

# The Role of an Interdisciplinary Approach to Improving Farmers' Resilience to Climate Change: Its Potentials and Challenges

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**Abstract.** Farmers are now experiencing hardships resulting from the increasing variability of climate, global warming, and the more frequent (and severe) extreme events. Those consequences of climate change on agriculture produced increasing vulnerabilities of food crops ecosystems and threats to farmers' resilience in the changing environment. Without any timely and appropriate services from the government, the farmers would be "trapped in their cages" by not knowing the phenomena beyond their ability to observe. Since farmers are the decision makers of their own fields, providing new scientific knowledge in agrometeorology is urgent. The absence of effective extension services, however, challenged the scientists in their efforts to assist farmers. Based on the experience of institutionalizing an educational commitment to groups of farmers in Indonesia, an inter-disciplinary approach between the natural scientist (agrometeorology) and social-cultural scientist (anthropology) has proved to be an effective means in providing climate services to farmers. The paper examines the ways the inter-disciplinary approach has been developed in the past decade in two regencies in Indonesia (Indramayu Regency and East Lombok Regency). An ongoing reflexivity and inter- subjectivity between the scientists from different disciplines and between scientists and farmers has been a significant means in making the collaboration works effectively.

## 1. Facing Climate Change, Failing to Understand

"Why has the rain stopped all of a sudden? Why does the dry spell last a very long time (up to 30 days)?" asked farmers curiously after experiencing a long dry spell after very intensive rainfall in early October 2007. These are only two questions among many others that have been raised by farmers over the past decade. Since farmers thought that the rainy season had already started, they began to start planting. During the long drought in the dry rain-fed fields, maize and rice were damaged (see Winarto and Stigter, 2011; Anantasari, Winarto, and Stigter, 2011). Unfortunately, such a risk was also experienced by many farmers in various other places in Java under the same unusual consequences of climate change. The phenomenon of a "false start of rain" grew, yet farmers were not well-equipped with the appropriate anticipation capabilities to avoid repeatedly creating wet nursery beds.

Our observation was validated by some rainfall observers in the regency of Indramayu in West Java who explained that the risks farmers experience were due to their ignorance of future climate conditions. This ignorance has persisted given the absence of an early warning system and climate services provided to the farmers by those in authority. Farmers are left on their own to struggle against various kinds of "puzzling phenomena" emerging in their habitat.

Farmers are meticulous observers of their own environment. Their rich empirical observations are a good means to improve their knowledge. For them, "seeing is believing" and "seeing is also knowing". Without seeing, they do not gain any belief, and without any belief, they would not consider what they see



as relevant to their farming. Thus, their knowing is significantly based on their empirical senses, and not on any other tools to help them know things beyond their ability to observe, see, taste and experience. Another factor enriching their knowledge is the extent to which the things they observe have cultural meaning (see Bentley, 1989, 1992; Winarto, 2004).

Brown planthopper (BPH), a very devastating pest for rice nowadays, was previously a non-pest for farmers when they were planting their own traditional rice. BPH became a pest after the introduction of the Green Revolution technological package, which involved the planting of high yield rice varieties. These varieties were susceptible to pests/diseases and thus chemical pesticides were introduced to farmers as a way to control these pests/diseases (Fox, 1991). Whilst spraying chemical pesticides has gradually become part of their farming culture, knowledge of the existence of “small insect-natural enemies” and their role in preying on insect-pests have been kept outside their empirical reach. Only after the introduction of the Integrated Pest Management Farmer Field Schools (IPM FFSs) in early 1990 has the function and role of insect-natural enemies gradually become part of the IPM-farmers’ schema of controlling pests/diseases. Thus, natural enemies had a new cultural meaning for the IPM farmers (see Pontius, Dilts and Bartlett, 2002; Winarto, 2004). This is an example of how observable phenomena, which are also culturally important, can become part of farmers’ schema (Bentley 1989, 1992; Winarto, 2004). Within this way of knowing and learning, farmers cannot foresee what is really going to happen in the future. As this is the case, how do they make decisions on what should be taken into account to sustain their farming in the context of ongoing climate change?

Farmers’ empirical knowledge, their experience as a result of the accumulated precedents in their life, and the inherited local cosmology from previous generations have become their points of reference in decision making. A combination of elements - stored in their schema – that is recalled by farmers at a particular time depends on their past experiences. These experiences result in lessons learned regarding the best or otherwise failed strategies for a rainy, dry, or second dry-season planting. However, if the forthcoming season produces different conditions than the past, their conventional adaptation strategies could yield a maladaptive result for both the environment and their own welfare (see Bartlett, 1980). Without any provision of knowledge (from scientists, governments, or other parties) about foreseeable climate conditions, farmers remain trapped in the “cages” of their past and present (see Winarto, Stigter, and Ariefiansyah, 2015, 2017; Winarto, Walker, and Ariefiansyah, 2017). While farmers experience increasing unusual risks and/or opportunities as a result of weather conditions, they do not understand the relationship between these conditions and climate change. They have only heard about “climate change” and “global warming” through the media, and they do not know of the significant consequences of climate change for agriculture derived from the increasing variability of the climate, global warming, and the more frequent (and more severe) extreme events (see Stigter and Winarto, 2015).

In the case of a “false start of a rainy season”, once farmers know the probability of this situation, and understand “dry spells” and the increasing number of dry days in the rainy season, they can decide to wait until the true rainy season starts. “Without understanding these factors, farmers would hastily start to plant. As explained by a rainfall observer who joined the Science Field Shops (SFSs) in 2009, “once the dry-spell comes, the nursery would dry up, and the seeds would fail to grow. Therefore, in these instances, farmers have to redo the nursery beds several times which is very costly.”

SFSs are arenas where farmers, scientists, other experts and extension workers meet to discuss and share any vulnerabilities found by farmers and how to solve them. In the SFSs, farmers also learn new knowledge on agrometeorology to enrich their schema of farming in the context of climate change (see Stigter and Winarto, 2012, 2013, 2015; Winarto and Stigter, 2013, 2016, 2017). In Bahasa Indonesia, we call the SFSs Warung Ilmiah Lapangan.

## 2. Transferring Scientific Knowledge to the Local Domain of Knowing

Farmers were indeed grateful to have some help in order to improve their anticipation capabilities (see Winarto, Stigter and Ariefiansyah, 2015, 2017). Once they received a “climate seasonal scenario” from the agrometeorologist (the late Stigter and later, Walker), which was then translated into Indonesian by an anthropologist and sent to farmers via mobile phone, the farmers could imagine that the forthcoming season would have near normal, or either above or below normal rainfall. Sometimes, they also received the warning of a weak or strong El-Niño or a weak or strong La-Niña. Gradually, they gained the skills to interpret these “alien” terms and relate them to their existing knowledge of planting seasons. They confessed that without practicing agrometeorology in their own fields and having regular monthly discussions, they would not have been able to understand these alien terms.

Seasonal climate scenarios are only one among seven climate services provided by scientists for farmers in the SFSs. The following are the seven climate services:

1. Guidance for daily rainfall measurements by all rainfall observers in their own plots;
2. Guidance about daily agroecological observations;
3. Measurement of yields and the understanding of differences between fields, seasons and years;
4. The organization of the SFS;
5. The development and exchange of monthly updated seasonal climate predictions in the form of seasonal rainfall scenarios;
6. The exchange of new knowledge related to the above, and
7. Guidance on the establishment of field experiments to develop best practices and obtain on-farm answers to urgent local questions.

See Stigter (2016); Winarto and Stigter (2016, 2017); Walker (2017).

Measuring daily rainfall in their own fields by using farmer-made rain gauges was one of the prominent services introduced by the scientists. Observing their fields’ agroecosystems in detail, supplemented with written documentation, was another service provided in the SFSs. In combination with measuring daily rainfall, the agroecosystem documentation and analysis become a strong foundation for advancing farmers’ understanding of the impacts of a particular rainfall pattern on the growth of crops and the condition of fields. Gradually, they became able to relate the rainfall data and the qualitative nature of rain with their own lexicons and taxonomy (see Winarto *et al.*, 2011, 2013). By experiencing this exercise daily for several years in a row, they have developed their senses and ability to classify “near normal, above normal, or below normal” rainfall and their impact on plants and fields.

Together with the new forms of knowledge the farmers received through dialogues and discussions in the SFS monthly meetings, the farmers have gradually been able to enrich their schema of farming by incorporating previously “unseen and unforeseen” phenomena. For them, such a wider horizon in interpreting their “world of farming” has been significant indeed to improve their anticipation capability towards the ongoing and the forthcoming planting season. Some farmers expressed their gratitude of knowing the probable “wet-dry season planting following the first dry season in 2016”, as they could avoid planting “watermelons” in fallow periods. Whilst some farmers experienced harvest failure and spent their capital without earning anything, some rainfall observers did not lose their capital as they did not plant this commodity. Knowing the forthcoming “wet dry season”, a group of rainfall observers in a village in East Lombok, who used to plant tobacco in the dry season, decided to diversify their cropping strategies. Those who did not decide to plant tobacco and made deeper drainage, preferred to plant rice and tobacco to spread risks, or cultivated rice or maize instead of tobacco. These farmers could save their

harvests in the midst of the hardships faced by those who kept planting tobacco as usual. In the previous long drought of 2015 under a strong El-Niño, some rainfall observers - followed by their neighbouring fields - gained benefits by planting mung-beans which could withstand drought (see Winarto, Stigter, Ariefiansyah, 2015, 2017; Winarto *et al.*, in preparation).

These stories are exemplars of the improvement in farmers' anticipation capabilities once they are able to "foresee" the forthcoming unusual risks of El-Niño, La-Niña, or normal seasons with increasing variability of rainfall. The provision of new agrometeorological knowledge as an important component of climate services has proved to be beneficial for farmers who have to rely only on their empirical knowledge and precedents from past and present experiences. Face-to-face dialogue with scientists and an enduring commitment between farmers and scientists in advancing farmers' learning capabilities are evidence of the effective means of improving farmers' resilience to climate change. How can this be further developed?

### **3. Developing an Inter-Disciplinary Approach: Practicing Anthropology in Applying Agrometeorology**

"Where are the IPM facilitators? Why don't they return to us? We have so many questions to ask in this ongoing pest infestation," complained some IPM farmers at the time when I was the only one left in the field following their practices in the post-period of IPM FFS training in the early 1990s. Interestingly, yet not surprisingly, I experienced the same situation in 2007 in the post-period of the Climate Field School (CFS) in another place (in Gunungkidul Regency in Yogyakarta). Farmers were "puzzled" after following the introduction of the "water harvesting method" which involved making dikes inside their small fields to retain water in the soil in their karst-dry rain-fed ecosystem. That was the introduced technology in the CFS at the end of their training. Without any warning of the incoming La-Niña in the following rainy season, farmers kept their additional dikes in the field. Accordingly, their young plants were damaged in flooded fields due to the excessive rains and the existing dikes. None of the CFS facilitators returned to the farmers and no climate services were provided in the post-period of the training. Instead, the facilitator asked us, the anthropologists, to assist farmers during our stay in the field. As anthropologists, we did stay to continue our ethnographic fieldwork. But, why, the CFS facilitator asked us as anthropologists to assist as we did not have any expertise in meteorological climatology, or agrometeorology, stay (see Winarto and Stigter, 2011, 2017)?

The reality was that any new knowledge and technology provided by the state was packaged as a "one-season-long training program" by adopting the method of Farmer Field Schools, which were developed in the early 1990s to introduce IPM principles and strategies. Yet no follow-up activities were institutionalized with the farmers to help them internalize this new knowledge and introduced technology. Even though a number of multi-disciplinary scientists had been working together to prepare the IPM FFSs curriculum and learning methods (see Pontius, Dilts and Bartlett, 2002), the implementation of the "schools" were entirely in the hands of agricultural officials. If there were some anthropologists observing the program and the post-period of the training, they were positioned more as "observers". Based on such an experience and the intention to help farmers in their adaptation to the consequences of climate change, the SFSs were not designed as "short-period training programs" with a pre-fixed curriculum prepared in advance.

From the beginning, an inter-disciplinary approach was initiated by accident with the presence of anthropologists in the field. A Dutch agrometeorologist - who passed away in May 2016 during his visit to farmers in Indramayu - was willingly assisting the farmers to learn agrometeorology. He designed the method of measuring rainfall and observing the agroecosystem in detail. Instead of doing this in an "observation or demonstration plot", as practiced in the IPM FFS and CFS, he asked each farmer to collect the rainfall and agroecosystem data in their own field. During his visits, he answered farmers' questions

on various agronomic problems and not the problems of climate change per se. Yet enabling the farmers to carry out the nitty-gritty of agrometeorological observation and documentation was beyond his capacity. As anthropologists left in the field, we developed our own innovative ideas to facilitate the farmers *in situ* by referring to the rules set up by the agrometeorologist. By following a group of farmers and observing how they interpreted the new ideas, how they dealt with the problems they faced in mounting the rain gauges, the difficulties they had in documenting the data, and their way of evaluating the data and discussing the problems, we learned - together with the farmers - how to improve their learning day by day (see Prahara, Winarto, and Kristiyanto, 2011; Winarto and Stigter, 2011). Once we discovered the core problems related to the agrometeorological methods or content, we consulted the agrometeorologist via email. As a professor at several universities in Africa, he could not stay in the field for long periods of time.

Over time, the collaboration grew. From season to season, we both discovered the complexity of farmers' vulnerabilities, the constraints in implementing and continuing the learning, the kinds of help the farmers needed to improve their understanding, as well as the finances we needed to keep the educational commitment going, and the challenges from other parties, including state authorities. Gradually, the agrometeorologist developed an understanding of the problems which led to the "garbage in, garbage out" style of data collection. "Why were the farmers sloppy in documenting the data?" questioned the agrometeorologist when he saw the incomplete data the farmers had collected. The anthropologists knew how difficult it was for the farmers to develop a new kind of *habitus*, writing the complexity of their fields' ecosystem into numbers and words. Only through time and persistent efforts by both parties did the tradition of carrying out more detailed observations, more precise documentation, and better ways of interpreting and analyzing their own data become incrementally established (see Winarto and Stigter, 2013, 2016). The establishment of new learning institutions could only be accomplished through intimate interactions between the farmers and the anthropologists (Winarto and Stigter, 2013, 2016; Taqiuddin, 2016), and the building of "trust" between them (see Prihandiani, 2016). Such is the strength of anthropological methodology which involves immersing oneself into the community they are studying.

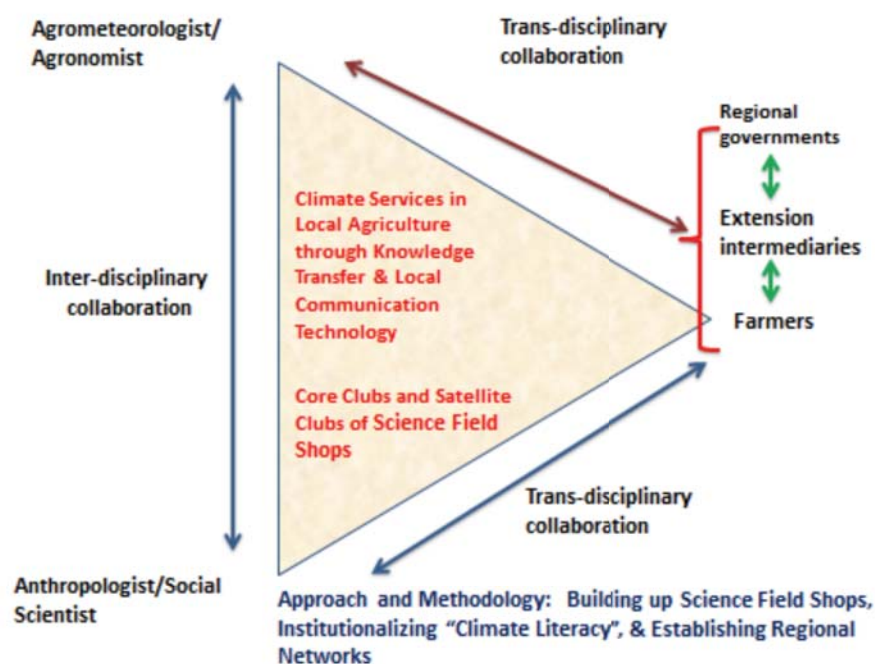
The anthropologists pursued their traditions of learning from the local communities by listening to their voices, following their activities, and observing their circumstances to understand better why some ideas were internalized by farmers and some were not. Ongoing reflexivity was the main method of improving the ways of establishing the farmers' learning. Such an accomplishment would not have been successful without the persistent curiosity and interests of the agrometeorologist to make the agrometeorological science simpler so that it could be applied by farmers *in situ*. The main aim of applying agrometeorology was to help as many farmers as possible. Providing climate services to farmers in as simple way as possible was his great motivation. The seven climate services developed were also the product of gradual thinking by the agrometeorologist, who incorporated lessons learnt from the reality on the ground. On many occasions, as exemplified in his publications, he told me and my colleagues that he would not have been able to do this work alone without our help. "I used to talk to my students and agricultural extension staff in the roving seminars I developed. But reaching farmers in their own fields would not have been possible without your help. Only in Indonesia am I able to do this," claimed Stigter. For us, it was also the first time we had developed an inter-disciplinary project.

Similar to the agrometeorologist's claims, the anthropologists would have never been able to assist farmers to improve their resilience to the consequences of climate change without collaboration with the agrometeorologist. Facing the increasing uncertainty and complexity of today's world, there was no other effective way to help local people but to draw on the willingness of each mono-disciplinary scientist to cross the borders of their own discipline. Figure 1 presents a visualization of our collaboration, which incorporated both interdisciplinary and trans-disciplinary approaches (Winarto *et al.*, in preparation; also see Stigter and Winarto, 2016).



#### 4. Developing Why it is Not Easy to Develop an Interdisciplinary Approach: A Reflection

In the past decade, I have been trying to approach scientists of two different disciplines: agricultural scientists and anthropologists from several other universities throughout Indonesia. I introduced the SFS and its benefits for farmers who are facing increasing uncertainty due to climate change. Unfortunately, these efforts have not produced any significant results. Why? Firstly, crossing the border of each disciplinary boundary and even the faculty's boundary to establish an interdisciplinary network has not been a tradition in Indonesian universities. Reflecting on my own work in the past decade, I can honestly say that I have been able to develop such collaborations with scientists from abroad, since there is no Faculty of Agriculture at my university (Universitas Indonesia). However, my efforts to establish a similar network with agrometeorologists from another university, Bogor Agricultural Institute, failed to produce an agreement on working collaboratively. It is likely that it would be possible to introduce applied agrometeorology in an arena such as SFSs, yet anthropological methods of working with the local community have not been a "tradition" of Indonesian natural scientists.



**Figure 1.** The 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

Secondly, attempts to collaborate with three other universities which have both agricultural scientists and anthropologists also failed. Not all anthropologists in Indonesian universities have an interest in developing their field of studies and expertise in the area of environmental anthropology, and in particular in the area of climate change. Therefore, without any interest in the same issues, it was difficult to initiate any collaboration with scientists from other faculties. If there was some interest from the faculty of

agriculture, who are the lecturers specialized in agrometeorology or other related disciplines who could take the lead as the initiators?

Thirdly, the technology-driven approach has been the basis of various kinds of state development projects, including community engagement programs at universities. It is much easier to propose a project with a “short-period of training to introduce new technology or practices” rather than a project that has an educational commitment for a long-term period involving longitudinal fieldwork. Related to this is the constraint of securing financial support for long-term projects, or projects that need a thorough design incorporating entry and exit strategies.

The nature of the educational commitment itself, which necessitates ongoing inter-subjectivity and reflexivity between all parties involved, is indeed very demanding and challenging. However, as scientists we have to seriously develop our commitment to helping millions of farmers in Indonesia and throughout world in their effort to survive amidst increasing uncertainties as a result of climate change.

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