs have also helped farmers access government subsidy schemes, such as seeds for reduced prices, and veterinary support, such as insemination. The farmer clubs and agro-service centers have their own bank accounts with positive balances. Furthermore, the farmer clubs have applied for support from the Farmer Club Programme. Implemented by the NABARD, the program supports farmer clubs with 10,000 Indian Rupees (INR) (equivalent to $150) per year for up to three years.

The LSKMs in the project villages are part of the national LSKM network. Farmers pay a membership fee of 5 INR per year. The LSKMs have helped farmers join their voices and concerns and bring their issues to the attention of policy and decision makers. As a result, some issues related to the conservation of CPR, such as open land, pasture land, forests, and water bodies have been resolved.

IMPACT ON CONSERVATION OF COMMON PROPERTY RESOURCES AREAS

Within the project villages, the project activities have contributed to the conservation of CPR areas. Farmers have brought their concerns about the encroachment of remaining CPR areas and pollution of water bodies successfully to the attention of local decision makers through the formed LSKMs. As a result, one 23,980 sq ft water body has been conserved, 23,150 sq ft of community land has been demarcated and conserved, and 3.5 acres of open land has been conserved through the establishment of a tree plantation. The conserved lands also provide a venue for social events such as weddings or child nurseries. In some cases, runoff and even wastewater is collected in CPR water bodies and used for irrigating surrounding fields. GEAG promotes the conservation of CPRs, as they provide critical supporting services to agriculture in peri-urban areas. This thinking was echoed by all the farmers that were approached.

Water pollution is also high on the agenda, due to the release of untreated sewage water from the city into rivers and other water bodies. Only 12 percent of Gorakhpur is covered by the sewage treatment systems. Thanks to the project, one DEWATS has been installed and one is in the process, which will help farmers in two project villages access clean irrigation water. Farmers continue to lobby for access to clean water and the treatment of sewage water from Gorakhpur.

IMPACT ON RELEVANT GOVERNMENT INSTITUTIONS

The impact on relevant government institutions is somewhat mixed. Many of the government line institutions are not yet convinced of the importance of maintaining peri-urban agricultural lands in relation to buffering floods in Gorakhpur. However, government institutions are convinced of the importance of conserving water bodies in the peri-urban areas to buffer flood risks and have issued instructions to conserve a water body in the Maheva area. The line departments such as horticulture and agriculture still pay little attention to peri-urban farmers and agriculture areas, as they have a traditional focus on rural areas. For example, the programs of the horticulture department concentrate on farmers in rural areas with land holdings of at least 1 ha. However, marginal farmers are eligible and some peri-urban farmers have successfully applied to government line department schemes and accessed seeds, veterinary, and other agro-services.

IMPACT ON BUFFERING FLOODS IN GORAKHPUR

The project's contribution to its overall goal of buffering floods in Gorakhpur has not been clearly established. The project was implemented in only eight villages of the 170 villages in the peri-urban agricultural area, which is considered too small in scale to have a tangible impact on buffering floods. The production interventions promoted by the project were also rather oriented toward reducing climate change impacts on agricultural production and income in the growing season, rather than reducing the impact of climate change on the city through preservation and

improved management of peri-urban agriculture.[7] More evidence is required to demonstrate the specific ecosystem services provided by peri-urban agriculture that go beyond water bodies and open lands within the peri-urban area, and, in turn, to demonstrate their contribution to buffering floods in Gorakhpur.

This would require further research on the hydrological functions of peri-urban agriculture land areas and further understanding of the role played by peri-urban agriculture in flood buffering through, for example, water infiltration and reduction of storm water flows. This knowledge will allow comparison with other flood reduction strategies as well as comparison and monitoring of flood buffering capacity in partially or fully built-up areas versus agricultural watersheds.

Research conducted by the project partner Arup has demonstrated the need for improving the drainage system of the city. At present, the drainage system is old, often blocked with solid waste, and full, even in the dry season. The current drainage system and its ongoing maintenance cannot address present needs, let alone the future needs of the expanding city.

The flood regulation service of water bodies is also under threat due to siltation, but also due to solid waste and waste water being dumped into them. In order to have a lasting impact on buffering floods in the city, it is of foremost importance to improve the drainage system of the city. Upgrading and expansion of the drainage system will be very costly and disrupt transport and daily activities. This means that taking this step must be balanced against benefits and costs of other forms of water management – a matter of green versus grey infrastructure.

Buffering floods in the city and surrounding areas will only be possible with a good functioning drainage system in the city, well maintained and proper management of existing water bodies, and preservation of agriculture in the peri-urban lands.

Sustainability

SUSTAINABILITY OF PROJECT OUTCOMES AND IMPACTS

The outcomes and impacts at project village level are very likely to be sustainable. Both model farmers and link farmers have shown interest in continuing to implement LEISA and climate-resilient agricultural practices because of their demonstrated and tangible benefits. Also, the farmer clubs, farmer field schools, agro-service centers, and LSKMs have become self-sustaining organizations. Farmers are motivated and committed to sustaining these organizations, as they have first-hand experience in the added value these organizations bring. The locally appointed master trainers also assert that they will continue to support the farmer clubs and farmers field school once the project phases out. Farmers have built their capacities, and have become more vocal as they have gained confidence in speaking up for their rights and in accessing information. Through the formed LSKMs, farmers have been able to conserve CPR and the government-owned *gram sabha* lands[8] and water bodies. They have also established linkages with line departments and GEAG scientists through the farmer clubs. These relations will continue to exist and GEAG is committed to continue answering questions from the field.

Furthermore, GEAG expressed its intention to continue disseminating district weather and agro-services. This means farmers will have continued access to these services, in order to make informed decisions about their agricultural practices.

Because the project impacts are very tangible, it is very likely the related activities will sustain at the level of the intervention villages and, in turn, lead to reinforcement of the project intended impacts. However, it would be

[7] This can be seen in Pikine, Dakar, Senegal, where the "Live with Water" project captures floodwater in large sandy basins, around which cash crop gardens of mint and basil provide an income for local residents. Using the basins, floods that once wiped out houses, strained the local economy, and heightened the risk of disease have been converted into a new stock of fresh water for a West African agriculture community.

[8] *Gram sabha* lands are land areas owned by the government and under the jurisdiction of the elected local self-government or Panchayat

interesting to undertake a rapid after-project evaluation in a year, to re-check this assessment.

Sustainability of the project's efforts beyond the eight targeted project villages is less established. Farmers in neighboring villages have had opportunity to see how the participating villages benefitted from LEISA and climate-resilient agriculture practices, as well as to human resources trained in LEISA and climate-resilient agriculture. They also have partial access to climate risk and resilience-building information, such as weather and agro-services. During the evaluation visits in three intervention villages, farmers estimated that 10 to 30 percent of the farmers in neighboring villages had adopted LEISA and climate-resilient agricultural production practices. However, it is unclear to what extent this adoption of practices has led to sustained impacts in these neighboring villages and beyond in the peri-urban area.

Advocacy efforts that draw attention to the issues and importance of the preservation of peri-urban agriculture lands need to be sustained. The project has raised awareness of the need to preserve and support agriculture in peri-urban areas, but this awareness has not yet transformed into the needed action or regulation. For example, the master plan for the development of Gorakhpur area recognizes the importance of peri-urban agriculture lands, but the plan's implementation is not enforced.

In summary, there is a great level of expected sustainability in project villages, limited sustainability in other villages in the peri-urban area of Gorakhpur, and unclear sustainability in terms of policy uptake at city level and beyond.

Replication

SCOPE FOR PROJECT REPLICATION TO OTHER VILLAGES OF THE PERI-URBAN AREA OF GORAKHPUR

There is a huge scope for project replication in other villages in the peri-urban areas of Gorakhpur/ District. At present, this happens naturally through beneficiary farmers' exchanges with their relatives and acquaintances who live in villages other than the project intervention villages. A master trainer in Semra Devi Prasad Village has put a sign in his small shop that he is a master trainer and can provide agro-services free of costs. These peer-to-peer learning and exchange opportunities could be further strengthened through establishing increased opportunities for interactions and sharing between model and link farmers from project villages and other peri-urban villages – for example, by identifying farmers who would like to become model farmers in the other peri-urban villages. Working with model farmers has proven essential for the adoption of LEISA and climate-resilient practices, such as "seeing is believing." Such replication would require additional project funding, but this would be a relatively small amount that potentially can be leveraged through successful advocacy.

The described typology of LEISA and climate-resilient interventions provides an indicative approach for further out-scaling. This typology, which is a more streamlined and potentially less resource-intensive approach than that adopted by GEAG, can be further applied and revised for different contexts. Existing or potential typologies of LEISA and climate-resilient interventions could be used to address different flooding situations. Some of the agricultural land is located in areas waterlogged for three to four months a year while others areas are "only" submerged for two to four weeks a year. Also, farmers' own initiatives for addressing flooding could be further studied and enhanced. For example, one farmer mentioned that they do rooftop farming and have guava orchards to overcome their three to four waterlogged months.

It will not be necessary to carry out all the project activities for the replication of the LEISA and climate-resilient practices in the other villages of the peri-urban areas of Gorakhpur. It will suffice to organize one- or two-day LEISA and climate-resilient practices technical sessions, identify two or three people as potential contact persons and model farmers per village, and provide backstopping support and follow-up. In this

way, the project results could spread further in the peri-urban areas with limited future funding. In addition, it is important to continue to facilitate linkages and service flows between farmers and government, scientists, and service providers, as has been done by the current project.

SCOPE FOR PROJECT REPLICATION AT CITY LEVEL AND BEYOND

The project's scope for replication at city level and beyond would need further adjustments. A first step in this direction would call for facilitating the inclusion of a chapter on peri-urban agriculture land management in the District Disaster Management Plan by: i) targeting the district governing body, and ii) supporting the development of such a chapter. The District Disaster Management Authority has indicated willingness to include such a chapter in this plan which is revised and updated annually. A second step would involve the implementation of additional research on the hydrological functions of peri-urban agriculture land areas and further understanding of the role peri-urban agriculture plays in flood buffering, such as water infiltration and reduction of storm water flows. This knowledge will allow comparison with other flood reduction strategies as well as comparison and monitoring of flood buffering capacity in partially or fully built-up areas versus agricultural watersheds. Scenarios could also be elaborated calculating costs of upgrading and expanding grey versus green agricultural infrastructure. In this respect, it is important to build alliances, including with the private sector, and for farmers to have a stronger voice in making sustained choices about land use.[9]

Finally, the development and implementation of a further communication strategy for proactive, targeted dissemination and, in turn, uptake of learning and techniques by line departments, policy and decision makers, private sector, and the general public is required to streamline the replication and uptake of the project. The project developed excellent communication products, but did not actually develop a communication strategy. Without a communication strategy that targets different audiences with materials that are appropriate for each of them, the influence and impact of the learning remains limited or ineffective.

INTEREST OF PARTNERS/ DONORS TO REPLICATE THE PROJECT

Unfortunately, currently there are no partners or donors within the Gorakhpur area interested in replicating the project. Government line departments focus on the implementation of their own programs which are mostly implemented in the rural areas. It was beyond the scope of this evaluation to interview partners and donors outside of Gorakhpur area.

[9] In other areas in India, cities apply a zero-loss of land policy. Private sector building on agricultural land have to compensate for the loss of this land by supporting (new) agricultural developments elsewhere in and around the city.

5

Conclusions

The "Enhancing climate resilience of Gorakhpur by buffering floods Gorakhpur through climate-resilient peri-urban agriculture" project has had a great and potentially lasting impact on the participating marginal farmers in the peri-urban areas. Farmers have been able to increase their income, as well as their food and nutrition security, because of: i) reduced input costs and market dependency, ii) increased crop diversity, iii) the ability to cultivate crops despite floods during the summer allowing them to harvest three crops a year instead of one or two, iv) cropping intensification, and v) expansion of areas under cultivation. Since agriculture has become a more profitable venture, lands that were earlier left fallow are now being cultivated, and in some cases, farmers have also purchased additional land to cultivate.

In addition, the project has been successful in forming self-reliant local institutions such as farmer clubs, farmer field schools, agro-service centers, and LSKMs. These institutions have supported farmers in accessing cultivation equipment within their areas for lower prices as well as in accessing subsidy schemes of in-line departments. However, more importantly these organizations have increased farmers' confidence in their ability to solve their own problems through the farmer clubs and farmer field schools which deal with agricultural issues, and through the LSKMs which deal with problems related to wider issues that are of concern to the entire community. If farmers are not able to solve the issues by themselves, they are connected and can reach out to experts from GEAG and in-line departments for advice to address their issues. Also, the weather and agro-services provided and disseminated by SMS, notice boards, and by word of mouth help farmers make more informed decisions about their agricultural practices and planning.

The project's activities, which have benefitted 1,377 households and 6,985 people, have resulted in greater resilience of model and link farmers, and have led to increased resourcefulness, access to information, and responsiveness.

Increased resourcefulness. Farmers have had better access to needed equipment through the agro-service centers, resources such as capacity building and financial information, and services such as government programs.

Increased access to information. Information has been provided, discussed, and disseminated through farmer clubs, farmer field schools, and LSKMs. Also, the weather and agro-services data provided by GEAG have helped farmers make informed decisions.

Increased responsiveness. Farmers can better respond and adapt to their situations and feel capable

of addressing issues themselves through their involvement with the formed farmer clubs and LSKMs, their access to weather and agro-services, and the established linkages to experts.

Farmers' greater resilience has also reduced their vulnerability. This has been clearly demonstrated by the strong decline in the sale of agricultural lands for other uses in the eight intervention villages. Because of the tangible benefits of LEISA and climate-resilient agriculture, these agricultural practices are also applicable in and beyond the targeted villages – to other peri-urban areas facing similar challenges. The typology of LEISA and climate-resilient interventions used by the project provides an indicative approach for further out-scaling. As for out-scaling, this typology could be further refined, as it currently draws on limited learning and contexts. The production interventions and typology promoted by the project focus on reducing climate change impacts on agricultural production and income. Interventions and typologies that specifically address the reduction of climate change impacts on cities through improved management of agricultural land areas should also be further explored.

Despite the great results in the project intervention villages, the project's contribution to the intended impact of buffering floods in Gorakhpur has not been clearly established. The missing links between the activities in the villages and the overall impact have been addressed in the revised ToC and indicator framework (see Annexes 2 and 3). The fact that the project had a demonstrated impact on reduction in sale of agricultural land is truly remarkable. However, the impact of agricultural land preservation on actual buffering of floods has not been demonstrated – that said, doing so was probably out of the scope of this project as it would have required monitoring over a longer period of time.

It is understood that peri-urban agriculture is only part of the solution to buffering floods. For example, insufficient city drainage systems need attention. In addition, more holistic planning is needed – planning that would include establishment of controls over city expansion and development, proper drainage systems, and the conservation and proper management of open spaces, water bodies, and agricultural lands in peri-urban areas and beyond. However, as stated, data have not provided evidence of the actual contribution of peri-urban agriculture to changes in flood risks and incidences. The project's advocacy efforts have increased some understanding among government line departments, policy and decision makers, private sector and the public about the importance of maintaining peri-urban agriculture lands. However, probably due to lack of more specific impact data, this increased awareness has in many instances not been sufficient to transform into the needed action.

6

Recommendations

In order to design a targeted approach to buffering floods, it will first be necessary to have a better understanding of the causes, frequency, and location of water flows and floods in Gorakhpur and surrounding areas. This will require more comparative research on the peri-urban ecosystem services that buffer flooding provides, in order to provide the evidence for maintaining peri-urban agricultural land. Such research could consist of monitoring rainwater infiltration in different periods of rainfall intensity, in different types of agricultural areas, up and downstream from the city, and in the city's watersheds. Flood risks and incidences in partially built-up versus agricultural areas could be monitored. Scenario studies can be developed to look at the increase in water infiltration and reduction of flood risk if agricultural open areas or water infiltration in those areas are increased or reduced.[10] Cost estimates can be made comparing the cost of expanding the city's drainage system with other solutions (green or blue infrastructure as compared with grey infrastructure).

Second, more and new research is needed to design, test, and implement production and agricultural land management models that contribute to reducing flood risks, and apply currently developed models to contribute to reducing impacts of flood on agricultural practices and livelihoods.

Holistic land-use and development planning is required for the city, and for peri-urban and rural areas. This holistic plan should address: controlled city expansion and development, proper management of drainage systems, conservation and proper management of open spaces, water bodies, agricultural lands, and the potential introduction of new agricultural production and management models.

A first step in this direction could be the inclusion of a chapter on peri-urban land management in the District Disaster Management Plan. GEAG could support this by targeting the district governing body and supporting the development of such a chapter. The District Disaster Management Authority has already expressed interest in including such a chapter.

Advocacy and lobbying need to continue. Although Gorakhpur's Master Plan 2021 recognizes the importance of peri-urban agricultural lands, the plan is not enforced and city expansion has already gone beyond the planned 2021 boundaries. Therefore, it is recommended that GEAG revisit the conducted stakeholder analysis which identified stakeholders who can support their work and those who have the power to make changes, then leverage those stakeholders with high interest, and target decision makers with medium to high power.

[10] See similar scenario studies developed by RUAF in other cities

The GEAG project lacked a clear communication strategy. The development of such a communication strategy is essential to formulating clear key messages targeted at different audiences by identifying the specific communication needs of line departments, policy and decision makers, private sector and the general public, and making use of different communication channels. Building further alliances and partnerships to address peri-urban area issues needs to be a key component for further advocacy and lobbying efforts.

It is further recommended to scale out LEISA and climate-resilient practices to other villages in the Gorakphur peri-urban areas. This has already happened – naturally through word of mouth – but this process could be accelerated given the excellent project results in the intervention villages. Because line departments are still not very interested in upscaling this approach due to their focus on rural areas and their own programs and targets, it is recommended that in the short term, GEAG try to find funds to cover costs for targeted out-scaling to key villages in the peri-urban areas in order to benefit from the current dynamic and positive results generated.

As stated above, lobbying of line departments and other actors providing agricultural services should continue to ensure their uptake of project results in the medium to longer term. The preparation of case studies covering the typology of LEISA and climate-resilient interventions could be an important tool to disseminate the project results to other farmers. The typology described in this formative evaluation report can be further developed. Different typologies of LEISA and climate-resilient interventions could be used to address different flooding situations. Also farmers' own initiatives to address flooding could be further studied and enhanced. The projects' excellent monitoring and evaluation data on model farmers and their climate-resilient and LEISA practices should be used to substantiate case studies that go into more detail than the "resilient narratives"[11] developed by the project. The production interventions and typology promoted by the project are oriented toward reducing climate change impacts on agricultural production and income, instead of on reducing the climate change impacts on cities through preservation and improved management of agricultural land areas. Agricultural land use practices that buffer floods and reduce climate change impacts on cities could be further explored.

The final recommendation to GEAG is to improve the way it shares the results of its project achievements, informing line departments and policy and decision makers in Gorakhpur area and beyond about the results. This can best be done by developing a comprehensive communication strategy and ensuring its proactive application and follow up. Although the LEISA activities might not be "new" or fashionable, the achieved results in increased income, food and nutrition security of farmers, and reduced sale of land in the intervention villages is absolutely remarkable. GEAG could be more outspoken in promoting its results and could inspire many others by being more vocal about the project's achievements.

[11] Bhat, S., Singh, A., and N. Mani, 2016. Peri-urban agriculture & ecosystems: Resilient narratives. GEAG, Gorakhpur, India

Annexes

Annex 1: Itinerary of the formative evaluation mission

DATE	DESCRIPTION AND PEOPLE MET	PLACE
Sat 8 April	Both Marianne Meijboom and Sunandan Tiwari arrive in Gorakhpur (no flight on Sundays)	Gorakhpur
Sun 9 April	Final preparation for workshop and field work	Gorakhpur
Mon & Tue: 11-12 April	Workshop with GEAG team (see workshop agenda below)	Gorakhpur
Tue 12 April (evening)	Meeting with the Department of Horticulture: Mr. Arjun Prasad Tiwari, Deputy Director, Horticulture, Mr. D K Mishra, District Horticulture Officer and Mr. Samdeo Pandey, Trainer, Department of Horticulture & Food Processing	Gorakhpur
Tue 12 April (evening)	Meeting with Mahanagar Paryavaran Manch (citizens' forum): Mr. M. P. Kandoi, Mr. P. K. Lahiri, Dr. Mumtaz Khan, Jitendra Dwivedi, Ashish Chouwdhry and Manoj Kumar Singh	Gorakhpur
Wed 13 April	Meeting with master trainers: Ms. Mamta, Ms. Pushpa Yadav, Mr. Feroze and Mr. Chotte Lal Project Supervisors: Irfan Khan, Ms. Karuna Srivastava, and Tariq Khan	Sanjhai Village, Northern cluster
Wed 13 April	Meeting with model farmers: Ms. Chanda Devi, Mr. Rama Prasad, Mr. Ram Nagina	Sanjhai Village, Northern cluster
Wed 13 April	Meeting with farmer club, farmer field school, and link farmers: ca. 20 women and men farmers (majority women)	Sanjhai Village, Northern cluster
Wed 13 April	Meeting with agro-service center: Chotte Lal, Chair-person	Sanjhai Village, Northern cluster
Wed 13 April	Meeting with LSKM; ca. 25 + farmers (women in majority)	Sanjhai Village, Northern cluster
Thu:14 April	Meeting with: Mr. Gautam Gupta, District Disaster Officer	Gorakhpur
Thu:14 April	Meeting with Gorakhpur Municipal Corporation: Mr. Rajesh Kumar Tyagi, Commissioner, Mr. Ajay Rai, Corporator, Civil Lines, Mr.R.K. Patel, Engineer	Gorakhpur
Thu:14 April	Meeting with model farmers: Mr. Mhd. Raza, Mr. Brindavan, Mr. Rajan Prasad	Shekpurva village in the Northern cluster
Thu:14 April	Meeting with: farmer club, link farmers and LSKM; ca. 30 + farmers (women in majority)	Shekpurva village in the Northern cluster
Thu:14 April	Meeting with master trainers: Mr. Mhd. Hussain, Ms. Madhulata	Shekpurva village in the Northern cluster
Thu:14 April (evening)	Meeting with: Mr. Ashish Srivastava, Acore Architectural Services	Gorakhpur

DATE	DESCRIPTION AND PEOPLE MET	PLACE
Fri: 15 April	Meeting with master trainers: Ms. Asha, Ms. Gunja, Ms. Priyanka, Mr. Dayanand, Mr. Khamboj and project supervisors: Mr. Amarjeet Sahni, Mr. Amit Kumar Singh	Semra Devi Prasad Village in the Southern cluster
Fri: 15 April	Meeting with: Mr. Indrasen Nishad, Village Head & Mr. Vinod Yadav, Panchayat Mitra	Semra Devi Prasad Village in the Southern cluster
Fri: 15 April	Meeting with model farmers: Mr. Mahajan Yadav, Mr. Ram Vilas Nishad, Ms. Rajmati Devi	Chakra Doyam Village (part of Semra Devi Prasad Gram Panchayat
Fri: 15 April	Meeting with LSKM; 8 farmers	Chakra Doyam Village (part of Semra Devi Prasad Gram Panchayat
Fri: 15 April	Meeting with: farmer club, and link farmers; ca. 10 farmers	Semra Devi Prasad Village
Sat: 16 April	Meeting with Department of Agriculture, National Mission of Agriculture, Extension and Technology: Mr. Jairam Singh, Deputy Project Director, Mr. Rameshwar Prasad Maurya, Deputy Project Director	Gorakhpur
Sat: 16 April	Meeting with Krishi Vigyan Kendra, Gorakhpur: Dr. Sanjeet Kumar, PC / Sr. Scientist cum Head, Dr. S. P. Singh, Scientist, Vegetable Science, Dr. S. K. Singh, Scientist, Animal Husbandry and Dairy and Mr. M. P. Singh, Extension Services	Belipur
Sun: 17 April	Analysis of data and preparation for the end workshop	Gorakhpur
Mon: 18 April	End workshop with GEAG team: Presentation of findings	Gorakhpur
Mon: 18 April	Departure Marianne Meijboom and Sunandan Tiwari to respectively the Netherlands and Delhi	

Formative evaluation workshop 11 & 12 April, Gorakhpur

Enhancing climate resilience of Gorakhpur by buffering floods in Gorakhpurthrough climate-resilient peri-urban agriculture

Objectives of the workshop:

- Development a theory of change
- Development of indicator framework
- Clustering of strategic activities/models into 'types' or typology of peri-urban interventions

Needed materials: Flipcharts, markers, colour cards, pin board and pins (if available), paper tape, projector for presentations.

Tentative program

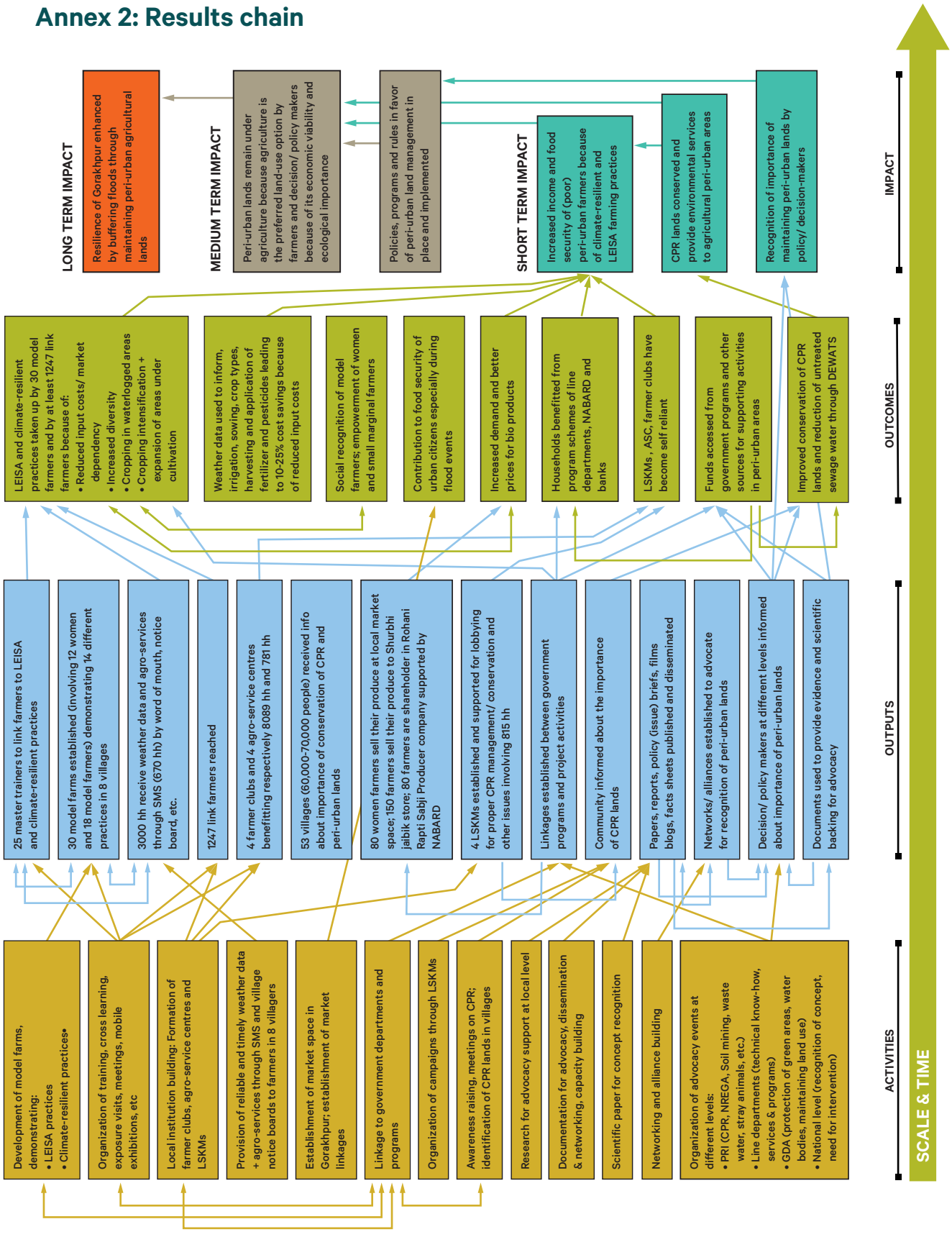
DAY 1

TIME	DESCRIPTION	RESPONSIBLE
Morning	Welcome	GEAG
	Introduction to the workshop	Marianne/ Sunandan
	Short presentation about the GEAG project	GEAG
	Theory of change What is a theory of change? Result chain example	Marianne/ Sunandan
Afternoon	Theory of change Picturing the implemented activities, results, outcomes and impacts in a result chain	All

DAY 2

TIME	DESCRIPTION	RESPONSIBLE
Morning	Review of result chain develop at day 1	Marianne/ Sunandan
	Indicator framework What is an indicator framework?	Marianne/ Sunandan
	Indicator framework Developing an indicator framework based on the developed result chain	All
	Reflection on available indicator data	All
Afternoon	Clustering activities/ project strategies into models for peri-urban land use management What are models?	Marianne/ Sunandan
	Clustering activities/ project strategies into models for peri-urban land use management Listing project strategies/ activities Describe link to climate resilience of each activity/ strategy Cluster activities/strategy that have close links and can be seen as model for peri-urban land use management	All
	Selection of several models for fieldwork/ case study	All
	Conclusion	Marianne/ Sunandan
	Closing of the workshop	GEAG

Annex 2: Results chain



Annex 3: Indicator framework

	INDICATOR	BASELINE (2010)	END LINE (2015/2016)	AVAILABILITY OF DATA/ REMARKS
Medium term impact				
Agriculture remains the preferred land-use option in peri-urban lands of Gorakhpur by farmers and decision/ policy makers because of its economic viability and ecological importance	Negative trend in selling of land in entire peri-urban area: Reduction of number of households selling land for different land use Reduction of area being sold	1.83 acres (Northern cluster) 6.9 acres (Southern cluster)	0.66 acres (Northern cluster) 0.2 acres (Southern cluster)	Data available from sample of 108 farmers in southern cluster and 166 farmers in northern cluster of the 8 project villages. No data available beyond project villages
	No change in agricultural land use (even after sale) GIS land use maps show no decline of agricultural land in peri-urban areas			No data available
Policies, programs and rules in favor of peri-urban land management in place and implemented	Concept of peri-urban lands recognised at higher levels and included in policies/ programs	Master plan for Gorakhpur development area 2021		Impression that implementation of master plan not enforced adequately - evaluation According to Google maps the present city boundary already exceeds the planned 2021 boundary (Arup report)
Short-term impact				
Increased income and food security of (poor) peri-urban farmers because of climate-resilient and LEISA farming practices	Increase in income	Average income of model farmers: 34982 INR	Average income of model farmers: 76498 INR	Project monitoring data on model farmers. Only data from model farmers available.
CPR provide environmental services for agricultural peri-urban areas	Number of water points conserved to provide access to safe use of surface water and ground water Number of open CPR conserved leading to less damage to crops due to water-logging			Only data from project villages available-see below
Recognition of importance of maintaining peri-urban lands by policy/ decision makers	Concept of peri-urban agriculture recognised and included in policies/ programs		Government instructions from divisional commissioner/chair of development authority to take actions to conserve water bodies and CPR in peri-urban areas	Instructions in writing to conserve a water body in Maheva cluster based on an order by the High Court

Outcomes				
LEISA and climate-resilient practices taken up by 30 model farmers and by at least 1247 link farmer households (benefitting 6985 people)	Reduced input costs		32.7% reduced compared to baseline	Project monitoring data about model farmers
	Increased input-output ratio	1.15	3.01	Project monitoring data about model farmers
	Reduced losses from crop damages due to natural hazards (incl. floods)		15% reduction in losses compared to baseline	Project monitoring data about model farmers
	Increase in intensification	133%	267% (state average 153%)	One cropping season 100%, two cropping seasons 200%, three cropping seasons 300%
	Increase in area of land under cultivation	20.79 acres southern cluster 28.21 acres northern cluster	23.30 acres southern cluster 31.4 acres northern cluster	Among model farmers no reduction but increase in area under agriculture
	LEISA and climate-resilient farming practices adopted by link farmers		1247 farmer households benefitting 6822 people	Project data
	LEISA and climate-resilient farming practices adopted by pilot villages and beyond		About 50-80% adoption in pilot villages; about 10-30% adoption in neighboring villages	According to interview data during the formative evaluation in three project villages
Social recognition of model farmers; empowerment of women, smallholder and marginal farmers	Model farmers used as resource person at local level and beyond		Model farmers expressed that they act as resource persons	According to interview data during the formative evaluation in three project villages
	No of model farmers covered in media	0	15	Document: Peri-urban agriculture & ecosystems-resilient narratives
	Model farmers included in government committees	0	3	As per Panchayati Raj Institutions data
	No of awards	0	3	According to GEAG staff
	Women and small marginal farmers are more vocal	Women, smallholder, and marginal farmers are generally shy	Women, smallholder, and marginal farmers have gained confidence and speak out	According to GEAG staff and evaluation results

Outcomes				
Weather data used to inform, irrigation, sowing, crop types, harvesting and application of fertilizer and pesticides leading	Cost saving because of use of weather data		reduced input costs by 10-25% compared to baseline	GEAG Focus group discussion report on weather and agro-services (Report by Kailash Pandey)
Increased demand & better prices for bio products	Increased price for bio products produced by farmers in the peri-urban areas Increased demand for bio-products		10-20% higher price at the local market Easy to sell bio-products	Interview data during evaluation
Contribution to food security of urban citizens especially during flood events	No of farmers able to produce/ sell during flood events because of climate-resilient agricultural practices	0	26 model farmers (Link farmers also sell during the monsoon but no numbers available)	There was much less rainfall during the monsoon over the last two years.
Improved conservation of CPR lands	CPR water points and land conserved	Water-bodies and open land encroached Total of 3.171 ha of water-bodies and open land	One water body (23,980 sq ft) conserved Community land (23,150 sq ft) demarcated and conserved 3.5 acre open land conserved through plantation	In 8 project villages according to project presentation; Report on Common Property Resource (CPR) management in peri-urban villages
	Reduction of untreated sewage water through DEWATS	0	One DEWATS established, one in process	Project data; field visits during evaluation
	LSKMs/ panchayats are able to lobby themselves for CPR issues	0	2	PRI proceedings
Farmers benefited from government programs	Number of successful applications to government schemes by farmers Funds accessed from government programs/ subsidies	0	983 successful applications 192,800 INR accessed from government schemes	Project data: Agriculture equipment: INR. 105,900; Seed input (wheat): INR. 14,000; Vermi-compost: INR 72,000; Gypsum for soil conservation: 900 INR (see also the list below)

Outcomes				
LSKMs, ASC, Farmer clubs become self reliant	ASC able to raise resources Farmer clubs have access to NABARD funds LSKM has access to federation funds Ability to deliver information and capacity building Farmers experienced benefits from LSKMs and express their interest to continue	0	4 ASC have net profit of 30,000 INR together Proposal submitted for 10,000 INR per year for three years for each farmer club LSKM has about 1 lakh in its State level account Regular visits of line departments Several issues addressed through LSKM: illicit liquor, soil mining, selling of land, application submitted to stop releasing untreated sewage water into the waterbody (Chakra Doyan village)	Project data Regular visits of in line departments: agriculture, horticulture, animal husbandry, food and fruit preservation department, Banks (rural bank, NABARD), and research institute KVK Issues addressed from evaluation results
Funds accessed from government programs and other sources for supporting activities in peri-urban areas	Contributions from line departments and others to support peri-urban agriculture		Community donated (1308 sq ft) land of worth Rs 5 lakh for DEWATS construction Panchayati raj Institution donated 1844 sq land of worth Rs 14.75 lakh DEWATS construction Proposal submitted for 10,000 INR per year for three years for each farmer club Funds for construction DEWATS accessed from RF demonstration fund from Agri Dept (INR 12,000/ vermi composting pit) – 6 pits – INR72,000	

Outputs				
Master trainers trained	Number of trained master trainers	0	25	Project data
Model farms established	Number of model farms established	0	30	Project data
Weather and agro-service data available to farmers through SMS and notice board	Number of farmers reached	0	670 farmers registered and receive SMS messages About 3000 households receive information either through SMS or notice board	Project data. The dissemination of information from notice board throughout the village and beyond was confirmed during the evaluation
Outreach to link farmers	No of link farmers reached	0	1247 households- equivalent to benefiting about 6821 people	Project data
Formation of farmer clubs to support farmers	No of farmer clubs formed No of farmers benefitting from farmer clubs	0	4 farmer clubs formed 8089 households reached through farmer clubs (farmer school meetings)	Project data
Agro-service centers formed to support farmers	No of agro-service centers established Number of farmers making use of agro-service center	0	4 agro-service centers established 781 households making use of agro-service center	Project data
Market linkages established	Availability of market space to sell bio products At least one additional store buying agricultural products from farmers At least one producer company established	0	Space available at local market where (80 women) farmers sell their produce 150 farmers sell their produce to Shurbhi jaibik store 80 farmers are shareholder in Rohani Rapti Sabji Producer company	Project data
LSKMs formed to support farmers in obtaining their rights	No of LSKMs formed No of people member of LSKM	0	4 LSKMs established 815 hh member of LSKM	Project data
Training, cross learning, exposure visits, meetings, mobile exhibitions, campaigns organized	No of learning events No of people reached by these events	0		See list below of learning events

Outputs				
Linkages established between government programs and project activities	No of linkages		6	Project data: Linkages with Rural Bank and in line departments: Agriculture, Forestry, Horticulture, Animal Husbandry, UP Agro-Service
Networks/ alliances/ established to advocate for recognition of peri-urban lands	No of institutions connected with to advocate for recognition of importance of peri-urban lands	0	at least 9	LSKM, National Institute for Urban Affairs, Mahanagar Paryavaran Manch, ACCCRN Network, Solution Exchange, CANSA, RUAF, ICLEI
Documents to provide evidence and scientific backing for advocacy	No of scientific papers	0		See list below of project publications
Papers, reports, policy (issue) briefs, films, blogs, facts sheets published and disseminated	No of reports, films, issue briefs and other documents	0		See list of project publications
Advocacy events organized at different levels	No of advocacy events organized to influence: PRI Line departments GDA National level	0		See list below of advocacy events

List of government schemes and beneficiaries in project villages

SL. NO.	NAME OF SCHEME	NAME OF DEPARTMENT	TYPE OF SERVICES	NO. OF BENEFICIARIES	AREA COVERED
01	National Food Security Mission (NFSM)	Agriculture	Seed input	132 farmers	8 villages
02	PRI	Development and GEAG	Adopt a village for drainage and sanitation	2 village Semra devi prasad and Shekhpurwa (315 HHs)	2 village
03	Mushroom production	ICAR (Sub unit Basti)	Skill and demonstration	79 farmers	6 villages
04	Composing	CIPM (Central Integration Pest Management)	Demonstration of vermi compost	3 units (24 farmers)	2 villages
05	National horticulture Mission (NHM)	Horticulture	Food and hygiene habits	40 farmers	6 villages
06	Income generation of women and men	Food and fruit preservation	Skill and demonstration	94 farmers	8 villages
07	Plantation	Forest	Plantation of fast growing plants	105 farmers (3.5 acre open land conserved through plantation	7 villages
08	Regular vaccination	Animal Husbandry	Vaccination & treatment of livestock	280 households and 666 animals	8 villages
09	Agriculture equipments	UP agro department	Agriculture equipments	32 farmers	4 villages
10	Rural bank	Kishan Credit Card (KCC)	Loan for crops	93 farmers	8 villages
11	Flower farming	Horticulture	Seed input of flowers	26 farmers	3 villages

List of project documents and publications

Arup. 2016. *Dynamism of flood risk change vis- a- vis land use change, sectoral research* as part of the project "Enhancing Climate Resilience of Gorakhpur by Buffering Floods in Gorakhpur through resilient peri-urban agriculture". Final report. GEAG.

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List of advocacy events

SL. NO.	NAME OF ADVOCACY EVENT	PARTICIPANTS	NO. OF PARTICIPANTS			DATE	PLACE
			M	F	TOTAL		
2	National workshop on peri- urban agriculture and ecosystem	Govt. department and organization	68	19	87	22th -23th February. 2016	Delhi
3	City workshop	Farmers and Govt. department	29	9	38	12th February 2014	City level
4	Block level workshop	Farmers and Block level officer	38	21	59	25th September 2013	Block of Chargawan
4	Block level workshop	Farmers and Block level officer	26	14	40	18th October 2014	Block of Khorabar

List of learning events

SL. NO.	NAME OF LEARNING EVENT	PARTICIPANTS	NO. OF PARTICIPANTS			DATE	PLACE	NAMES OF RESOURCE PERSONS
			M	F	TOTAL			
1	Training experiences sharing on crops season wise	Model and link farmers	22	13	35	19 April 2014	Moharipur	K.C. Pandey, Ajay Singh & Raviendra
2	Training on farm planning of the model farmers	Model and linked farmers	18	7	25	20 April 2014	Semradevi prasad	K.C Pandey, Ajay Singh, Dayaram & Hemant Singh
3	Refresher LEISA training	Master Trainers	7	3	10	21 May 2014	Moharipur	K.C Pandey, Ajay Singh & Raviendra
4	Refresher training on LEISA	Master Trainers	8	5	13	22 May 2014	Mahewa office	K.C Pandey, Ajay Singh, Dayaram & Hemant Singh
5	Exposure visit	Farmers	15	10	25	4-5 Mar 2014 & 12-13 Oct. 2015	IIVR, Varanasi	Ashuthosh Goswami
6	Workshop with Govt. department on peri-urban agriculture	Government officers and farmers	55	16	72	12 March 2014	Govt. garden	GEAG team
7	Meeting on Common property	PRI members and villagers	24	21	45	14 Dec 2013	Chakra village	GEAG team
8	Refresher training of Agro-service center for self managing process	Coordinators, Committee members, FFS coordinators	12	9	21	12-15 June 2014	Mehewa	GEAG team

SL. NO.	NAME OF LEARNING EVENT	PARTICIPANTS	NO. OF PARTICIPANTS			DATE	PLACE	NAMES OF RESOURCE PERSONS
			M	F	TOTAL			
9	Training of landless farmers on mushroom cultivation	Farmers	25	65	90	18th Oct 2013 and 20 November 15	Mahewa & Moharipur comp office	Horticulture and KVK Gorakhpur
10	Refresher training on farm planning of Rabi crop	Master Trainers and model farmers	52	28	80	23-24 October 14	Mahewa	Sushil Kumar and GEAG team
11	Training on formation and leadership LSKM	LSKM members (four bath)	42	63	105	February 2013 & March 15	Mahewa and Moharipur camp office	Vijay Panday Ashwani Panday & Satendara Tiwari
12	Training on Post harvesting like fruit preservation	Farmers and women	05	90	95		Mahewa and Moharipur	Horticulture
13	Campaign on CPRM	All villagers	88	112	200	19 April 15 and 01 May 2015	Mahewa and Moharipur cluster camp office	GEAG and PRI
14	Campaign on preposition of peri-urban agriculture	53 villages in peri-urban villages	53 villages approx 60-65 thousand population			12 January to 28 February 2015	53 villages	GEAG staff and street play team

Annex 4: Linkages between project interventions & impacts across scales

CODE NO.	PROJECT INTERVENTION	IN RESPONSE TO?	CLIMATE-RESILIENT COMPONENT AT VILLAGE LEVEL	CONTRIBUTION TO FLOOD BUFFERING OF THE CITY	LINKAGES WITH OTHER INTERVENTIONS
Farm Models					
FM1	Composting	Poor soil quality Low productivity Increasing costs of fertilizers High dependence on external inputs	Utilized local resources Healthier soil improves its ability to cope with climate stress / shock Improved ecosystem health and services Higher soil moisture levels – reduced water use Improved soil structure	Increased percolation due to improved porosity of the soil resulting in reduced waterlogging / flooding	FM 2, FM4, IB1,IB3,IB4
FM2	Trichoderma	Poor crop health Poor crop yield Increasing costs of pesticides	soil treatment plant root treatment like wilt disease Reduced input costs	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1 FM3, IB1, IB 2, IB3, IB4
FM3	Bio-pesticides	Adverse impacts of synthetic pesticides on health, environment, quality of produce Increasing costs of pesticides Change in types of pests High dependence on external inputs	Ability to adapt to changing pest types Improved ecosystem health and services Utilizes local resources	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM2,FM4 ,FM8, IB1, IB3, IB4
FM4	Oil cake	Poor soil quality Low productivity Increasing costs of fertilizers High dependence on external inputs	Utilizes local resources Healthier soil improves its ability to cope with climate stress / shock Improved ecosystem health and services	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM3, FM1, IB1, IB 2, IB3, IB4
FM5	Plantations	Reduced green cover Dependence on single / limited produce	Diversified income opportunities / reduced risks for farmers i.e. through inter-cropping Creating green spaces Water percolation / recharge zone Micro climate control Source of fuel wood and fodder	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas Potential vegetative flood break Water percolation / recharge zone Buffering of flood and water logging	FM6, (FM1, FM2), IB1, IB2, IB3, IB4, IB5

CODE NO.	PROJECT INTERVENTION	IN RESPONSE TO?	CLIMATE-RESILIENT COMPONENT AT VILLAGE LEVEL	CONTRIBUTION TO FLOOD BUFFERING OF THE CITY	LINKAGES WITH OTHER INTERVENTIONS
FM6	Mixed farming	Dependence on single / limited produce Soil erosion High dependence on external inputs Effect of insect and pest	Diversified income opportunities / reduced risks for farmers Healthier soil improves its ability to cope with climate stress / shock Efficient use of water resources Reduce input cost towards pesticides	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1, FM2, FM3, FM5, FM8, FM9, IB1, IB3, IB4
FM7	Seed production	High dependence on external inputs High costs of seed reduce profitability of farming	Utilizes local resources Climate compatible varieties available to farmers Local food security enhanced Availability of the seed at local level in time Extra income	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	(FM1, FM2, FM3, FM4), IB1, IB2, IB3, IB4, IB5
FM8	IPM	Adverse impacts of synthetic pesticides on health, environment, quality of produce Increasing costs of pesticides Change in types of pests High dependence on external inputs	Ability to adapt to changing pest types Improved ecosystem health and services Utilizes local resources	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM3,FM6,FM2, FM4, IB1, IB3, IB4
FM9	Kitchen gardening	Dependence on single / limited produce Poor diet / health of local population / children	Utilizes local resources Local food security enhanced Diversified income opportunities / reduced risks for farmers Healthier communities / children Efficient use of water resources	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1, FM2, FM3, FM4, FM6, FM10, IB1, IB3, IB4
FM10	Loft farming	Vulnerability to waterlogging / flooding Dependence on single / limited produce	Crops not affected by local flooding / waterlogging Productive utilization of space and resources Local food security enhanced Diversified income opportunities / reduced risks for farmers	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1, FM12, FM3, FM4, FM5, FM9, IB1, IB3, IB4

CODE NO.	PROJECT INTERVENTION	IN RESPONSE TO?	CLIMATE-RESILIENT COMPONENT AT VILLAGE LEVEL	CONTRIBUTION TO FLOOD BUFFERING OF THE CITY	LINKAGES WITH OTHER INTERVENTIONS
FM11	Low tunnel polyhouse	Dependence on single / limited produce Impacts of climate variability Unusual weather happenings	Cultivation of multiple crops possible under partially climate independent, controlled conditions Local food security enhanced Diversified income opportunities / reduced risks for farmers Efficient use of water resources	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1,FM2, FM13, IB1, IB 2, IB3, IB4
FM12	Thermocol /Bag farming	Limited space Poor diet / health of local population / children	Utilizes local resources Local food security enhanced Healthier communities / children Efficient use of water resources	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1, FM2, FM3, FM10, FM9, IB1, IB3, IB4
FM13	Permanent raised bed farming	Vulnerability to waterlogging / flooding Dependence on single / limited produce	Crops not affected by local flooding / waterlogging Productive utilization of space and resources Local food security enhanced Diversified income opportunities / reduced risks for farmers	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM11, FM2, FM1, FM3, IB1, IB3, IB4
FM14	Relay farming	Dependence on single / limited produce Shorter growing period Increased climate impact risks	Improved land, space and time management Healthier soil improves its ability to cope with climate stress / shock Efficient use of water resources Diversified income opportunities / reduced risks for farmers	Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	FM1, FM2, FM3, FM4, FM6, IB1, IB3, IB4

CODE NO.	PROJECT INTERVENTION	IN RESPONSE TO?	CLIMATE-RESILIENT COMPONENT AT VILLAGE LEVEL	CONTRIBUTION TO FLOOD BUFFERING OF THE CITY	LINKAGES WITH OTHER INTERVENTIONS
Common Property Resource Management					
CPR	CPR Management	Degradation of common property resources such as water bodies, open spaces Land use changes Increased exposure to flooding Increased loss and damage	Improved ecosystem health and services Enhanced ability to deal with climate related shocks and stresses Diversified income opportunities / reduced risks for farmers	Enhanced flood absorption capacity of peri-urban areas can reduce occurrence of floods within the city	
Institutional Building					
IB1	Farmers Clubs	Limited learning opportunities Uncoordinated activities amongst farmers	Opportunities for peer-to-peer learning and exchange Opportunities for collective action Access to knowledge and good practices Farming in peri-urban areas continue to be a viable livelihood and land use option	Creates a local pressure group that can influence policy and decision makers in supporting peri-urban agriculture Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	IB3, IB4
IB 2	Agro-Service Center	Limited / no access to extension services such as soil testing, improved (climate-resilient) crop varieties Limited learning opportunities	Access to information, technologies and skills related to climate-resilient and improved agricultural practices / techniques Farming in peri-urban areas continue to be a viable livelihood and land use option	Potential to bring increased area under peri-urban agriculture that creates an appropriate flood buffer zone Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	IB3
IB 3	Training of Master Trainers	Limited knowledge and skills among farmer with regards to climate-resilient agriculture Limited learning opportunities	Enhanced local capacities to promote and practice climate-resilient agriculture Access to knowledge and skills locally available Farming in peri-urban areas continue to be a viable livelihood and land use option	Potential to bring increased area under peri-urban agriculture that creates an appropriate flood buffer zone Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	IB1, IB4, IB5 IB2

CODE NO.	PROJECT INTERVENTION	IN RESPONSE TO?	CLIMATE-RESILIENT COMPONENT AT VILLAGE LEVEL	CONTRIBUTION TO FLOOD BUFFERING OF THE CITY	LINKAGES WITH OTHER INTERVENTIONS
IB4	Climate services and Advisory	Increasing climate variability / climate change (droughts and flooding events) No access to tailored weather forecast and agro-advisory information that support climate-resilient agriculture	Farmers are able to respond appropriately to climate variability / climate change impacts Reduced crop losses Farming in peri-urban areas continue to be a viable livelihood and land use option Secured livelihoods	Potential to bring increased area under peri-urban agriculture that creates an appropriate flood buffer zone Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	IB1, IB3, IB5
IB5	LSKM	Limited opportunities and support for smallholder and marginal farmers Uncoordinated activities amongst farmers	Opportunities for peer-to-peer learning and exchange Opportunities for collective action Access to knowledge and good practices Farming in peri-urban areas continue to be a viable livelihood and land use option	Creates a local pressure group that can influence policy and decision makers in supporting peri-urban agriculture Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	IB3, IB4
Market Linkages					
ML	Market linkages	Limited additional financial incentives and opportunities for farmers in peri-urban areas	Peri-urban agriculture continues to be a viable livelihood option despite climate variability / climate change Increased income to farmers	City residents have access to fresh food / vegetables during flooding events Potential to bring increased area under peri-urban agriculture that creates an appropriate flood buffer zone Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	

CODE NO.	PROJECT INTERVENTION	IN RESPONSE TO?	CLIMATE-RESILIENT COMPONENT AT VILLAGE LEVEL	CONTRIBUTION TO FLOOD BUFFERING OF THE CITY	LINKAGES WITH OTHER INTERVENTIONS
Awareness and Cross Learning					
ACL	Campaigns; Workshops; Mobile exhibitions; IEC	Limited / no access to information climate risks, climate-resilient agriculture opportunities and practices Limited learning opportunities	Limited / no access to extension services such as soil testing, improved (climate-resilient) crop varieties Opportunities for peer-to-peer learning and exchange Opportunities for collective action	Public opinion at the city level mobilised to support agriculture in peri-urban areas that could create an appropriate flood buffer zone Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	
Research and Documentation					
RD	Research and documentation	Limited evidence of flood buffering services of agriculture in peri-urban areas	Evidence that supports the need for preserving climate-resilient agriculture in peri-urban areas generated Reduced contamination of soil and water resources due to open dumping of solid water and disposal of untreated wastewater	Evidence that supports the need for preserving climate-resilient agriculture in peri-urban areas generated Value of ecosystem services from per-urban areas valued Wastewater water reuse options to support agriculture in peri-urban areas	
Advocacy					
Ad	At city, state, and national levels	Limited knowledge and appreciation of flood buffering services of agriculture in peri-urban areas	Potential opportunities for financial, policy, program and regulatory support for climate-resilient agriculture in per-urban areas	Potential to bring increased area under peri-urban agriculture that creates an appropriate flood buffer zone Supports the case for agriculture as a viable and sustainable land use option in peri-urban areas	

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