Addressing Environmental Degradation and Rural Poverty through Climate Change Adaptation

An evaluation of social learning in drought-affected districts of Southern India

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CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Sreeja Nair

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Abstract

The overall goal of this paper is to apply the climate change and social learning monitoring and evaluation (M&E) framework of the CGIAR's Research Program on Climate Change, Agriculture and Food Security (CCAFS) Policies and Institutions Flagship program to a climate change innovation platform. The Strategic Pilot project on Adaptation to Climate Change (SPACC) is selected to illustrate the usefulness of the social learning M&E framework and add to the social learning evidence base. The SPACC project was launched as a three-year (2010-2013) pilot initiative in Andhra Pradesh, a state in southern India to strengthen the knowledge and capacities of communities to respond to climate variability and change impacts in seven drought-prone districts.

The social learning component of SPACC is captured at three levels: community level, project level and beyond the project level. The CCSL M&E framework identifies a total of 30 primary indicators across four areas that form key components of the theory of change, viz. Iterative Learning, Capacity Development, Engagement, and Challenging Institutions. Among these four areas, indicators for capacity building and iterative learning were most easily observable in the case of SPACC. While the process and outcome indicators were observed for Engagement, it was difficult to study the quality of engagement and its impact in terms of change in value/practice. Engagement can be quantified in terms of number of new institutions formed, representation of marginalized groups and number of Farmer Climate Schools conducted. It was difficult to study indicators relevant to challenging institutions, primarily because the SPACC activities tried to build on and strengthen existing institutional structures where possible. Additionally, as the project primarily focused on building capacities and knowledge base at the community level, the learning beyond the project level was not as evident.

Keywords

Climate change adaptation, social learning, drought, rainfed agriculture, Andhra Pradesh

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Contents

Acronyms

APFAMGS	Andhra Pradesh Farmer Managed Groundwater Systems
APWELL	Andhra Pradesh groundwater borewell irrigation
BIRDS	Bharathi Integrated Rural Development Society
CCAC	Climate Change Adaptation Committee
CCAFS	CGIAR Research Programme on Climate Change, Agriculture and Food Security
CCSL	Climate Change and Social Learning
FAO	Food and Agriculture Organization
FCS	Farmers Climate Schools
FF	Field Facilitators
GEF	Global Environment Facility
GMC	Groundwater Monitoring Committee
HU	Hydrological Unit
HUN	Hydrological Unit Networks
KVK	Krishi Vigyan Kendras
M & E	Monitoring and Evaluation
MAC	Mass Awareness Communication
NGO	Non- Governmental Organizations
PMU	Project Management Unit
SPACC	Strategic Pilot project on Adaptation to Climate Change

Introduction

CCAFS CCSL Initiative and M&E framework

A Climate Change and Social Learning (CCSL) community of practice has been established by the Policies and Institutions Flagship of the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS) over the past years. The Monitoring and Evaluation (M&E) framework for social learning is one of the key outputs from the CCSL community. The purpose of building this framework was to facilitate structured collection of evidence and analysis of results to reflect on a social learning-oriented approach in the context of climate change adaptation and food security that can benefit vulnerable rural communities.

This paper conceptualizes social learning as per the CCSL Initiative's definition, which is as follows: "Social learning approaches help facilitate knowledge sharing, joint learning and co-creation experiences between particular stakeholders around a shared purpose, taking learning and behaviour change beyond the individual to networks and systems. Through a facilitated iterative process of working together, in interactive dialogue, exchange, learning, action and reflection and on-going partnership new shared ways of knowing emerge that lead to changes in practice" (Van Epp and Garside, 2014).

The CCSL M&E framework categorizes social learning indicators into those related to the learning process, learning outcomes (with respect to knowledge, norms and stakeholder relations) and changes in values/practice across stakeholders and institutions. A total of 30 primary indicators are identified across four areas that form key components of the theory of change, viz. Iterative Learning, Capacity Development, Engagement, and Challenging Institutions (Van Epp and Garside, 2014; details in Appendix).

The Policies and Institutions Flagship is in the process of applying the M&E framework to different contexts. This paper aims at contributing to a growing inventory of case studies that apply the M&E framework to different innovation platforms across the world, focusing on climate change adaptation and social learning.

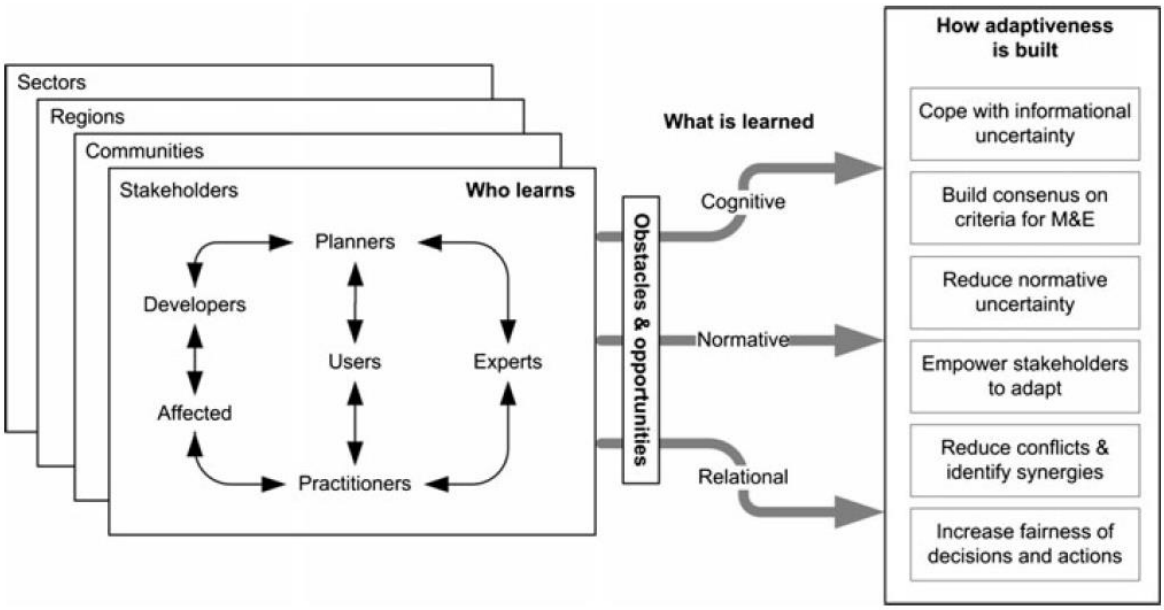
Social learning for climate change adaptation

The role of social learning in building adaptive responses for effective natural resource management (Lebel et al, 2010) and enabling transitions (Tschakert and Dietrich, 2010; Gorddard et al, 2012) in response to or anticipation of changes in the environment has

been well-acknowledged. However there is less guidance on how to operationalize the concept of social learning and measure it in practice (Van der Wal et al, 2014).

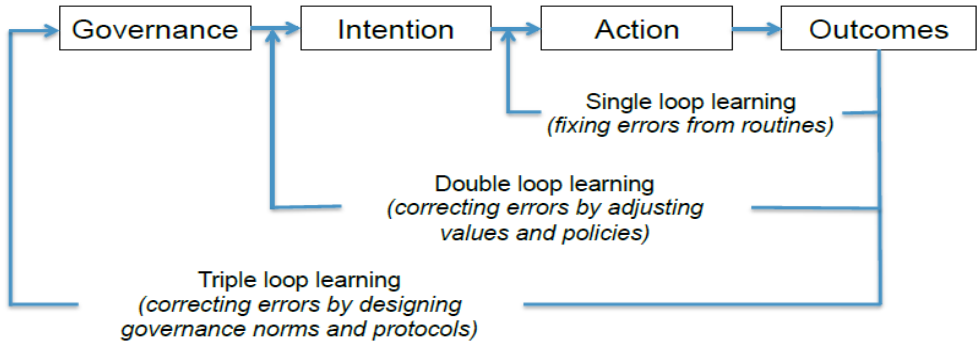
A key challenge in standardizing frameworks and methods to assess social learning could be related to the rather diffused and varied forms in which social learning can manifest itself. For example, social learning can happen across different sectors, regions and stakeholders; involve changes in knowledge base, norms and values and/or changes in the nature and type of interactions and exchanges between stakeholders (Lebel et al, 2010; see Figure 1).

Figure 1. Social learning among different groups to build adaptiveness (Source: Lebel et al 2010)



Learning can advance to different levels, ranging from incremental changes in problem solving ('single-loop learning') to questioning key assumptions about the problem and the solution ('double-loop learning'), to questioning and altering the broad values and worldviews governing the problem and solution context itself (triple-loop) (Pahl-Wostl 2007; Armitage et al 2008; see Figure 2).

Figure 2. Multiple loop learning for natural resource management (Source: Armitage et al 2008)



Learning approaches can help communicate climate change impacts and design of appropriate responses at the community level. These approaches can be situated along a continuum (Moser, 2010; see Figure 3), moving from single-loop learning aspirations that primarily involve sharing of information with and educating individuals about climate change, to substantive triple-loop learning aspirations for bringing changes in embedded societal values, related to society-environmental interactions (Harvey et al, 2012; Moser, 2010).

Figure 3. Communicating climate change: a continuum (Source: Harvey et al, 2012; adapted from Moser, 2010)

Inform and educate individuals about climate change	Achieve some type and level of social engagement/action	Bring about changes in social norms and cultural values
- Inform on science (including level of consensus and magnitude of the problem) - Inform on causes - Inform on current and potential impacts - Inform on possible solutions - Inform on mitigation practices - Inform on risk management - Inform on adaptation practices - Inform on political/policy responses	- Encourage consumption-related action - Encourage political/civic action across unusual boundaries or scales - Encourage action which helps people to adapt or reduce their vulnerability and/or exposure - Encourage action/behaviour that encourages' forward-learning'/adaptation	- Influencing values through early education - Influencing values through pervasive modelling - Influencing on climate "smart" or "resilient" thinking/planning

Communicating climate change (information focus) ---- Communicating adaptive practice (process/social learning focus)

Tschakert and Dietrich (2010) note the lack of learning tools and processes of 'translation and diffusion of learning' to facilitate adaptation, including experimentation and innovation to deal with complexity. An anticipated outcome of effective social learning to deal with environmental change is improved decision making and problem-solving capacities by gaining a better understanding of the linkages and fostering stronger relationships between communities and with the environment (Cundill and Rodella, 2012). Gorddard et al (2012) argue that the separate treatment of scientific information, values placed by the communities on adaptation practices and the actual decision-making process at the policy level has led to limited opportunities for triple-loop learning, which would essentially require close collaboration between these three. Single-loop learning or 'adjustments to existing actions' or 'error correction' often remain the main outcome (Harvey et al 2013).

Understanding the challenges in operationalizing and measuring the nebulous concept, the CCAFS Monitoring and Evaluation (M&E) framework marks an important step towards operationalizing the concept of social learning and offers a framework to measure social learning in practice.

Objectives of the paper

The overall goal of this project is to apply the CCSL M&E framework to an appropriate innovation platform or institutional mechanism. Within the broader goal, the objectives of this paper are:

- To test and contextualize the CCSL M&E framework and illustrate its application in a developing country and rainfed agriculture conditions.
- To study how best to consolidate results from application of the M&E framework.
- To understand the links between climate change adaptation and social learning in a rainfed agriculture system.

The remainder of this paper is structured as follows. The next section introduces the Methodology, covering the case description and methods used, followed by a section on the Case Study Analysis, followed by Discussion and Conclusions.

Methodology

Case Study Description

The Strategic Pilot project on Adaptation to Climate Change (SPACC) was identified to illustrate the usefulness of the social learning M&E framework and add to CCSL's social learning evidence base. The SPACC was launched as a three-year (2010-2013)

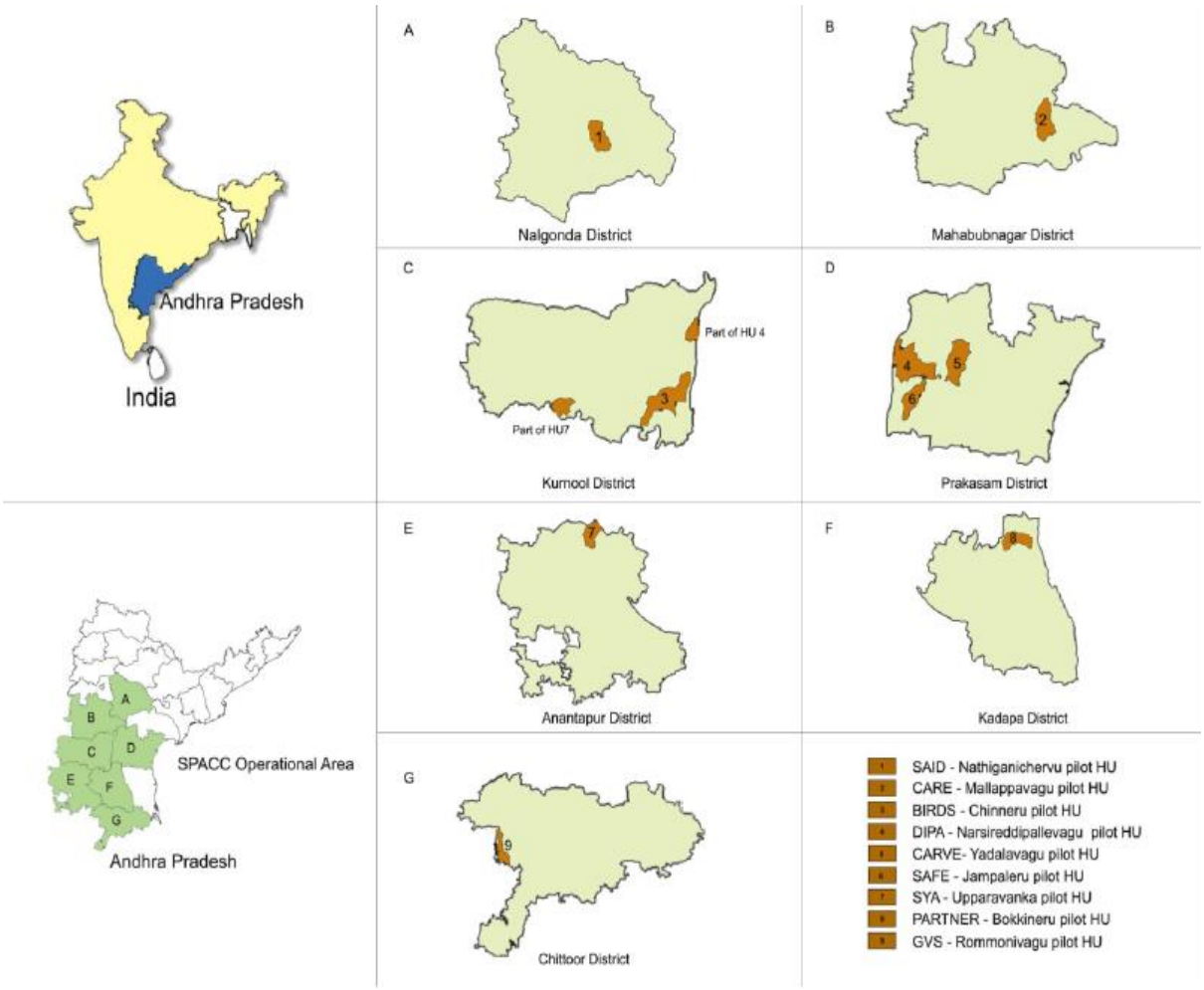
pilot initiative in Andhra Pradesh- a state in southern India, and titled 'Reversing Environmental Degradation and Rural Poverty through Adaptation to Climate Change in Drought Stricken Areas in Southern India: A Hydrological Unit Pilot Project Approach'. The objective of the SPACC was to strengthen the knowledge and capacities of communities to respond to climate variability and change impacts in pilot hydrological units in seven drought-prone districts of Andhra Pradesh. Specifically, the objective of SPACC was to "develop information tools and local institutional capacities developed for farmers and community-based organizations to make informed decisions on land and water management based on scientific and local knowledge, taking into account impacts of climate variations" (SPACC, 2012a).

The implementation for SPACC was defined at a hydrological unit level covering a natural area of drainage. SPACC was implemented in 9 such hydrological units (HU), across 143 habitations[1] in the state of Andhra Pradesh. The Project was funded by the Global Environment Facility (GEF) and co-financed by the Food and Agriculture Organization (FAO). The SPACC was operational in seven drought prone districts of Andhra Pradesh: Anantapur, Chittoor, Kadapa, Kurnool, Mahbubnagar, Nalgonda and Prakasam (see Figure 4).

The project took a bottom-up approach for rehabilitation, protection and productivity enhancement of the dryland agriculture areas in the state and to encourage soil carbon sequestration. A network of nine Non-Governmental Organizations (NGOs) executed the project in these seven districts. Bharathi Integrated Rural Development Society (BIRDS) based in Hyderabad was the Project Management Unit and nodal NGO. BIRDS executed the project in Kurnool district, along with providing overall technical and managerial assistance to the partner NGOs (SPACC, 2012a).

[1] A habitation refers to a distinct cluster of houses existing in a compact and continuous manner, with a local name. Its population should not be less than 25 in plains and not less than 10 in hilly/desert/sparsely populated areas. Accessed 25 May 2016, https://data.gov.in/keywords/habitation

Figure 4. Operational area of the SPACC project (Source: SPACC, 2012a)



The CCSL M&E framework has been used to study the social learning features of the SPACC project, using the following guiding questions:

1. How does the SPACC project perform with respect to the four components and indicators identified in the CCSL framework?
2. Do the framework indicators match with the SPACC project's own M&E indicators?
3. What are some insights in terms of data availability for the CCSL indicators?
4. What are some lessons for strengthening the CCSL indicators, based on the SPACC case evaluation?

Methods

This paper has a descriptive case study research design. A single case, SPACC, is identified as an innovation platform within the context of climate change adaptation in India. This particular case is identified because it was considered a good example of the international community supporting adaptation at the local level, while engaging

local NGOs and the state government to build on a highly successful earlier programme. The case was one of several cases identified as part of my PhD dissertation research that comparatively studied innovative pilot projects launched to deal with production risks to agriculture in rainfed parts of India.

Semi-structured interviews were conducted with the project staff and partners. This included a total of five key informant interviews. The interviewees included the project in-charge from the lead implementing NGO, BIRDS, one official from the donor Food and Agriculture Organization (FAO) (previously a field researcher and PhD student under this project), two district-level staff (one from the lead NGO and one from a partner NGO) and one state government official who was also the State project advisor and chair of the SPACC Project Steering Committee. These people held important roles in the design and implementation of the project and also had continuous involvement in the project cycle, i.e. from the project inception to its completion.

As this assignment was a desk-based review, telephone interviews with field staff were conducted between January- February 2016, and these were considered to be a proxy for gauging community-level implementation, social learning planning processes and challenges faced by the project. The interviews were supplemented with a detailed analysis of all quarterly reporting material submitted by the lead NGO BIRDS to the donor agency FAO, and training material and other project documentation developed during the course of the project. The CCSL M&E framework was adapted to develop a questionnaire for semi-structured interviews with key informants of the selected case study (see Appendix). The process of selection of indicators and questionnaire development was done in consultation with CCAFS staff and CCSL members.

Case study analysis and application of the M&E framework

The SPACC project builds on the foundation set by two previous pilot projects in the State of Andhra Pradesh that aimed at tapping the groundwater resources to bring in the productivity in wastelands and agricultural lands affected by recurrent droughts. This includes the Andhra Pradesh groundwater borewell irrigation (APWELL) project (initiated in 1995) and the Andhra Pradesh Farmer Managed Groundwater Systems (APFAMGS) Project (initiated in 2003).

The specific activities undertaken by SPACC have been categorized as they relate to the four components of the CCSL framework: Iterative Learning, Capacity Development, Engagement and Challenging Institutions.

Iterative Learning

The iterative learning component aims at capturing repeated cycles of collective learning that occurs in the process of co-production of knowledge by multiple stakeholders (Van Epp and Garside, 2014). In this case it included the project beneficiaries, project staff as well as the larger farming community not directly involved under the project. A unique component introduced by the SPACC was the design of Farmers Climate School (FCS) to demystify the concepts of climate change and variability and increase farmers' awareness of the impacts of climate change, selection of good adaptation measures and ability to cope with climate variability. The FCS's were based on the positive experience of the APFAMGS Project in the implementation of Farmer Water Schools. During the project cycle, FCS were conducted once every year and structured as a year-long school to cover different cropping seasons, starting in June and continuing until May of the successive year.

The objective of the FCS was to integrate traditional knowledge and indigenous farm practices with scientific and technical knowledge. Quarterly meetings were conducted during the course of the project bringing farmers from all districts, to share their experiences and challenges in adoption of adaptation practices. Furthermore, this was an opportunity for cross-learning between the partner NGOs as well, operating in the different districts. After each training feedback forms were given to obtain suggestions from all farmers regarding suggested improvements in the school format and curriculum.

FCS encouraged a 'discovery-based learning process' through participatory and experiential methods and aimed at continuous engagement of the farmers throughout the year. The FCS also sensitized the farmers on the need for collective action to adapt to climate change. A group of 25-30 farmers were part of the FCS throughout the year and interacted in small learning groups to ensure group cohesion and maximize participatory learning. These FCS were held close to their farming plots. The main learning material was the local weather data collected for the specific Hydrological Unit by the farmer volunteers and project staff (SPACC, 2012b).
At the end of FCS, Field Days were conducted to synthesize and share participants' learning and tested adaptation practices with the larger community. Field Day also included a graduation ceremony for its participants (a total of 1156 farmers, including

650 women and 506 men graduated from two cycles of FCS). To check the improvement in the knowledge and skills on topics related to climate change adaptation, Ballot Box Exercises were conducted with the participants. The same questions were used in the first and last FCS, and a clear improvement was found in their understanding of the issue and practices (Das et al, 2015).

Capacity Development

The capacity development component aims at capturing the development of knowledge and skills at the individual or community level that are specifically oriented towards improving the ability of stakeholders to engage in social learning (Van Epp and Garside, 2014). Demystification of climate science and its translation into information that can help farmers decide on farm-level measures to deal with climate risks was a major contribution of the SPACC. Not only did this transfer knowledge from scientific experts to the communities, but also within the community. The field observations became a source of learning and feedback for the communities, field staff, scientific experts as well as the local government officials, in terms of groundwater monitoring and drought planning in the area. For example, before the APFAMGS and SPACC projects, measuring groundwater was considered to be a scientific activity that can only be undertaken by experts. Following the engagement efforts of SPACC, farmers in the HUs were themselves able to conduct groundwater monitoring on a regular basis. Furthermore, they were able to adopt cropping patterns according to the availability of water.

The SPACC brought historical as well as real-time data monitoring within the reach of farmers. The weather-related and farm-related information collected at the HU level comprised of the following variables: i) historical temperature and rainfall trends, ii) real-time information on seven climate variables (temperature, humidity, rainfall, evaporation, sun-shine hours, wind speed, and wind direction), iii) information on soil type and classification (based on hydrogen ion concentration and percentage of calcium carbonate), iv) real-time information on soil organic carbon and available nutrients and micro-nutrients, v) real-time soil moisture availability and vi) historical and real-time groundwater balance (Das et al, 2015).

At the village level, data collection was done by farmers on a voluntary basis. Their task was to collect data and then discuss it during the Climate Change Adaptation Committee (CCAC) meetings. Volunteers were mostly middle-level farmers based on land size (4-5 acres). These volunteers were identified by the CCACs, and were usually those who can read and write and have space and facility to keep the

monitoring equipment in their house. The district level NGOs are still providing assistance with repair of the instruments. Six pieces of equipment were installed as part of the community-operated weather stations: rain gauge, evaporation pan, Stevenson screen (consisting of maximum-minimum and dry-wet bulbs/thermometers, sunshine recorder, wind vane and anemometer. The project trained 65 local project staff on weather monitoring, and 295 farmer volunteers were trained in data collection, dissemination and operation and maintenance of the equipment (Das et al, 2015).

Groundwater Monitoring Committees (GMCs) were created as part of the APFAMGS project as farmer institutions at the habitation level to monitor groundwater resources in the habitation. These GMCs were further divided into Hydrological Unit Networks (HUNs) at the Hydrological Unit level. A total of 638 GMCs and 63 HUNs were functioning actively as part of the APFAMGS Project. The project helped build capacities of the GMCs and HUNs to manage groundwater resources based on data that is generated in a scientific way and managed by the local population. The extent of data collection for SPACC was more extensive than in APFAMGS which was limited to measuring data pertaining to rainfall, water level in borewells, annual groundwater balance and cropping patterns. SPACC built on the successful format of engaging community-based organizations to generate and collectively manage relevant data for their farm-level activities, with the technical support of partner NGOs.

The SPACC project trained the farmers to take everyday farm-based decisions on a scientific basis. The farmer volunteers were trained to measure the data on different weather parameters like rainfall, humidity, temperature and evaporation on a daily basis using basic instruments provided to each HU. The projected rainfall for the next 24 hours (among other variables) was displayed on the notice board for discussion in the evening Gram Sabha (local community meeting). On rainy days, the amount of rainfall was monitored and data recorded on the display board at a central location in the village to help farmers decide on whether they should plough the field or postpone (depending on the amount of rainfall). In addition, evaporation loss during the day and heat intensity was calculated and helped farmers decide on an appropriate time and intensity for irrigating the fields, for specific crops. Wind direction was also calculated to take decisions regarding spraying of pesticides. When monsoons are delayed, farmers sometimes decide to plant short-duration crops. Such decisions have also been taken depending on the moisture content of the soil, for example.

SPACC also trained farmers in measuring soil conditions including field capacity, wilting point and soil moisture, using gravimetric methods with the use of equipment such as digital weighing machines and electric ovens. These measurements enabled real-time monitoring of soil moisture during cropping season, and helped farmers make informed decisions on timing their irrigation schedule and intensity. Farmers were also trained to collect relevant information pertaining to soil quality as well as pest management (Das et al, 2015).

The curriculum for the FCS was developed through Curriculum Development Workshops by a group of External Resource Persons, Subject Experts, Project Officers, Field Officers, and Professionals in land and water management. CCAC members participated in these workshops (SPACC, 2012c) to deliberate on the FCS curriculum. The curriculum of FCS was divided into 12 sessions. Sessions one to six focused on improving awareness on impacts of climate change on agricultural livelihoods. Sessions seven to twelve focused on identification of adaptation options to cope with climate change/variability (SPACC, 2012b).

Location-specific adaptation pilots were undertaken with the help of the partner NGOs and CCACs based on agro-climatic conditions including crop type and soil quality parameters to identify localized adaptation package of practices. These pilots were trialled in farmer fields measuring 0.2 hectares, next to control plots of the same size, where conventional practices were followed for crop development. Results from these pilot demonstrations were discussed in FCS.

Engagement

The engagement component aims at capturing the spread of project learning to individuals and communities, focusing on marginalized and vulnerable populations (Van Epp and Garside, 2014). For SPACC's implementation the partner NGOs were selected based on their strong field presence in the target districts. The target population overlapped with the small and marginal farmers identified as part of the APFAMGS and APWELL project. In SPACC, the engagement scope was expanded out to the entire farming community, including the small and marginal farmers and also the landless. Regional *Krishi Vigyan Kendras*[2] (KVKs) were closely involved with the project activities, especially for comparing the weather monitoring readings with the SPACC weather stations. Members of the KVKs regularly participated in the

[2] A frontline agriculture extension system in India established by the Indian Council for Agriculture Research, Ministry of Agriculture, Government of India

HU project meetings and interacted with farmers. District-level government departments, especially agriculture, animal husbandry and forestry departments also used weather data generated by SPACC for their planning. Sometimes the CCAC staff also became resource persons for the government training programmes related to climate change and agriculture risks.

The role of Field Facilitators (FFs) was crucial for capacity building as well as engagement with the farmers and the CCACs. FFs were appointed by the partner NGOs and were usually university graduates who had experience of working at the grassroots level. The FFs often resided in the villages or nearby towns and were often well aware of the community needs and expectations. FFs mobilized several farmers for project trainings, meetings and workshops including participation in the FCSs. FFs were also able to assist in the formation of CCACs through identification of vulnerable groups and ensuring a fair representation of the most marginalized groups, including women. FFs played an important role in bridging interactions between different stakeholders (Reddy, 2014). The FFs ensured that there were an equal number of women participating in the decision-making at the GMC and CCAC meetings.

SPACC also utilized Mass Awareness Communication (MAC) tools for engagement and to spread the concepts of climate science, project impacts and possible adaptation practices. The objective of using these MAC tools was to motivate the farmers towards individual and collective action for adapting their current land and water management practices in light of current and expected future changes in the climate. The following four MAC tools were used:

- Cultural shows that use folk-arts such as storytelling (*pallesuddulu*) and comedy skits (*pittaladora*), street theatre, magic shows, group songs, dances and mimicry performances consisting of local groups and folk artists to perform at different community-gathering areas in the project domain. Care was taken to include women artists as well to encourage women to see the shows and relate to the content being performed. Once the performing artists were selected, key members of the troupe (including a woman artist) were given an orientation by the SPACC Project Management Unit (PMU) staff regarding the technical content and project objectives of SPACC. Scripts were developed with the artists and reviewed by the PMU. The Field Facilitator responsible for a particular village publicized the venue and date of the cultural shows, which were performed in key locations of the HU. A questionnaire was given to the audience to receive their feedback.

- Audio/Video Compact Discs were used to communicate the project objectives through songs and documentaries. The materials for audio visual shows are collected from various institutions engaged in preparation of Information Education material on climate change/variability. Similar to the cultural shows, the Field Facilitator publicized the venue and date for the screening of the Audio/Visual show and feedback was again sought from the audience to check if the content screened was relevant to their farm practices.
- Wall writings were a simple, inexpensive and unique means of MAC. These wall writings in SPACC habitations include slogans or quotes on climate change and variability, various land and water management practices, and the importance of institutions and collective action to deal with climate risks. Wall writings were prepared in main meeting points, including important Government buildings such as local government offices (Gram panchayat), schools, farmer cooperatives etc. in the villages so that the maximum number of villagers could read the messages.
- Leaflets and brochures were developed in the local language to mobilize farmers to think about climate risks and undertake pilot adaptation initiatives and experiments on a piece of their agriculture land. These leaflets and brochures formed part of resource materials in the Climate Field Schools sessions. The CCACs helped in the distribution of leaflets in their HUs.

Challenging Institutions

This component seeks to challenge existing institutional structures and practices to remove any institutional barriers and strengthen social learning (Van Epp and Garside, 2014). The SPACC did not challenge existing institutional structures directly; rather it tried to develop avenues to facilitate social learning within existing institutional structures and in the process remove any barriers to social learning. For example, SPACC helped form new community-based organizations called Climate Change Adaptation Committees (CCACs) by restructuring the GMCs and the HUNs that were formed during the APFAMGS project. The CCACs are registered bodies under Society's Act of Government of Andhra Pradesh. This restructuring was beneficial in two ways; firstly it avoided duplication of efforts by creating a parallel institution, and secondly it helped preserve the experience and knowledge base from the previous project. The membership of the GMCs and HUNs was expanded to include representation from the vulnerable communities. Apart from data generation, CCACs activities included selection of volunteers and additional resource persons, conducting Climate Field Schools, identifying pilots to test adaptation measures,

selecting field sites for pilots, preparing climate change adaptation plans, conducting field days, and disseminating project lessons and results.

In order to ensure sustainability of activities and institutions at the local level, the communities were engaged with the community-based organizations in Vision-Building Exercises to instil ownership and accountability for the project activities, monitoring and updating them in a collective manner to reflect community aspirations. Inputs from the vision-building activities organized at the HU level have been incorporated into the SPACC annual plans. Additionally, functional linkages were fostered between CCACs and local agencies, specifically to continue providing technical assistance to the project activities after its completion. This included linkages with regional agriculture research stations, district agriculture departments, KVKs and biological control laboratories. A climate adaptation fund was created towards the end of the project tenure to cover for some of the operation and maintenance of the community-operated weather stations, crop specific adaptation pilots, and organizing of the FCS (Das et al, 2015).

Thus, while SPACC did not directly challenge or dismantle any existing institutions, the project tried to operate and expand within the current system. While this is often a requirement of projects operating with limited budgets, it is also a necessity in order to avoid conflict with related initiatives in the region engaging local partners and the local governments.

Discussion and Conclusions

This section refers back to the questions set out in the paper initially to demonstrate the application of the CCSL framework to monitor and evaluate social learning.

How does the SPACC project perform with respect to the four components and indicators identified in the CCSL framework?

The case analysis of SPACC in the drought-prone state of Andhra Pradesh presents an example of application of the CCSL M&E framework in Indian rainfed agriculture context. The analysis has provided insights of how learning aspects of SPACC project can be classified as per the elements of the four broad components of the theory of change that form the M&E framework. Firstly, SPACC enabled iterative learning through farmer climate schools that run throughout the year spanning all cropping seasons. The learning process was experiential and discovery-based.

Secondly, in terms of capacity development, while the project helped build the capacities of the farming community in general, its main contribution in terms of capacities relevant for social learning occurred in the form of facilitating the communities to collect and monitor agro-climatic data and use it as a basis for their everyday farm-level decisions and also to plan for long-term good adaptation pilots and practices. This process provided feedback to the scientific experts and project staff as well as the larger farming community in general as well in order to re-assess their farm-decisions in the light of climate change adaptation needs of the area.

Thirdly, in terms of engagement, field facilitators have a critical role to play to communicate the aspirations and needs of the vulnerable communities to the project staff. A variety of mass awareness communication tools in the form of local theatre, cultural shows, audio-visual, wall writings and pamphlets and brochures were developed as part of SPACC to expand the project outreach activities and engage maximum number of beneficiaries. Development of the Climate change adaptation committees was a major contribution of the project towards social learning, though their composition was a restructuring of the earlier committees on groundwater management.

Fourthly, through a process of developing locally-suited adaptation strategies and expanding the community networks for adaptation, SPACC did not directly challenge current institutions, but rather aimed at convergence with existing institutional structures and function where possible. This observation indicates that due to political factors, social learning projects and initiatives might often try to work with rather than against the existing institutions, especially when these are launched at a pilot scale and thus need support from multiple stakeholders to scale-up substantially.

Do the framework indicators match with the SPACC project's own M&E indicators?
The key project indicators for the SPACC project were process and institutional indicators (see Appendix 2) to capture the capacity building and local institutional strengthening objectives. Some of these indicators were found to link well to the four components of the CCSL M&E framework. This included the tools developed (climate monitoring system, climate change adaptation plans, farmer climate schools and curriculum development, preparation of manuals on best adaptation technologies) and levels of created capacities (number of community members and leaders trained in integration of adaptation measures within current land and water management practices, farmers graduating from farmer climate schools and participating in pilot

testing of adaptation measures and results of pilots in terms of performance of alternative adaptation technologies and practices).

The on-ground impact indicators included average crop yields, improved annual groundwater balance, volume of water harvested or saved through usage of water harvesting and saving devices/methods, soil moisture availability and/or organic carbon content). The monitoring of indicators was done with respect to a baseline prepared for all the HUs (FAO, 2010). These Objectively Verifiable Indicators were designed for the SPACC to measure success or failure of the activities by comparing the baseline value and date with the achieved value and date (SPACC, 2011).

Broadly, the social learning component of SPACC is captured at three levels:

1. Community level: At the community level, the farmers are now basing daily farm-level individual and collective decisions on weather, groundwater and soil data that they collect. Single-loop learning occurs as scientists and project staff train progressive farmers on monitoring of selected biophysical variables as well as with further farmer to farmer learning with trained farmers empowering other farmers. Double-loop learning can be observed as farmers earlier used to consider dealing with climatic vagaries as something beyond their control. Furthermore understanding climate science was also considered to be a scientific activity restricted to trained researchers and scientists to interpret. By demystifying climate science, the SPACC project has helped farmers in the study area to base farm-level decisions on scientifically collected and interpreted data. At the farmer level, Ballot-box exercises as part of FCS indicated the changes in knowledge and assumptions about the climate risks over time.
2. Project level: At the project level, only single loop learning has been observed. This has primarily been in the form of feedback from Farmer Climate Schools, CCAC meetings and from the field facilitators.
3. Beyond project level: While the SPACC project engaged with district and state-level governments and government agencies and contributed to data provision as well as capacity building activities for the government, it is difficult to categorize the level of learning in this case. Most of the engagement was on an as-per-need-basis and limited to sharing of knowledge about project activities and findings. As the project aimed at grassroots capacity building hence the learning beyond the community level can be considered to be rather diffused and hard to clearly identify and measure.

What are some insights in terms of data availability for the CCSL indicators?
Table 1 summarizes the CCSL M&E indicators as observed in the SPACC project.

Table 1. CCSL M& E framework and the SPACC project

	Iterative learning	Capacity development	Engagement	Challenging institutions
Learning process	Farmer Climate Schools helped identify adaptation practices	Farmers collect and monitor agro-climatic data relevant to farm-level adaptation decisions	Ensure inclusion of marginalized groups in community-level decision making for agriculture and groundwater management through mass awareness campaigns	Strengthen existing institutions and build new institutions for convergence of adaptation activities
Learning outcome	Discovery-based learning; farmer to farmer experience sharing	Undertake daily farm-level decisions and adaptation pilots at the farm level and share findings with experts and farming community at large	Maximum number of groups of stakeholders included in farm-level decisions based on current biophysical conditions	-
Value/ practice	Integration of traditional and modern farm practices	Farmers were able to initiate necessary changes in farm practices for adaptation based on available agro-climatic data, and encourage others to follow	Collective sustainable farming and groundwater management action enabled at the community level	Vision-building exercises to increase project ownership and accountability at the community level

As Table 1 indicates, the iterative learning and engagement components are more clearly defined and observed in the SPACC case as compared to capacity development and challenging institutions components of the CCSL framework. This is because it was difficult to obtain data that captured capacity building relevant to social learning only. Furthermore, as the project did not directly challenge existing institutions, the indicators, especially learning outcome could not be clearly identified. The process and value indicators related to strengthening existing institutions to aid in social learning for adaptation and/or remove any barriers therein.

What are some lessons for strengthening the CCSL indicators, based on the SPACC case evaluation?
Among the four key components of the theory of change identified as part of this framework, indicators for iterative learning and engagement components were most easily observable. Using the CCSL M&E framework to study the learning aspects of the SPACC project, the following insights can be drawn for strengthening the framework:

1. The iterative learning component largely involved the farming communities and to a lesser extent the wider stakeholder network including Government department officials. The framework in its current form does not differentiate between iterative learning involving only the marginalized communities and

other stakeholders at large. The quality of iterative learning can be captured by observing higher levels of learning (double or triple learning) though these were not observed in the current project.

2. While the SPACC contributed to general capacity development of the farming communities, the overlap with capacity development targeted to bring about an increased level of social learning was rather blurred. As capacity development is usually a integral part of most developmental and adaptation programmes a clear distinction of the indicators under this component would be helpful within the framework to avoid inclusion of all general capacity building activities in a programme and identify only those relevant to social learning.
3. While the process and outcome indicators were observed for Engagement, it was difficult to study the quality of engagement and its impact in terms of change in value/practice. For example in terms of quantity engagement can be studied in terms of the number of new institutions formed and representation of marginalized groups, capturing the quality of this engagement can be an ongoing challenge, especially for short-term projects. The framework should consider indicators that could reflect the quality of engagement.
4. Indicators relevant to challenging institutions were not clearly observed in the case of SPACC. This was primarily because the SPACC activities largely operated within existing institutional structures where possible. In some cases thus, the other three components may play a significant role as compared to challenging institutions.

Apart from the observations on the individual components, the CCSL framework in its current form does not comment on whether all four components are necessary to be observed in each case being studied for its social learning aspects or can even three or less of these components also lead to a high level of social learning? Another broad question relates to the determination of the overall social learning in a project as a sum of all indicators within these four components. The framework can be strengthened by including guidelines on how to integrate the large amount of information obtained on the indicators (which could further include both qualitative and quantitative data), on assigning weights (or not) to the individual components and indicators and on balancing between the number of indicators to be included under each component (some components may have higher number of observable indicators as compared to others).

Limitations and scope for future work

The SPACC project built on the lessons and institutional structures developed by the previous two initiatives for groundwater management- APWELL and APFAMGS. With such project legacy, it is difficult to attribute social learning aspects to SPACC specifically. In the context of assessing the role of social learning and adoption of agriculture innovations, Maertens and Barrett (2013) suggest that collection on social networks data over time, information flows and other unobservable variables can be used to study how networks form and grow. Tools such as Social Network Analysis can be used for such a study. As the project primarily focused on building capacities and knowledge base at the community level, the learning beyond the project level was not as evident.

The CCSL M&E framework was found to be applicable to SPACC and could therefore also be used to evaluate social learning in similar pilots on agriculture risk management in the region. Given that the SPACC project only ran for three years, the time period was quite short to observe learning at the double- and triple-loop levels. This project was a desk-based review hence it can further be supplemented by detailed field interactions to capture the district-level variations in social learning. The differences in learning between the selected seven districts of SPACC's operation were not able to be captured, while considering the difference in context and capacities of the partner NGO operating in that district. Interviews with some field-level staff could not be fixed as they only conversed in the local language.

Appendix 1: Questionnaire

Questionnaire for evaluating the social learning aspects of the Strategic Pilot on Adaptation to Climate Change (SPACC) project

Project background

1) Why was this project launched as a pilot?
2) What are the different stages the pilot has gone through and where is it currently?
3) Does this pilot have synergies (or conflicts) with any ongoing Government schemes and programmes?
4) What was the coalition of actors/agencies involved in a) conceptualization of the pilot and b) implementation of the pilot?
5) What has been the acceptance of the pilot by different stakeholders? How can this be quantified? Has this changed over time?
6) Have the outcomes or experience of the pilot been adopted onto any existing plans/ policies/ pilots? If yes, how?
7) What were some anticipated and unanticipated challenges encountered in the implementation stage?
8) Was/ is there any monitoring and evaluation system?
    a. What are the indicators and have these changed over time?
    b. How are the impacts and outcomes of the pilot being captured?

E: Social learning

These questions have been developed based on van Epp and Garside, 2014.

E 1: Indicators for engagement

Overview question: How did outreach and involvement of individuals and groups as part of the problem definition (i.e. adapting to drought risks) and learning process occur?

1) How were target groups/individuals identified and engaged?
2) What was the effect of engagement on individuals' and collective knowledge of the issue, and on group dynamics and relationships among the stakeholders?
3) Has the engagement lead to a change in target groups'/individuals' values regarding the problem and solutions?
4) Has the engagement empowered target groups/individuals to continue and/or expand their involvement in finding a solution? How?

E 2: Indicators for iterative learning

Overview question: Did collective learning regarding adaptation to droughts occur in an iterative manner? How?

5) What kinds of learning did the project lead to?
6) How was the quality of learning evaluated?
7) What was the impact of social learning across different stakeholders?

E 3: Indicators for capacity building

Overview question: Were capacities of individuals and groups built in multiple directions and involving multiple stakeholders to adapt to drought risks?

8) What was the focus of capacity building components of the project and how was this done?
9) How was the baseline assessed to design capacity building activities?
10) What were the changes to capacities brought about by the project and how were these evaluated?

E 4: Indicators for challenging institutions

Overview question: Did the project challenge existing institutions (formal and informal rules, values and practices) to enable social learning and adapt to drought risks?

11) Did the project have champion individuals or institutions to support (or oppose) the project activities?
12) What changes at the institutional level were required and brought about by the project?

Appendix 2: Indicators by Type

30 social learning indicators spread across the process, learning and value/practice categories are summarized below. Italics refer to optional/secondary indicators.

	ID#	Process Indicators	ID#	Learning Outcome Indicators	ID#	Value / Practice Outcome Indicators
ENGAGEMENT	P1	Women, youth and other disadvantaged groups are identified and targeted	L1	[Cognitive] Knowledge of the problem enhanced by interactions	V1	[Value] Engagement leads to increased commitment on the part of target groups/individuals in reaching the goal of the project
	P2	Groups/individuals identified are engaged through appropriately tailored means	L2	[Relational] a. Engagement has led to better relations between target groups/individuals *b. Trust created* *c. Engagement has led to awareness and valuing of other stakeholders*	V2	[Practice] 3 parts: a. New social networks established b. New initiatives and projects c. Empowerment of most vulnerable beneficiaries (communities) inc. women & children
	P3	2 parts: a. All target groups/individuals are actively participating in the project *b. Facilitator role identified as trusted and effective by all parties*	L3	[Normative] 2 parts: a. Different knowledge types successfully integrated b. Engagement has led towards a change in collective understanding of the problem and solutions		
	P4	*Emergence of champions is fostered*				
ITERATIVE LEARNING	P5	Cyclical, inclusive learning and evaluation "moments" are available for the group	L4	[Cognitive] 2 parts: a. Results of learning/evaluation are incorporated into the project strategy *b. Creative solutions and innovations are developed*	V3	[Value] Wider stakeholder groups understand the reasons to change their relations and behaviours
	P6	*Learning and evaluation processes are supported and facilitated*	*L5*	[Relational] *Evidence as learning/evaluation takes place that people understand the reason to change relations and behaviours between people and groups*	*V4*	*[Practice] Wider stakeholder groups relate to each other differently*
	P7	Systems are in place to foster and implement new ideas	L6	[Normative] Participants understand the need for alternatives and room to fail	*V5*	*[Value] The need for alternatives and room to fail is evident in other projects/programs*
	P8	Questioning the TOC itself and key assumptions is valued and happening regularly			V6	[Practice] Alternatives and room to fail are built in to other projects/programmes

	ID#	Process Indicators	ID#	Learning Outcome Indicators	ID#	Value / Practice Outcome Indicators
ITERATIVE LEARNING	P9	Questioning of values, norms and governance underlying problem is valued and happening regularly				
CAPACITY DEVELOPMENT	*P10*	*Capacity development activities are integrated into the project/program*	L7	[Cognitive] Similar level of understanding of the problem by all stakeholders	V7	[Value] More informed stakeholders
	P11	Capacity development activities target all participants in appropriate ways (e.g. governments, farmers, scientists)	L8	[Relational] Increased understanding between different participant groups of different needs and perspectives	V8	[Practice] 2 parts: a. Capacity development leads to different groups working together better b. Capacity development leads to changes in practice that reflect a better understanding of the problem and solutions
	P12	Capacity needs are determined collectively in a bottom-up manner	*L9*	*[Normative] Increase in collective challenging/understanding methods of building capacity for particular stakeholders*		
	P13	*Capacity development needs are systematically integrated into all project components*				
CHALLENGING INSTITUTIONS	P14	Key individuals/institutions who will support/champion change are identified	L10	[Cognitive] Project participants understand the particular opportunities and barriers	V9	[Value/Practice] Reduced number and severity of barriers; increased number and potential impact of opportunities
	P15	A change strategy is developed, including mapping of existing norms and endogenous processes.	*L11*	*[Relational] Key institutional and project actors share a common understanding of the problem and approach to solving (social learning)*	V10	[Value] Challenges lead to changes in institutional openness towards SL-orientated approaches (evidenced in e.g. attitudes, conflicts)
	P16	*Existing norms and endogenous processes are mapped*	L12	[Normative] Institutions understand that a shift in values or practice is needed to foster social learning	V11	[Practice] Challenges lead to changes in institutional support for SL-oriented approaches (evidenced in e.g. policy/roles, and resources made available for implementation)
	P17	Key institutions are challenged to make changes that facilitate social learning				

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