Extreme Risks, Vulnerabilities and Community- Based Adaptation in India (EVA)

A PILOT STUDY

Final report of WP 5
Capacity building approach and activities

Ulka Kelkar (TERI)

Research partners

AFPRO Action For Food Production

CICERO Center for International Climate and Environmental Research - Oslo

NIBR Norwegian Institute for Urban and Regional Research

NIVA Norwegian Institute for Water Research

teri The Energy and Resources Institute

Extreme Risks, Vulnerabilities and Community- Based Adaptation in India (EVA): a pilot study

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1. Approach

The pilot study 'Extreme Risks, Vulnerabilities, and Community-Based Adaptation in India (EVA)' was carried out in Jalna District, Maharashtra, during 2012–2014, with the support of the Royal Norwegian Embassy in New Delhi. The study was a collaborative endeavour of The Energy and Resources Institute (TERI), Action for Food Production (AFPRO) and the CIENS institutes— – Norwegian Institute for Urban and Regional Research (NIBR), Norwegian Institute for Water Research (NIVA), and Center for International Climate and Environmental Research, Oslo (CICERO).

In addition to the research objectives of this study, which aimed to better understand the conditions required for successful community-based adaptation (CBA) to extreme events in India, the project also aimed to contribute to capacity building at various scales.

The capacity building approach of the EVA project has been driven by three overarching goals:

1. The need to build the awareness of local communities (men and women) about climate change and thereby help contribute to enhancing their adaptive capacity
2. The need to sensitize local policymakers, practitioners and community and institutional leaders about climate change with the ultimate goal of contributing to the operationalization of climate change adaptation
3. The need to build the capacity of young Indian researchers to conduct climate change vulnerability and adaptation research and contribute actively to the climate change research community

With these goals, the EVA team developed and implemented a capacity building approach, which closely drew from the field research activities and learnings of the EVA study in Jalna. Figure 1 gives an overview of this capacity building approach, and the following sections describe the specific activities that were carried out to implement this approach.

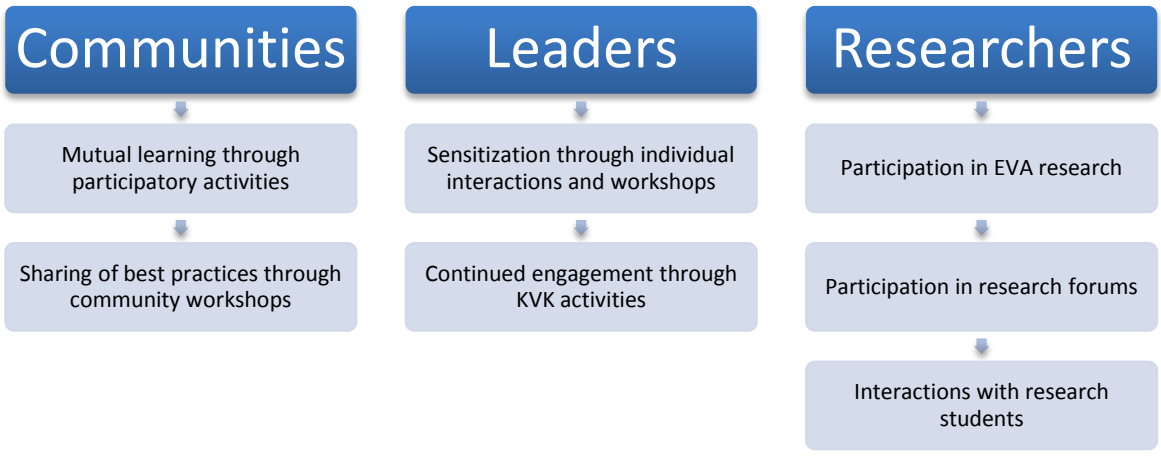

Figure 1. Overview of EVA capacity building approach

2. Sensitization of policymakers and institutional leaders at different scales

One of the major objectives of the EVA project was to engage with policymakers and institutional leaders at different scales to sensitize them about the need for building adaptive capacity to climate change and extreme events.

National and State scale

The EVA team organized a side event at the 14th Delhi Sustainable Development Summit on 7 February 2014, at which a booklet on key messages from EVA research was launched by Mr Lars Andreas Lunde, Deputy Minister of Climate & Environment, Norway and Mr. R. A. Rajeev, Principal Secretary (Environment), Government of Maharashtra. The event was attended by representatives of the Government of India, Government of Maharashtra, donor community and research institutions.

At the state scale, there has been continuing engagement with the Government of Maharashtra. The then Environment Secretary of the Government of Maharashtra participated in EVA workshops in Oslo and Mumbai and contributed his suggestions about the kind of research that would be useful to the policymakers. He included the final state-level dissemination workshop of the EVA project in the World Environment Day celebrations of his Department, thus ensuring the presence of the Maharashtra chief minister, environment ministers, and senior officials of all relevant departments.

In this 'Science-Policy Dialogue on Extreme Climate Events and Adaptation in Maharashtra', held in Mumbai on 7 July 2014, Trond Vedeld (NIBR) was able to present the highlights of the EVA project to an audience of about 600 persons from government, academia and civil society. Senior representatives of government organizations that are key to implementing the messages of the EVA project, such as the Department of Water Resources, Marathwada Agriculture University, National Bank for Agriculture and Rural Development (NABARD), Yashwantrao Chavan Academy of Development Administration (YASHADA) and India Meteorological Department (IMD) participated in the technical sessions through the day. This Dialogue provided a platform to understand the constraints faced by policymakers and practitioners, and identify their needs for supporting and scaling up CBA. In fact, YASHADA (the state's administrative training institute which runs capacity-building programmes for all levels of the state government including panchayati raj institutions) subsequently invited TERI as experts in their training programmes, and AFPRO continues to be YASHADA's nodal agency on watershed development (see state workshop report for details).

Four policy briefs aimed were published and disseminated at this state-level workshop on 7 July 2014 in Mumbai.

1. Water resources, agriculture and drought: understanding the context of drought in Marathwada
2. Community-based adaptation and differential vulnerability
3. Participatory assessment of adaptation options: climate change and extreme drought in Marathwada
4. Governing extreme drought: enabling CBA in Marathwada

These are also available on the EVA website and are being disseminated at other research and policy forums.

District and block scale

At the district and block scale, AFPRO has had sustained engagement with the administration from the inception of the EVA study, both directly and through the Krishi Vigyan Kendra (KVK) Jalna. Dr S G Sonune, who heads KVK Jalna and Shri Pandit Wasre were both actively involved in the EVA project throughout. During the extreme drought of 2012–13, AFPRO was invited by KVK to speak to farmers in its monthly training programme.

As part of WP3 governance work and other WPs, detailed key person interviews were conducted with about 30 officials at the district and block scales during the two-year period of the EVA study. TERI produced an introductory leaflet on the EVA project, which was translated to Marathi and was widely distributed during stakeholder consultations in Jalna during 2013.

A district-level workshop was organized in the district collector's office in February 2013, at the peak of the extreme drought of 2012–13. In this workshop, the EVA research presented climate change scenarios for Jalna, preliminary results of the participatory drought risk mapping activity in nine villages, and key findings related to socioeconomic vulnerability to extreme drought. The district-level officials, led by the district collector, participated in the discussions enthusiastically and shared their views on capacity-building needs and constraints to CBA (see workshop report for details).

Similarly, a block-level workshop was organized on 10 July 2013 under the aegis of KVK Jalna with agriculture extension officers, Gram Sevaks, and other block-level officials to introduce them to the need for adaptation to the heightened risk of extreme events under climate change scenarios. WP1 findings on past climate trends and future climate scenarios were shared with the participants, including updated analysis of data received from Badnapur research station and KVK. WP2 results from the digitization of participatory mapping conducted in two village clusters in February 2013 were the participants including overlay with remote sensing data on vegetation cover in normal and drought years. Following presentations by the EVA team on climate change scenarios and discussion on possible impacts on the agroecosystem of Jalna, these block-level officials brainstormed about important criteria for adaptation options and then prioritized a long list of adaptation options with respect to these criteria. They also pointed out barriers and constraints to the effective implementation of the identified adaptation options. Based on their experience, they highlighted the crucial role of people's participation (which is very relevant for community based adaptation) and thought that people will actively take up adaptation options only when they perceive direct private benefits from them in addition to the larger social benefits to the community at large.

At the village scale, several sarpanches and heads of important village committees of the EVA case study villages consistently participated in all village-level workshops organized by the EVA team, with some of them even participating in the district-level workshop in February 2013 and the state-level workshop in June 2014. Thus the EVA capacity building approach attempted to have sustained engagement with local policymakers, practitioners and community and institutional leaders. In order to continue this endeavour, AFPRO has developed a user guide which is described in Section 4.

3. Mutual learning with communities through participatory activities and sharing best practices

EVA activities in Jalna reached out to an estimated 500 households and about 50 local officials. The EVA approach aimed for mutual learning between researchers and local communities through discussions on climate change scenarios, drought risk mapping, participatory institutional mapping, prioritization exercises on adaptation and well monitoring. With this aim, community workshops were organized by AFPRO in the EVA case study villages in September 2012, February 2013, July 2013 and October 2013.

EVA workshop in Palaskheda Pimple, 22 October 2013

The premise of sharing climate change scenarios with village communities is that this will help contribute to enhanced climate literacy and improved awareness about the need for climate change adaptation, since past experience may no longer be a good guide for a climate change future with greater uncertainty and heightened risk of extreme events. In three village cluster workshops conducted in February 2013, data on past climate trends and future climate scenarios were shared with the community. Following this, the villagers developed what-if scenarios (increased temperature, increased rainfall, increased drought risk) of potential impacts on agriculture and water resources and came up with desirable adaptation options for their landscape and socioeconomic context.

The adaptation options collected in three village cluster workshops, one district-level workshop, and several key person interviews were collated to develop a long list of adaptation options. In three village cluster workshops organized in October 2013, these adaptation options were prioritized and shortlisted by groups of farmers with and without village governance positions, women and landless labourers. In going through this process, the EVA team discovered many gaps in the participants knowledge about potential adaptation options—even when these relate to ongoing government schemes or agricultural extension programmes (such as organic farming, integrated farming system, national rural livelihood mission, etc.)—and limited awareness of positive examples from within the same district such as the watershed development programmes in Shivni and Kadvanchi villages. This was particularly true in the case of women due to their

limited mobility and literacy. AFPRO and TERI researchers took this opportunity to brief them about such options and programmes. Hence, the discussions around the prioritization of adaptation options contributed to the community's awareness about adaptation measures. Moreover, by conducting such discussions separately by the type of stakeholder group (women, landless, etc.), the EVA approach took cognizance of the varying capacity levels and adaptation priorities within a community.

A third set of activities conducted at the village scale was participatory mapping of spatial drought vulnerability which led to mutual learning between researchers and villagers. This revealed variations in vulnerability to drought within a village, depending on the soil type or proximity to drainage channels. This participatory mapping was an iterative process, initiated in September 2012 in nine village level workshops, refined in February 2013 in three village cluster level workshops, and shared back with the community in July 2013 and October 2013. Unlike conventional participatory resource mapping efforts, the EVA approach used satellite imagery and remote sensing data and added to the community's knowledge base about drought risk zones.

The EVA capacity building approach for communities built on ongoing initiatives of the KVK, including a network of progressive farmers who regularly participate in KVK trainings. Under the aegis of KVK Jalna, a formal interaction was conducted on 9 July 2013 to share good practices across villages. The workshop brought together 21 farmers from the EVA study villages and 28farmers from other villages in Jalna. The workshop exposed farmers from the EVA study villages to best practices (in agriculture, cropping practices, watershed development, rainwater harvesting, water use efficiency, water budgeting, etc) adopted by farmers in villages like Shivni, Kadvanchi and Revgaon that had coped well even during the extreme drought of 2012–13 (for details see workshop report).

Finally, a detailed well monitoring survey was implemented in nine villages in the EVA study. It is hoped that the well survey will be continued by the community themselves and will contribute to their understanding of long-term trends in water availability and water stress due to extreme events.

EVA farmer workshop in KVK Jalna, 9 July 2013

4. Capacity development user guide

To carry forward the learning from the EVA project, AFPRO has developed a Capacity Development User Guide to engage different stakeholders to assess climate risks and vulnerabilities and plan for CBA.

The specific objectives of the capacity development supported by the User Guide are:

1. To enhance the understanding of climate change and its impacts
2. To familiarize stakeholders with tools, methodologies and framework for vulnerability and risk assessment and risk communication, adaptation planning process
3. To build and enhance adaptive capacity to mitigate the impact of climate change

The focus is on four key areas that are in concurrence with the prevailing situation of the dry land areas in Maharashtra:

1. Climate literacy
2. Vulnerability and risk assessment
3. Community based adaptation
4. Dry spell and drought management

The User Guide builds on the methods and processes tested in the EVA project, including participatory methods for understanding present patterns of community vulnerability to drought, determinants of and barriers to adaptive capacity.

5. Participation of young researchers

The EVA study provided the opportunity to several young researchers from TERI, TERI University and AFPRO to enhance their research capacity by participating in field research and interacting with Norwegian researchers on methods and analysis.

Ms Vrishali Chaudhuri (TERI University) conducted extensive field work in Kadvanchi village, Jalna District, for her doctoral research on governance and institutional aspects of watershed development. The successful watershed development programme and community water budgeting activities in Kadvanchi village offered a valuable counterpoint to the other EVA case study villages. Vrishali, a native Marathi speaker, conducted several focus group discussions and key person interviews along with the EVA research team (in July 2013 and October 2013 rounds of field work). On many occasions, she shared the Kadvanchi experience with participants (especially women participants) in the EVA community workshops, highlighting the role of women in the village's transformation. Vrishali also conducted field work in Asarkheda village, which was one of the EVA case study villages. She developed a close working relationship with KVK Jalna who facilitated her interactions with the community for her doctoral research.

Ms Shivani Wadehra (TERI University) was actively involved in the EVA project right from the inception of the study. With her background in mathematics and statistics, she worked closely with Guro Aandahl (NIBR) and AFPRO team members on the household survey data entry, coding, cleaning and analysis. During this process, she interacted with the field surveyors who carried out the household survey in nine villages, to understand the possible biases and gaps in the data. For her Masters' thesis, Shivani designed and conducted an experiment on risk taking attitudes and adaptation measures (such as capital investment on irrigation) among farmers in one EVA case study village in Jalna. She also worked under the supervision of Arabinda Mishra to analyse National Sample Survey data for Maharashtra to identify possible determinants of adaptive capacity of farmers.

Furthermore, three early career researchers from TERI: Ms Sambita Ghosh, Ms Prutha Lanjekar and Ms Divya Mohan were core team members in the EVA study. These young researchers participated actively in all rounds of field work in Jalna. Sambita, Prutha and Divya are co-authors of the final reports and policy briefs from WP2, WP3 and WP4 respectively. During this study, they were able to consolidate their previous experience with the use of participatory methods for vulnerability assessment. Moreover, by working with Line Barkved (NIVA) in WP2, Trond Vedeld (NIBR) in WP3 and Karianne de Bruin (CICERO) in WP4, they gained knowledge of new frameworks and methods.

From AFPRO, several young team members played central roles in EVA research by facilitating participatory exercises. In addition to their experience on rural development, they gained greater appreciation of vulnerability and governance issues. Nikhil Kusmode took on the responsibility of coordinating the household survey as well as the well monitoring survey in 9 villages. This required him to train and supervise several surveyors from Jalna. Along with other AFPRO core team members, he also liaised with the district administration and village leaders to ensure their receptiveness to EVA activities.

Working with the EVA research team, particularly the CIENS researchers, was an immensely valuable experience for these young researchers. In fact, there were many opportunities for mutual learning among all the Indian and Norwegian researchers, for instance combining community and satellite mapping. The Oslo workshop in March 2014 was useful for the entire

team—Indian and Norwegian—to learn from each other, exchange insights from the field research and consolidate our knowledge.

Interview conducted by Vrishali Chaudhuri (TERI University), Asarkheda, 23 October 2013

EVA study team, Aurangabad, 24 October 2013

6. Interactions with research students

In addition to the two research students from TERI University who were included in EVA study activities, Arabinda Mishra who led TERI's EVA research team, ensured cross-fertilization of research ideas and capacity between TERI researchers and TERI University students in his capacity as Dean of the Department of Policy Studies at TERI University.

One specific aspect of capacity building of young researchers involved interacting with students doing their course work at TERI University. Ulka Kelkar (TERI) gave a seminar on EVA research methods and findings on 21 November 2013 to Masters students from three academic programmes (M.Sc. Climate Science and Policy, M.Sc. Environmental Studies and Resource Management, M.A. Sustainable Development Practice). The seminar was coordinated by Dr Chubamenla Jamir, Assistant Professor, Department of Natural Resources, TERI University, who teaches courses on Food Security and Agriculture; Science and Policy of Climate Change; and Climate change: Vulnerability, Impacts, Adaptation and Resilience. Ulka discussed some of the methods used in the EVA project, e.g., participatory mapping of institutional access, participatory mapping of drought risk zones, sharing of climate scenarios with communities, and participatory multi-criteria analysis of adaptation options. She also discussed various examples from EVA field work which highlighted different aspects of vulnerability (e.g., connectivity, role of local leaders, women's work, livelihood diversification, regional policy priorities). These methods and ideas can be useful to the students in framing their own research problems.

7. Presentations in research forums

EVA team members used various opportunities to present and discuss the EVA study with other researchers. Some of these presentations are listed below (details are given in Annexes at the end of the report).

EVA researchers presented the first results from the participatory drought mapping carried out in the project at the European Climate Change Adaptation Conference (ECCA) in Hamburg, 18–20 March 2013. The theme of the ECCA conference was 'integrating climate into action' and in total about 700 participants from all around the world attended. The conference was organized in several plenum and parallel sessions with the aim of bringing together scientists, policy makers and practitioners working on adaptation to the impacts of climate change. Line Barkved (NIVA) gave the presentation 'Participatory mapping for drought resilience in Jalna District, Maharashtra, India,' on behalf of the team in the session 'Role of tools and knowledge in adaptation—participatory methods'. Karianne de Bruin (CICERO) also attended the conference and the discussions in the session. The EVA presentation spurred interesting questions and comments around dealing with droughts and participatory mapping as a method, and the project made valuable contacts for further dialogue and exchange.

Divya Mohan (TERI) and Sambita Ghosh (TERI) presented a paper on 'Multi-stakeholder based approaches to building community resilience towards the impacts of droughts' in the 3rd International Conference on Building Resilience, 17–19 September 2013, Galle, Sri Lanka, organized by Centre for Disaster Resilience, University of Salford, UK; Royal Melbourne Institute of Technology University, Australia and Queensland University of Technology, Australia. The conference was attended by 142 participants.

Ulka Kelkar (TERI) was invited to present EVA research at the Indo-US Science and Technology Forum on the theme 'Adaptation of rural communities to climate change: Bridging the gap between academia and community workers and identifying research needs'. This was co-organized by Columbia University and ATREE (Ashoka Trust for Research in Ecology and the Environment) at Bangalore during 20–21 February 2014. The Forum was attended by five American and 14 Indian researchers using a range of methods—climate models, remote sensing, economic analysis, participatory tools—to study climate change impacts on farmers in India.

Ulka Kelkar (TERI) presented EVA research at the Delhi Sustainable Development Summit side event 'Key Lessons from Research on Disaster Risk Reduction and Climate Change Adaptation in South Asia' organized by CDKN (Climate and Development Knowledge Network) and START (Global Change System for Analysis Research and Training) on 8 March 2014. The event was attended by about 50–60 Indian and foreign participants of the Summit.

EVA research was discussed in a CIENS seminar in Oslo on 17 March 2014. The seminar was organized around the theme 'Climate change and water stress in India'. EVA team members from India (4 from TERI and 2 from AFPRO) and Norway were able to exchange ideas with other Norwegian researchers studying climate change and water stress in India. The programme included:

1. *Trond Vedeld, NIBR*: 'Challenges to community-based adaptation to climate change in India – findings from the EVA-project'
2. *Suruchi Bhadwal, TERI and Isabel Seifert, NIVA*: '"Too much, too less, too bad" – climate change and water stress in Maharashtra'
3. *Trude Rauken, CICERO*: 'Mainstreaming of climate change adaptation in Norway and India—institutional issues'

4. *Karianne de Bruin, CICERO*: 'Himalayan climate change adaptation programme—adapting to climate change in the Eastern Brahmaputra Plains of Assam'
5. *Johannes Deelstra, Bioforsk*: 'More crop per drop: is System of Rice Intensification (SRI) or Alternative Wetting and Drying (AWD) the solution?'
6. *Jan Erling Klausen, NIBR*: 'Water governance and implementation of the EU Water Framework Directive in Norway, lessons for multi-level governance'

In the final state-level workshop of the EVA project, the Science and Policy Dialogue on Extreme Events and Adaptation in Maharashtra, held in Mumbai on 7 June 2014, the findings of the EVA study were presented to research and civil society organizations that are actively engaged in building agricultural and social resilience in Maharashtra, like the Watershed Organization Trust, Tata Institute of Social Sciences, and Action for Agricultural Renewal in Maharashtra (AFARM).

Most recently, Ulka Kelkar (TERI) made a presentation on 'Agricultural vulnerability and participatory methods for vulnerability assessment' at the Vulnerability and Adaptation Conference organized in Bangalore during 26–27 August 2014, by C-STEP (Centre for Study of Science Technology & Policy), Public Affairs Centre and ISET (Institute for Social and Environmental Transition) Nepal. The conference aimed to gain a better understanding of the strategic advantages for adaptation offered by different vulnerability assessment methods. It was attended by about 50 participants from India, Pakistan and Nepal, including climate change vulnerability researchers from leading Indian research institutes, donor agencies and NGOs.

In addition to participating in research forums, EVA team members are also working to publish EVA research findings in peer-reviewed journals. A research paper from the EVA project has been selected to be published in a special issue of the Indian journal Current Science in 2015.

The EVA project website (www.teriin.org/projects/eva) has been regularly updated with stories from the field and summaries of project activities.

Annex 1: EVA state-level science and policy dialogue

The final workshop of the project 'Extreme Risks, Vulnerabilities and Community-Based Adaptation in India (EVA)' was held in Mumbai on 7 June 2014. Titled 'Science and Policy Dialogue on Extreme Events and Adaptation in Maharashtra', this marked the culmination of two years of research and capacity building activities carried out with the support of the Norwegian Embassy in India and implemented by The Energy and Resources Institute (TERI), Action for Food Production (AFPRO), and the Norwegian CIENS institutes Norwegian Institute for Urban and Regional Research (NIBR), Norwegian Institute for Water Research (NIVA), and Center for International Climate and Environmental Research in Oslo (CICERO).

The Government of Maharashtra demonstrated its support to this project by including this event in the Department of Environment's programme for World Environment Day. The Hon'ble Chief Minister of Maharashtra, Shri Prithviraj Chavan inaugurated the event, and the Environment Minister Mr Sanjay Deotale and State Environment Minister Mr Sachin Ahir also spoke on the occasion.

Dr Trond Vedeld, Senior Researcher, NIBR, was able to present the highlights of the EVA project to an audience of about 600 persons from government, academia, and civil society. Senior government officials who participated in the event included

- Principal Secretary, Environment Department, GoM, Shri R. A. Rajeev
- Principal Secretary, Water Supply and Sanitation Department, GoM, Shri Rajesh Kumar;
- Member Secretary, Maharashtra, Pollution Control Board, Shri Rajeev Kumar Mittal.
- Principal Secretary, Water Resources Dept, GoM, Ms Malini Shankar
- Principal Secretary, Water Conservation and EGS, Mr. V. Giriraj

Senior representatives of government organizations that are key to implementing the messages of the EVA project, such as the Marathwada Agriculture University, National Bank for Agriculture and Rural Development (NABARD), Yashwantrao Chavan Academy of Development Administration (YASHADA), and India Meteorological Department (IMD) participated in the panel discussions. Non-governmental organizations that are actively engaged in building agricultural and social resilience in Maharashtra, like the Watershed Organization Trust, Tata Institute of Social Sciences, and Action for Agricultural Renewal in Maharashtra (AFARM) also participated in the event. Several farmers from Jalna District participated in the workshop and shared their experiences with combating drought.

The Dialogue provided a platform to share the findings of the EVA study with key policymakers and practitioners, understand the constraints faced by them, and identify their needs for supporting and scaling up CBA.

Annex 2: EVA side event and booklet launch at Delhi Sustainable Development Summit 2014

The event opened with welcome remarks by Dr Prodipto Ghosh, TERI. Dr R K Pachauri, TERI, spoke about the Indo-Norwegian research partnerships in EVA, and commended the study as a good example of connecting science with vulnerable communities.

The objectives, methods and preliminary findings of the EVA study were summarized by Dr Trond Vedeld, NIBR. He highlighted the need for better local climate risk management, more effective water management and addressing policy gaps for community-based adaptation to become a reality in the villages of Jalna. The EVA study combined a variety of research methods, which showed us local variations in vulnerability and adaptive capacity. The preliminary findings of the study indicate the need for both incremental and transformational change. In particular, Dr Vedeld emphasized three policy messages:

- Move to long-term climate risk management, including coordinated climate services and improved provider-user interface
- Decentralize powers and capacity, e.g., coordination across neighbouring village panchayats on watershed development
- Convergence among actors across scales, e.g. MNREGS has become a major vehicle for watershed development but is not being implemented accordingly.

Shri R A Rajeev, Principal Secretary, Environment Department, Government of Maharashtra, spoke about the 2012 drought in Jalna, and noted that despite facing the worst drought in 40 years, households in Jalna were food secure as they had sufficient food stocks from previous years. He fully endorsed the three recommendations of the study on behalf of his state's government. Acknowledging that the well-intentioned policies of the state or centre do not always operate efficiently at local levels, he agreed that village institutions should be empowered. Since traditional knowledge may not be sufficient in such extreme events, we need to give village institutions timely information for their decision-making and bring in technological innovations into a proper long-term planning process. He expressed his expectation for a detailed follow-up field study to develop a concrete adaptation programme for Jalna. He offered his government's help to carry out such a study and willingness to consider for financing the actions recommended by it.

A perspective on climate change governance was presented by Dr Trude Rauken, CICERO. Even though knowledge is getting more certain, governments are not putting climate change higher on their agendas. A review of the role of subnational institutions in their role in climate change adaptation in India, reveals that the top–down system of governance undermines incentives for adaptation, and often even earmarked funding remains unused. Moreover, adaptation does not receive substantial media coverage and knowledge networks are lacking. She noted that uncertainties in scenarios are problematic for decision makers. She concluded by saying that adaptation is not a decision, but a process, and should be viewed as such.

Dr Seleshi Bekele Awulachew, ACPC spoke about the relevance of the EVA study to the drylands of Africa. He outlined the critical challenges for this region, including water scarcity (both physical and economic), low agricultural productivity, and very low energy production and access, and linked these to the water–food–energy theme of the DSDS. Climate change and climate variability will intensify this challenge, for instance, with current semi-arid areas becoming arid. Dryland livelihoods, especially pastoralism, are very vulnerable. The solutions

proposed by EVA are useful to create resilience in the African context also. We need technologies and better access to markets and institutions. For instance, it has been found that those who have access to irrigation technologies are 22% less poor than rain-fed farmers in Africa. Women are an important part of the workforce in Africa and their livelihoods need to be addressed.

The panelists' remarks were followed by the launch of the EVA booklet by Mr Lars Andreas Lunde, Deputy Minister of Climate and Environment, Norway. Mr Lunde expressed his pleasure that environmental cooperation between Norway and India is well established. Studies like this have the potential to reduce the vulnerability of the poor, not just in Jalna, but also elsewhere in India and other countries. He was glad that the Government of Maharashtra showed interest in the project. The research is important but the results should be communicated in simple language to all stakeholders and this booklet is a fine effort in this regard.

Annex 3: Presentation on EVA research in CDKN-START event

Ulka Kelkar, TERI, made a presentation on EVA research at the Delhi Sustainable Development Summit side event 'Key Lessons from Research on Disaster Risk Reduction and Climate Change Adaptation in South Asia' organized by CDKN (Climate and Development Knowledge Network) and START (Global Change System for Analysis Research and Training) on 8 March 2014. The event was attended by about 50–60 Indian and foreign participants of the Summit. The other presenters are listed at the end of this note.

Ulka described EVA field work in nine villages in Jalna District in Maharashtra during 2012 and 2013, and the launch of the summary booklet. The premise of CBA is that it is better than top–down decision making, which can be maladaptive because it misses some of the realities on the field. But how should bottom-up adaptation happen? One approach used by EVA to answer this question involved the use of participatory mapping, starting with satellite images, of drought-risk zones. This revealed variations in vulnerability to drought within a village, depending on the type of soil, for example. In fact, one way that certain farmers hedge their risks in this drought-prone region is by having patches of land in different zones. But after the extreme drought of 2012–13, even the lands with good soil failed to grow a winter (rabi) crop. This means that that in this drought-prone region, where farming systems are—or should be—adapted to drought, normal development measures (like water conservation, watershed development, rainwater harvesting) may not be enough in an extreme drought. So you need agricultural value addition, livelihood diversification, and safety nets to deal with such extreme droughts. Second, when we put such maps of neighbouring villages together, we see that rainwater from one village runs off to another, but the watershed development schemes are being implemented in these villages separately, often under different programmes, without any institutional linkages. So the definition of what constitutes a 'community' needs to be reconsidered for CBA. And third, conserving water is pointless if people are locked into a farming system of water-intensive crops. So, if millets are better than sugarcane or cotton, make the prices right and provide access to markets. That is not something that can be accomplished through CBA alone.

DSDS CDKN-START event presenters list

Name	*Organization*	*Country*	*Study area*
Anshu Sharma	SEEDS India	India	Ladakh, Rajasthan
Laxmi Devkota	Nepal Development Research Institute	Nepal	Koshi River Basin
Sarala Khaling	ATREE	India	Sikkim
Shiraz Wajih	Gorakhpur Environmental Action Group	India	Gorakhpur
Anil K Gupta	National Institute of Disaster Management	India	Gorakhpur
Rab Nawaz	WWF Pakistan	Pakistan	Indus Ecoregion
Sumana Bhattacharya	Inter Cooperation India	India	-
Mihir Bhatt	All India Disaster Mitigation Institute	India	-
Hassan Virji	START	United States	-

Annex 4: Presentation on EVA research in Indo-US Science and Technology Forum

Ulka Kelkar, TERI, made a presentation on EVA research at the Indo-US Science and Technology Forum on the theme 'Adaptation of rural communities to climate change: Bridging the gap between academia and community workers and identifying research needs'. This was co-organized by Columbia University and ATREE (Ashoka Trust for Research in Ecology and the Environment) at Bangalore during 20–21 February 2014. The Forum was attended by five American and 14 Indian researchers using a range of methods—climate models, remote sensing, economic analysis, participatory tools—to study climate change impacts on farmers in India. The Indian researchers included scientists from universities and government research institutions (like Indian Agriculture Research Institute, IIT Mumbai, Tamil Nadu Agriculture University, Central Research Institute for Dryland Agriculture, Indian Institute of Science) and grassroots NGOs (like Watershed Organization Trust and Foundation for Ecological Security).

Ulka described the context in which the EVA field work was carried out and discussed key learnings from the project. For example, participatory scoring of adaptation options in block-level and village workshops underlined the differences in priorities at different scales and among different social groups at the same scale. It is important to acknowledge this heterogeneity within the community in planning CBA. These exercises also revealed gaps between policy and implementation—many adaptation-relevant measures are known but do not reach all those who need them. Moreover, it is important to consider the livelihood and gender implications of adaptation options. WP2 and 3 findings were also discussed.

IUSSTF participants list

Shrinivas Badiger	ATREE (Ashoka Trust for Research on Ecology and the Environment)	Bangalore
Robert Bailis	Yale University	New Haven
Govindasamy Bala	IISc (Indian Institute of Science)	Bangalore
Rahul Chaturvedi	Foundation for Ecological Security	Anand
Ruth DeFries	Columbia University	New York
Ram Fishman	George Washington University	Washington DC
Gouranga Kar	Directorate of Water Management	Bhubaneshwar
Ulka Kelkar	TERI (The Energy and Resources Institute)	Bangalore
S. Naresh Kumar	IARI (Indian Agricultural Research Institute)	New Delhi
Crispino Lobo	WOTR (Watershed Organization Trust)	Ahmednagar
Sonali P. McDermid	NASA Goddard Institute for Space Studies	New York
Pinki Mondal	Columbia University	New York
K. Nagasree	Central Research Institute for Dryland Agriculture	Hyderabad
Harini Nagendra	Azim Premji University	Bangalore
Krishnan Narayanan	IIT Bombay	Mumbai
P. Paramasivam	Tamil Nadu Agricultural University	Coimbatore
K. Bhavana Rao	WOTR (Watershed Organization Trust)	Ahmednagar
P. R. Sheshagiri Rao	Farmer, Karnataka	Anantapur
Veena Srinivasan	ATREE	Bangalore

Annex 5: Presentation on EVA research in Climate Change Vulnerability and Adaptation Conference

Ulka Kelkar, TERI, made a presentation on EVA research at the Vulnerability and Adaptation Conference organized in Bangalore during 26–27 August 2014, by C-STEP (Centre for Study of Science Technology and Policy), Public Affairs Centre, and ISET (Institute for Social and Environmental Transition) Nepal. The title of her presentation was 'Agricultural vulnerability and participatory methods for vulnerability assessment' in the session on 'Understanding vulnerability assessment and adaptation'.

The conference was attended by about 50 participants from India, Pakistan and Nepal. These included climate change vulnerability researchers from leading Indian research institutes (like ATREE (Ashoka Trust for Research on Ecology and the Environment), IISc (Indian Institute of Science), IIT (Indian Institute of Technology) Delhi, Madras School of Economics,IEG (Institute of Economic Growth), IIHS (Indian Institute for Human Settlements); donor agencies like IDRC, SDC and GIZ;and NGOs like Dhan Foundation, WOTR (Watershed Organization Trust) and Gorakhpur Environmental Action Group.

The workshop aimed to gain a better understanding of the strategic advantages for adaptation offered by different vulnerability assessment methods. Ulka discussed the insights offered by the use of mixed methods and gender sensitive approaches to identify vulnerable groups and prioritize adaptation options.

Annex 6: Seminar on EVA research at TERI University

Ulka Kelkar, TERI, delivered a seminar on EVA research at TERI University on 21 November 2013.

The seminar was coordinated by Dr Chubamenla Jamir, Assistant Professor, Department of Natural Resources, TERI University, who teaches the following courses:

- Food Security and Agriculture (NRE 168)
- Science and Policy of Climate Change (NRE 181)
- Climate change: Vulnerability, Impacts, Adaptation and Resilience (NRC 182)

The seminar was attended by Masters students from three academic programmes at TERI University:

- M.Sc. Climate Science and Policy
- M.Sc. Environmental Studies and Resource Management
- M.A. Sustainable Development Practice

Ulka discussed some of the methods used in the EVA project, e.g., participatory mapping of institutional access, participatory mapping of drought-risk zones, sharing of climate scenarios with communities, and participatory multi-criteria analysis of adaptation options. She also discussed various examples from EVA field work which highlighted different aspects of vulnerability (e.g., connectivity, role of local leaders, women's work, livelihood diversification, regional policy priorities). She ended with successful examples of watershed development in Jalna.

Questions and comments from the participants included:

- Rationale for choice of Jalna as case study
- In the institutional maps, why were some institutions (e.g., APMC) perceived as important and accessible but less relevant in drought?
- In the prioritization of adaptation options, it would be informative to see detailed scores for each stakeholder group in each village cluster
- Loss of traditional practices of water conservation
- When people shift to non-agricultural occupations or migrate, how difficult is it to bring them back to agriculture?
- How is triangulation of data being done? (answer: e.g., overlaying remote sensing NDVI data on community-drawn drought risk zones, household survey and interviews/group discussions)
- In the Somthana example, would it have been better to give management rights to local users?
- Other similar research projects in Maharashtra in which students can get involved
- Why don't success stories like Hiwre Bazaar get replicated?

About the Project

The EVA project focuses on the state of Maharashtra. More than 30 % of the state of Maharashtra falls under the rain shadow area and about 84 % of the total cultivated area is rainfed. Drylands in Maharashtra face the combined stress of human pressures and drought. Communities within these drylands are poor and face extreme conditions of water stress. This pilot project aims to assess the extreme risks and vulnerabilities to climatic extreme events in the drylands of Maharashtra and their impacts on agriculture and water resources, and the implications for community-based adaptation in response to these extreme events.

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