Institutionalizing Science Field Shops:

Developing Response Farming to Climate Change

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Case study

Science Field Shops (SFSs) in Indonesia promote farmers' agrometeorological learning enabling them to adapt their farming activities to cope with increasing climate variability. Seven climate services forming the core of SFSs are based on trans-disciplinary collaboration between farmers and scientists.

GACSA
GLOBAL ALLIANCE FOR CLIMATE-SMART AGRICULTURE

Yunita T. Winarto, Sue Walker, Rhino Ariefiansyah, Adlinanur F. Prihandiani, Mohamad Taqiuddin and Zefanya C. Nugroho

UNIVERSITAS INDONESIA
Veritas, Probitas, Iustitia
EST. 1849

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
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1. Introduction

Farmers from all over the world have reported that both the timing of rainy seasons and rain patterns are changing. These perceptions of change are striking in that they are geographically widespread, and because the changes are described in remarkably consistent terms (Jennings and Magrath, 2009). Consequences of climate change are global warming, increasing climate variability, more frequent and more severe weather events affecting people's livelihood, particularly in vulnerable areas, such as tropical Asia. Increasing temperatures have been emerging together with a shift in seasonal patterns, which may have severe consequences for human health, agricultural and ecosystem productivity.

patterns, has changed in recent years. When La Niña occurs, Indonesia is prone to above average rainfall (Yamauchi et al., 2012). In contrast, during El Niño events with delayed rainfall, late planting could extend the "hunger season" and further reduce area planted to rice resulting in annual rice deficit. An emerging issue in Indonesia and other Southeast Asian countries is that of the "false start" of the rainy season, where isolated precipitation events are followed by long dry spells without consistent rainfall to keep seedlings growing (Marjuki et *al.*, 2014).

In the case of irrigated rice production in Indonesia, as observed from 1999 to 2007, delay in the onset of rainy season significantly decreased rice production (Yamauchi et *al.*, 2012).

INDRAMAYU REGENCY

Figure 1. Indramayu Regency in West Java Province.

In Asia, and specifically in Indonesia, where rice is the primary staple food, higher night temperatures may lead to yield reduction and thus food insecurity. Agricultural production in Indonesia is strongly influenced by El Niño-Southern Oscillation (ENSO) dynamics. The frequency of both El Niño and La Niña, and their succession

These factors have increased the rice ecosystems' vulnerability, which affects farmers' capability to develop farming strategies. In this framework, climate services were introduced through the agrometeorological learning approach with a group of farmers in Indramayu Regency on the north coast of the West Java

Province in early 2009, and in East Lombok Regency in the West Nusatenggara Province at the end of 2014. Both irrigated and rainfed ecosystems in Indramayu, and the mainly rainfed systems in East Lombok, have been affected by the consequences of climate change (see Figure 1 of Indramayu Regency in West Java Province and Figure 2 of East Lombok Regency in West Nusa Tenggara Province).

a third time that year. This policy unintentionally led to severe outbreaks of brown planthopper as well as grassy-stunt and ragged-stunt viruses due to continuous mono-cropping. Up to 400 000 hectares of paddy fields across Java were severely infected by these pests/diseases. In contrast, the long drought of 2015 provided economic opportunities for farmers who understood that mung bean, which is drought resistant, performed better than rice.

Figure 2. East Lombok Regency in West Nusa Tenggara Province.

Farmers in these two regencies, and elsewhere in Indonesia, suffer from increasing average temperatures and decreasing rainfall. Between 2015 and 2017, farmers observed a greater number of dry days without rainfall, and fewer wet days with high amounts of rainfall. The late onset and/or false start of the rainy season, long "dry spells" in the midst of the rainy season, and shorter duration of consecutive rainy days, significantly affected not only the productivity of rice, but also the outbreak of pests and diseases, leading to yield reduction. During 2016 dry season (May-Sept) when more than normal rain was received, the central government policy to increase rice production, forced farmers to plant rice for

Similarly, cultivating watermelon during the long El Niño of 2015 gave high profits; however during 2016 dry season (May-Sept) with more than normal rain, it resulted in a total watermelon harvest failure.

With increasing climate-related risks and opportunities for agricultural production, farmers need help to improve their anticipation capabilities and resilience to climate change. Providing climate services to farmers to improve their agrometeorological learning is, thus, an urgent need.

2. Science Field Shops: Agrometeorological Learning as a New Extension Approach

Agrometeorological learning is the basis of the educational commitment developed in Science Field Shops (SFSs). Agrometeorological services and their four support systems, namely data, research, education/training/extension and policy, have gained increasing attention since the late 1990s (Stigter, 1999).

rather than knowledge transfer. Moreover, extension workers were found not to be well trained on conditions of a changing climate. In this framework, the educational commitment called Science Field Shops (SFSs[1]) was developed, based on learning meetings between farmers, scientists, scholars and farmers, and wherever possible, between farmers and extension intermediaries (Figure 3; Winarto and Stigter, 2013, 2016).

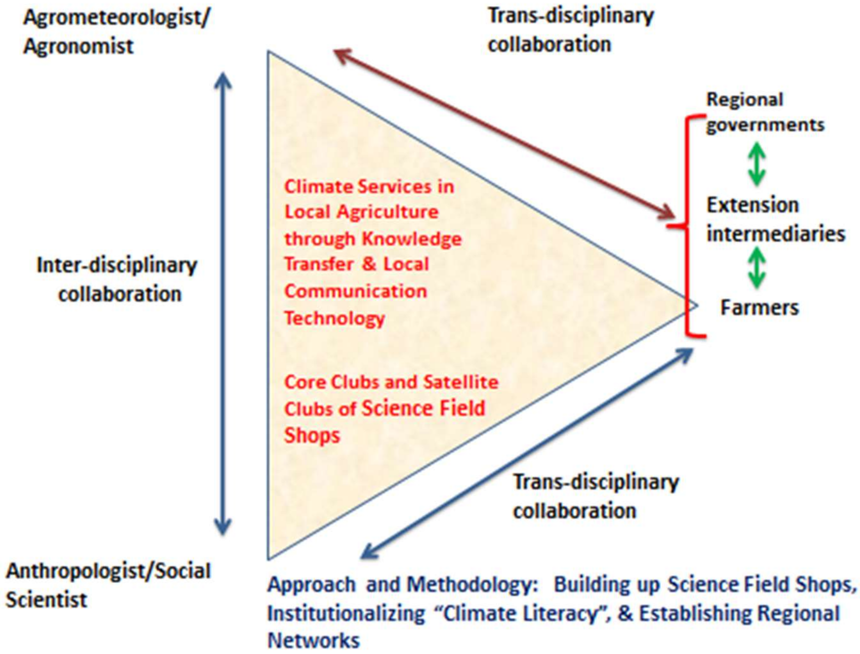

Figure 3. Inter- and trans-disciplinary collaboration in Science Field Shops.
Source: Center for Anthropological Studies, FISIP Universitas Indonesia for FAO Webinar on FFS and Climate Change, 3rd November 2016 (also see Stigter and Winarto, 2016)

In the past decade, these support systems have driven the support action needed for the most urgent issue of mitigating the impacts of disasters. Applied agrometeorology, however, seldom reaches farmers in developing countries due to their low formal education rates, communication and connectivity challenges, and weakness of organizational infrastructures. Therefore, there is an urgent need to make agrometeorology more operationally relevant to farmers' livelihoods. A key to the development of agrometeorological advisories established in collaboration with farmers is the presence of a "services culture". Instead, the Indonesian government's extension service operates by applying a technology-driven approach,

Such collaboration was further strengthened by the adoption of a collaborative inter-disciplinary approach between agricultural climatology, meteorology and anthropology, and trans-disciplinary collaboration between farmers and scientists, which became the basis for establishing climate services in local agriculture (Stigter and Winarto, 2016; Winarto and Stigter, 2017).

[1] Stigter and Winarto preferred to name the arena where farmers can come and "shop whatever information they need" as "Science Field Shops" (SFSs, *Warung Ilmiah Lapangan,* WIL) and not "Climate/Weather Field Shops". The latter has a limited scope for farmers', as "Climate/Weather Field Shops" only relates to climate and/or weather issues. Science Field Shops has a wider scope across the whole range of agricultural issues for farmers' queries, dialogues and problem solving.

Through this collaborative work, farmers are positioned as active learners, researchers and organizers of their own activities in implementing the SFSs in their own associations, called "clubs" (in Indramayu) or "groups" (in East Lombok).

3. Providing climate services: improving farmers' resilience to climate change

Science Field Shops (SFSs) are "shops" rather than "schools". There are no curricula for knowledge exchange with farmers. In these shops, farmers, scientists and local extension officers meet to discuss consequences of vulnerabilities based on the farmers' own discoveries from rainfall measurements and agroecosystem observations, and to contribute to solving actual local problems expressed by farmers. Listening to farmers precedes dialogue between participants in the SFSs, according to a "farmers first" paradigm.

This knowledge sharing is aimed at understanding the yields farmers have obtained, including differences between varieties, fields, and seasons and years, with scientists guiding this process. The main objective is to help farmers better understand their field conditions under a diverse range of climate conditions. It is expected that based on this understanding, complemented with the forthcoming three-month seasonal rainfall scenarios, farmers would be able to improve their anticipation capability and make decisions accordingly.

A total of seven climate services have been developed in the SFSs, including guidance on:

1. daily rainfall measurements by all rainfall observers in their own plots;

2. daily agroecological observations;

3. measurement of yield and understanding of differences between fields, seasons and years;

4. organization of the SFSs;

5. development and exchange of monthly updated seasonal climate predictions in the form of seasonal rainfall scenarios;

6. exchanging new knowledge related to the above;

7. establishment of field experiments to develop best practices and obtain on-farm answers to urgent local questions.

The following paragraphs provide further explanation of the above climate services provided through the SFSs.

3.1. Climate Service #1: guidance for daily rainfall measurement

Rainfall is the most variable climate parameter over time and space. Therefore, each farmer, who identifies as a rainfall observer must thoroughly understand the implication of rainfall on their own field, as well as on crop growth. Measuring rainfall daily on their own field is the first activity every rainfall observer must do once they agree to join a Rainfall Observers Club/Group. A unique feature of the SFSs approach is that this activity does not stop at the end of the crop growing or planting season. While participating in SFSs, farmers are guided through the preparation of a cylindrical metal rain-gauge, correctly sized by taking into account the daily rainfall amount received in Indonesia, which seldom exceeds 220 mm/day (Figure 4).

This climate service includes guidelines for farmers on rain gauge usage. A set of rules was defined as follows:

- mount the rain gauge in a field owned and cultivated by the rainfall observer (accommodating local land tenure arrangements);

- assign a unique code for each rainfall station location;

- the rainfall observer should mount the rain gauge avoiding any obstacles (houses, sheds, high trees, etc);

- farmers agreed to make the measurement every morning between 6.30 a.m. and 7.30 a.m. in order to uphold comparability of their rainfall data across different areas;

• the rainfall observers use a dipstick and a ruler to measure total rainfall in millimeters;

• Data should be written in their notebook immediately and transcribed into their logbook;

To support this practice, the following services were also provided:

• guidance in categorising the data in data sheets;

• a template for farmers to make the monthly and annual rainfall graphs;

• method for categorising rainfall data (as below normal, normal and above normal) in order to compare with categories provided in seasonal scenarios.

Figure 4. Indramayu farmer's homemade rain gauge (Photo: B. Dwisatrio, 2012).

3.2. Climate Service #2: observing the agroecosystem on a daily basis

Each rainfall observer is also responsible for observations of their agroecosystem. Developing the analytical capacity to relate rainfall data to the agroecosystem condition is paramount in the agrometeorological learning on which SFSs is based (see Box 1 for the list outlined by Stigter as a guide for farmers to observe their field's agroecosystem).

Box 1: Guidance for observing, documenting and analysing agroecosystem data

- Commodity: paddy and/or non-paddy (and variety)
- Ecosystem: irrigated or non-irrigated
- Soil: type, color, and texture
- Land management: timing and preparation of soil before transplanting
- Seedlings (sowing): methods and time
- Total monthly rainfall (mm): including dry and wet spells
- Rainfall impact on field
- Planting schedule
- Water management: flooding, draining
- Growth conditions of crop – stages of development, height, etc.
- Fertilizers: composition, availability, and schedule
- Pests and diseases: kind of pests/diseases, level of damage and pest control management
- Natural enemies presence
- Depth of roots

Source: Hand-out for roving seminar, training of trainers (Stigter, 2016)

The items listed in Box 1 can be modified according to the particular situation in each region. For example, the both paddy and non-paddy commodities were added, and the varieties for each commodity, to accommodate the planting of non-paddy in the third season in Indramayu and the second and third seasons in East Lombok.

The gradual improvement of farmers' analytical capability developed throughout the monthly evaluation meetings, where farmers were expected to share their rainfall and agroecosystem data, as well as their analysis of vulnerabilities and/or opportunities they faced in the past month. The aim was to focus on the most urgent problems and how to solve them. Through this dialogue, farmers learn from one another's data, analysis, and experience.

3.3. Climate Service #3: evaluating yields

The third climate service focuses on predicting and measuring yields of a planting season while explaining and understanding the differences (between fields, seasons and years) from rainfall data, ecosystem observations, inputs (crop varieties, water, fertilizers, pesticides, labour, machinery and knowledge) both in terms of amount and timing, and management strategies. It was expected that by contextually analysing the plausible causal factors of a given yield, a farmer could then reduce the risk of yield reduction or crop failure in future seasons, and improve cropping conditions.

Yield evaluations were organized by each ecosystem zone after the harvesting period. The discussion, facilitated by each zone coordinator, focused on plausible factors leading to differences in yield among farmers, as well as on the similarities or differences across seasons, and during the same season but comparing different years. From 2016 onwards, our attention was focused on improving the following: 1) examination of costs and benefits, so that farmers would be able to understand their gross margin in detail; and 2) analysis of increase or decrease in yields achieved from the current season harvest compared to the last year's harvest as a percentage. Each zone was assisted in drawing conclusions based on these analyses as part of preparation for future plantings under similar climate conditions.

3.4. Climate Service #4: organizing the SFSs activities

The fourth climate service is the organizational structure of the SFSs to address the uncertainties induced by climate change. Farmers made it clear that they had the right to organize the activities for themselves. Monthly evaluation meetings were the main activity organized by the rainfall observers. In this regard, dialogue and discussion are the two main methods introduced as the underlying premises for any communication and interaction between SFSs members. Such an approach was formalized and named "Knowledge Transfer and Communication Technology" (Stigter and Winarto, 2015).

Other matters addressed while organizing the SFSs were establishment of the clubs/groups (both core and satellite), selection of leaders, and definition of roles and tasks for leaders and members of each club/group. In general, the club/group members must be farmers or rainfall observers who commit to making daily observations of both rainfall and agroecological parameters, and recording them according to SFS methods. Also, they are required to attend the monthly evaluation meetings, during which the rainfall data, field observations and climate vulnerabilities are discussed.

To pursue their own empowerment, farmers decided to appoint official leaders, including a head, secretary, treasurer, and zone coordinators. Zone coordinators are responsible for transferring information and news to their members regarding the club/group's activities, and also monthly seasonal scenarios, as well as monitoring members' rainfall and agroecosystem observations and documentation. Later, with the formation of new satellite groups, the zone coordinators also became responsible for assisting the new groups members in learning the agrometeorology methods as developed in the SFSs.

With the aim of increasing access to the SFSs for other farmers, and considering the need to assist farmers in the absence of the Universitas Indonesia (UI) team in the future, farmers were invited to appoint several members as facilitators. These facilitators had the responsibility of recruiting new members for the formation of new satellite clubs/groups in collaboration with the extension staff from the Regency Agricultural Offices, as well as to facilitate new members' learning about agrometeorology. Figure 5 represents the organization of SFSs based on farmers, government agencies and scientists.

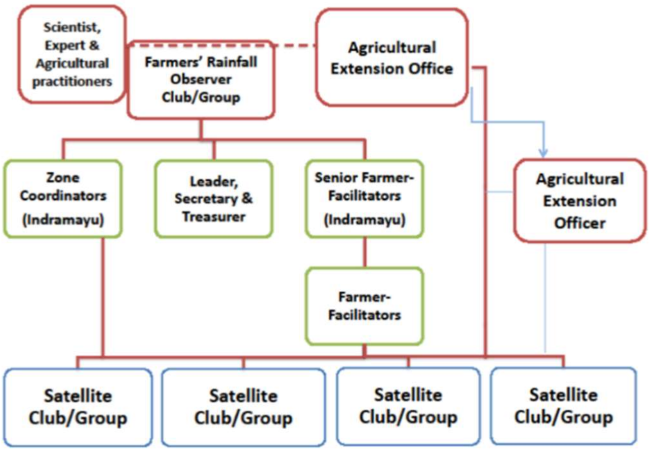

Figure 5. Diagram of the organization of SFSs.

3.5. Climate Service #5: disseminating seasonal climate scenarios

Seasonal rainfall scenarios were introduced to the rainfall observers in Indramayu in 2011. It was also the first time that the farmers received an outlook or forecast of the expected future climate condition before and during the cropping season. This "seasonal scenario" is a monthly summary of the rainfall expected over the next three months according to predictions from El Niño - Southern Oscillation (ENSO) indicators of sea surface temperatures and Southern Oscillation Index (SOI) pressure differences (Walker, 2017). Such updated climate outlook information was based each month on global climate model predictions given by the National Oceanic and Atmospheric Administration (NOAA), and on International Research Institute for Climate and Society at Columbia University (IRI) maps. In 2016, information released by the Bureau of Meteorology, Australia (BOM) was added. The following is an example of the first climate scenarios based on NOAA and IRI data:

"From August until October (2011), the condition in Java will be normal with the second dry season. Rainfall is expected to fall in October or November".

Such a climate scenario was perceived by the rainfall observers as very unusual, though beneficial in filling in the empty gap in their schema of what would happen in the future. Rainfall observers could plan for predicted climate conditions in the ongoing or next planting season. Such knowledge provided rainfall observers with the ability to anticipate future risks and/or opportunities for their crops by improving their decision-making capacities and, thus, the ability to design more flexible and adaptive strategies.

The scenarios, first written in English, were then translated into Indonesian and circulated via Short Message Services (SMS) on mobile phones. The representatives and zone coordinators received it first, and had the responsibility to send it to all club or group members. Other means of circulating the seasonal scenarios are radio broadcasting sessions, farmers' social media and discussion in the traditional neighbourhood "*berugaq*[2]".

3.6. Climate Service #6: providing and exchanging new knowledge

The sixth climate service is the delivery and exchange of new knowledge related to the "puzzling phenomena" farmers experienced in their daily farming activities, and issues raised in the discussion of becoming "climate literate".

Their questions were mostly related to climate change, its consequences for agriculture, agroecological conditions and issues experienced in their fields.

[2] *Berugaq* is a small hut built in the farmer's home yard as a place for chatting and discussing daily matters and farming problems.

Usually questions from farmers were addressed by a) sending their queries via mobile phone to the UI team, who would then send them to the appropriate expert, with answers being sent back to farmers later; b) inviting experts on particular topics to share their knowledge during a monthly evaluation meeting; and c) promoting and facilitating individual farmer's initiatives to find answers from various other sources. Examples of such "missing knowledge" requested by farmers are listed in Box 2.

Box 2: Examples of farmers' questions related to climate change

- Is there any chance that global climate change could lead to total changes in climate, so that a tropical country like Indonesia could also get snow?
- Why will the dry season start earlier?
- Why are the rains in the present time different from the old days?
- Why is rainfall up this year with extreme conditions (very intense rainfall) and lots of floods?
- What factors cause this very intense rainfall?

Source: Indramayu Rainfall Observers Club members, March, 2014

Recently, a new method for stimulating dialogue between all parties involved in the SFS (farmers, extension staff and scientists) was introduced, encouraging the training of trainers (ToT) participants to share their own experiences, knowledge, and findings as a means to improve one another's knowledge base. Several other sources and agents of knowledge can also be invited to share their knowledge and experience during the monthly evaluation meeting. Monthly SFS meetings should be used as an opportunity to spread new knowledge about a range of agronomic practices. For example, information is shared on available water in relation to soil characteristics (illustrated using different colour sponges), together with the stages of plant growth and transpiration. Recently, knowledge-sharing techniques between farmers were developed by the farmers themselves, including using various means of communication, namely farm exchange visits, SMS via mobile phones, dedicated groups on the application WhatsApp, Facebook, and web blogs.

3.7. Climate Service #7: experimentation in farmers' fields, a win-win solution

Rice farming is the main methane emitter in Indonesia, through anaerobic metabolic processes. In response, a "win-win solution" experiment was introduced in 2013 in Indramayu. The experiment focused on testing practices to mitigate methane emission. In a comparative analysis, the effects were monitored using experimental plots under different soil treatments—tillage and the use of composted or uncomposted straw. Best practices are still being tested by the farmers, particularly looking at soil homogeneity/uniformity, different rice varieties, pesticide treatments and fertilizer application rates. See Figure 6 for an image of farmers measuring the depth of roots after harvesting the paddy in the experimental plots.

Figure 6. Measuring the depth of roots (Photo: R. Ariefiansyah, 2017).

The main challenge of introducing scientific experiments into the farmer groups is the conflict with their own knowledge culture, based on trial-and-error experiments where they use to combine many variables that could alter the experimentation process. Throughout the implementation of these climate services, farmers gradually learned how to apply a scientific approach based on the definition of a question to be tested, how to observe and document each step, and to focus only on one changing variable to be examined.

4. Being Rainfall Observers: advantages and constraints

Promoting the training and the dissemination of the concept of "rainfall observers" as part of an extension approach, provides the following advantages:

(i) each participating farmer can create a record of their own rainfall over the years in a climate logbook;
(ii) derivatives such as monthly, seasonal and annual totals, maxima, minima, can easily be obtained, graphically compared and understood as consequences of climate related issues;
(iii) higher than usual measurement densities can be obtained to show the exceptional distribution of rainfall;
(iv) measurements other than rainfall: things that are affected by climate (e.g. agroecosystem observations) can be compared and discussed;
(v) measurements can serve as an input to understand yield differences between areas, farmers, seasons and years;
(vi) measurements can work as a basis for adaptation to climate change, particularly in relation to increasing climate variability and the occurrence of increasingly severe weather events (e.g. droughts, heavy rains and floods).

Based on data collection and observation, farmers can improve their analytical skills and better understand risks and/or opportunities, thus, using this information to make their decisions accordingly in the future. The following are some examples of farmers' coping strategies for forthcoming climate scenarios:

• by considering the forthcoming delay of the onset of the 2014/2015 rainy season, early cessation of rains, and peak-flight of white rice stem borer moths, rainfall observers in one village of Indramayu suggested to village leaders and farmers in their community when to start planting and what varieties to plant. Their strategies successfully helped them in alleviating the risks of crop failure.

• approaching the 2016 dry season, the rainfall observers in East Lombok were informed about a probable "wet dry season", which could affect tobacco growth. After thoroughly discussing the topic, the rainfall observers reached a consensus on different strategies. One was based on planting tobacco as early as possible and digging up a deeper drainage canal for those who would decide to continue planting tobacco. Other anticipatory strategies were to diversify the commodities (rice and tobacco), substitute tobacco with maize or rice only, and to replace tobacco with rice if necessary under wet conditions. Those who practiced those alternative coping strategies were able to successfully harvest their crops, unlike those who continued to cultivate tobacco without any modification.

These examples are evidence of the benefits gained from joining the SFSs.

5. Scaling-up and replication: potentials and challenges

Establishing an educational commitment and institutionalizing a new learning approach among farmers is a significant challenge, particularly under the continuous Green Revolution paradigm defined by the government's food policy. Even though farmers are managers of their own fields, or fields under their responsibility, being "researchers" is something novel in their life. Similarly, the prolonged program, based on knowledge transfer and exchange was new to them. However, despite farmers' hardships in becoming rainfall observers, the agrometeorological learning has gradually been institutionalized as part of their traditional rice farming systems. As such, scaling-up the educational commitment beyond the two regencies where it was tested was taken into consideration. Scaling-up the experience by replicating the formation and implementation of the SFSs in other areas would be a significant means to helping a larger number of farmers in Indonesia and abroad to better adapt to climate change.

The steps taken in East Lombok Regency to promote the formation of new satellite-clubs and groups is an example of replicating the SFSs. Those steps include 1) approaching local leaders and key farmers to introduce the climate change issue and its consequences on agriculture; 2) introducing the idea of educational commitment through SFSs and its climate services as the means to improving farmers' agrometeorological knowledge; 3) forming core club or groups of rainfall observers; 4) operationalizing the key methods (e.g. measuring rainfall and observing the agroecosystem) at the initial stage of learning, followed by the others on an incremental basis; 5) organizing a Training-of-Trainers (ToT) program for the rainfall observers of the core club and the government extension staff at a later stage; and 6) facilitating, monitoring, and evaluating the establishment and institutionalization of new satellite clubs or groups to foster and consolidate a new approach to rice farming.

Once the core club and the new satellites are able to organize their own activities facilitated by local government agencies, the scientists could retreat from direct involvement in organizing the SFSs, to take the position as the providers of "seasonal climate scenarios" and new knowledge related to agrometeorology as necessary. The present experience in approaching and inviting the regency government officials to be involved in providing their assistance in the form of annual programs and funding has not been fully successful yet. Besides the existing Green Revolution paradigm with the high-productivity of food crops as the main target, the culture of providing services to farmers through the current extension approach is not conducive yet to assist the institutionalization of the SFSs. This is the most constraining and most challenging element of scaling up the SFSs.

6. Final remarks and recommendations

There is evidence that the government or non-profit organizations have introduced various short-life programs in the area where the SFSs was tested. These are different from SFSs, where long-lasting educational commitment was the focus, as well as training farmers and transferring technology. A comparison of these experiences highlights some major points to consider:

- acknowledging to farmers the role of researchers and learners has been shown to be complemented through the development of a trans-disciplinary collaborative research program;
- providing ownership to the farmers for their own discoveries and data collection by enabling them as "rainfall observers" has been shown to empower them in the process of understanding climate related issues and elaborating adaptation and mitigation strategies accordingly;
- the adoption by scientists of the role of facilitators for dialogue and discussion, as well as of knowledge providers, has been shown to motivate farmers' eagerness to voice and share their own experience, findings and questions;
- promoting the exchange of experiences and strategies in regular meetings has been shown to stimulate the motivation to participate to the life-long learning process;
- providing the access to knowledge from dialogue and discussion with experts and/or other resources has been shown to turn into valuable opportunity for improving practices that could be tested and adopted by farmers;

• improving farmers' anticipation and adaptation capability based on their own unique agrometeorological learning and observations has been shown to increase their "bargaining" position in any negotiation with a wide range of stakeholders, including state agencies, in order to win the opportunities of obtaining funded projects and financial support for their own needs and interests.

Not least, from the farmer's side, participating in the SFSs and becoming "knowledgeable farmers" has been shown to improve their pride and status in their own community through becoming "climate literate" farmers and "rainfall observers".

From the scientists' perspective, such a collaborative research activity provided a very good opportunity to learn in order to better design services to facilitate farmers developing sustainable best practices, amend their misinterpretation and misunderstanding, advance their writing skills and improve their analytical capability. The ongoing reflection and inter-subjectivity between agrometeorologists, anthropologists and farmers in a long-term continual interaction promoted the process of learning from responses, reactions and feedback issues.

SFSs are in line with Climate-Smart Agriculture (CSA) objectives as it enables farmers to identify agricultural strategies that consider climate variability when making their farming decisions. As they measure daily rainfall in their own fields, they can use this together with the current seasonal outlook to increase the sustainability of their agricultural practices. During SFSs the farmers have learnt much about climate change and so they are able to apply that information to adapt and build resilience to climate change which is an objective of CSA. Several practical interventions were shared about greenhouse gas emissions from paddy rice fields during the training of trainers and the preparation of farmer-field-experiments; this addresses the other leg of CSA regarding the reduction and/or removal of such emissions.

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INSTITUTIONALIZING SCIENCE FIELD SHOPS: DEVELOPING RESPONSE FARMING TO CLIMATE CHANGE

The case studies are aimed to give insights on specific experiences to be possibly reproduced and scaled up to foster the adoption of climate-smart agricultural practices.
Please visit GACSA website for more information: www.fao.org/gacsa/en/

Authors
Yunita T. Winarto, Professor in Anthropology, Universitas Indonesia
Sue Walker, Professor in Agrometeorology, University of the Free State, South Africa
Rhino Ariefiansyah, Senior Researcher, Universitas Indonesia
Adlinanur F. Prihandiani, Researcher, Universitas Indonesia
Mohamad Taqiuddin, Director of Consortium for Study and Development of Participation
Zefanya C. Nugroho, Researcher, Universitas Indonesia

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Bianca Dendena, Consultant for FAO

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Cover Photo: Farmers' discussion during a "*berugaq*" meeting, East Lombok Regency.

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