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Agrometeorology and sustainable development: agrometeorological services to prepare farmers for climate extremes and climate use[1]

Agrometeorologia e desenvolvimento sustentável: serviços agrometeorológicos de preparação dos agricultores para extremos climáticos e uso do clima

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- SPECIAL PAPER/ ARTIGO ESPECIAL -

Abstract: From an introduction it is concluded that (i) analyses of existing priority problems must be made for current farming systems, with the farmers concerned themselves advising on their needs, (ii) provincial/regional agrometeorologists are as important as the means they have to actually serve the farmers with planning and information and (iii) all local research undertakings must intentionally be related to these means, needs and problems. The recommendations based on this same introduction are that (a) dialogues with farmers, of each farming system distinguished in the region, are the very beginning of preparing for agrometeorological services, (b) for various farmer groups involved, income levels must be considered as well as occupation, where applicable and (c) an inventory of best practices for natural risk reduction, that have actually made a difference in the livelihood of farmers, should be established. In the remainder of this paper four questions are answered: (i) what is sustainable development? (2) what is the role of agricultural meteorology? (3) what about the explicit role of research? (4) can development be sustainable when the climate is not sustainable? From the answers three overall conclusions are drawn: (I) means of communication & education are part of sustainable development; (II) to a large extent only richer farmers are able to make use of whatever support systems are organized while the majority of marginal farmers are left in misery; (III) developing a response farming approach with forecasting capabilities that change and improve in the course of time, is a condition for sustainable development. Also three overall recommendations are made: (α) use the expression "agrometeorological services to prepare farmers for climate extremes and climate use" because it is closest to reality; (β) new or adapted preparedness strategies have to be developed as responses to increasing climate variability, but once response farming is aimed at, this remains the same approach but to more varying conditions; (γ) society as a whole must want to focus on rural as well as industrial development.

Keywords: agrometeorological services, farmers' needs, farmer differentiation, farmer participation, response farming, sustainable development

Resumo: A partir de uma introdução, conclui-se que (i) deve ser feita uma análise de problemas prioritários existentes nos sistemas agrícolas atuais, com os agricultores se preocupando em conhecer suas próprias necessidades.(ii) agrometeorologistas regionais são tão importantes quanto os meios que eles têm para realmente servirem os agricultores com planejamento e informação, (iii) todas as pesquisas locais desenvolvidas devem estar intencionalmente relacionados a esses meios, necessidades e problemas. As recomendações baseadas nessa mesma introdução são que (a) diálogos com os agricultores, dos diferentes sistemas agrícolas da região, representam o início da preparação para os serviços agrometeorológicos, (b) para os vários grupos de agricultores envolvidos, os níveis de renda bem como sua ocupação, onde aplicáveis, devem ser considerados e (c) um inventário das melhores práticas de redução dos riscos naturais que tem realmente feito diferença para o sustento dos agricultores, deve ser estabelecido. No restante deste artigo, são respondidas quatro questões: (1) o que é desenvolvimento sustentável? (2) qual é o papel da meteorologia agrícola? (3) qual é o papel específico da pesquisa? (4) pode o desenvolvimento ser sustentável quando o clima não é sustentável? Dessas respostas, três conclusões gerais são tiradas: (I) os meios de comunicação e educação são parte do desenvolvimento sustentável, (II) em grande extensão, somente os agricultores mais ricos estão aptos a fazer uso de todos os sistemas de suporte que estão organizados, enquanto a maioria dos agricultores marginalizados são deixados na miséria, (III) o desenvolvimento de uma forma de agricultura de resposta, com capacidades para mudar e melhorar com o passar do tempo, é uma condição para o desenvolvimento sustentável. Além disso, são feitas, três recomendações gerais: (α) usar a expressão "serviços agrometeorológicos para preparar os agricultores para extremos climático e uso do clima" por que é mais próxima da realidade; (β) estratégias novas ou adaptadas de preparação tem de ser desenvolvidas como respostas ao aumento da variabilidade climática, mas desde que agricultura de resposta é desejada para tal, isso mantém a mesma abordagem, mas para condições mais variáveis; (γ) a Sociedade como um todo deve focar tanto o desenvolvimento rural quanto o industrial.

Palavras-chave: serviços agrometeorológicos, necessidades dos agricultores, diferenciação do agricultor, participação do agricultor, agricultura responsiva, desenvolvimento sustentável

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Introduction with examples, conclusions and recommendations

The approach of this paper results from some personal experiences in Asia and Africa.

The first example is from Indonesia. Living there part of the year, the author was approached some years ago on behalf of provincial agrometeorologists there with questions on local problems with underutilization of already established automatic weather stations. I replied that I saw such problems not as isolated events but as symptoms of a wider overall disease, caused by a lack of active analysis of existing local problems in agricultural production with an agrometeorological component.

"No policies, no cure" is what applies to such questions. Because of this standpoint I was not invited to come over and discuss these maters. The conclusion had to be that in Indonesia analyses of existing priority problems must be made for the current farming systems, with the farmers concerned themselves advising on their needs. Only in such an approach will it be clear where which data are needed for what purposes. Of course the decisions to buy and install automatic weather stations had been wrongly made here. But even when installed for the right purpose, many problems remain (Stigter, 2007a). Nevertheless Indonesia is on the right track in other programmes (Stigter, 2007a).

A second example is from Vietnam. In a Workshop in Hanoi for provincial agrometeorologists, where I lectured (Stigter, 2001), it appeared that they had in fact very little to offer to farmers. Because of this, they kept quiet in their local offices and had few contacts with extension people or users. Here the conclusion had to be that provincial/regional agrometeorologists are as important as the means they have to actually serve the farmers with planning and information. They work hard in Vietnam to improve on the situation (Stigter et al., 2007a; 2007b).

ODA studies in Africa have indicated that climate information available to farmers, if any, is most often not what they wanted or needed most (e.g. Blench and Marriage, 1998; Blench, 1999;). Recent WMO/CAgM reports from Africa show that interaction with farmers often leaves much to be desired (examples in WMO, 2000; 2004a; 2004b) unless very well organized as to two way communication between specially trained multi-disciplinary teams of agrometeorologists and intermediaries close to the farmers (examples in WMO/CTA, 1992; WMO, 2001). Such conclusions remain also more generally valid (e.g. Stigter, 2004; Stigter et al., 2005).

The next example is about well established long term programs on "research farms" in India that remained after all fully scientist oriented and that did not become farmer or user oriented. This resulted in only very small grain yield (maize, sorghum, millet) increases with seasonal rainfall in farmers' fields that did not match very good increases on the research farms (Gadgil et al., 2000). This lack of a participatory on-farm approach caused a failure very often observed in all kinds of agricultural research due to insufficient assessment of the actual information and services needs of producers in their specific production situations (e.g. KNMI, 2006; Murthy and Stigter, 2006).

Work in China (Stigter et al., 2007) shows that information services for rural people as well as their supporting technologies (means of communication) should always be differentiated. Poverty alleviation will be served! While farmers in China are mainly concerned with (a) information on practical technology with low investment and instant profits and (b) information on market demands for agricultural products, rural people are heterogeneous in their education, income, occupation and information demands. But this diversity has not been genuinely identified, and their detailed priority information demands have not been properly revealed. Therefore, although information service systems have been shaped and established, the scientific and technological requirements of investigated farmer households have not been met yet (Stigter et al., 2007).

A final example is on project funding. Take the Asian Pacific Network (APN) projects in so called "global change research". In practice it is again about forecasting and modelling and not about services to farmers that have to be the ultimate goals of all these projects. Review boards do understand very little about the actual research needs to improve the livelihood of farmers and are not actually interested in such approaches. There is very insufficient understanding by donors, but also by reviewers, of what scientists should contribute to development (STIGTER, 2009). Also here absence of a participatory "bottom up" approach and of a sufficiently deep involvement, of project participants, supervisors and reviewers, with the actual livelihoods of those whose problems should be tackled. This criticism will be generalized below. Research interests should not be the driving force. Response to farmers' needs and conditions ought to be the starting point (STIGTER, 2009).

The conclusions of this introduction must be that (i) analyses of existing priority problems must be made for current farming systems, with the farmers concerned themselves advising on their needs, (ii) provincial/regional agrometeorologists are as important as the means they have to actually serve the farmers with planning and information and (iii) all local research undertakings must intentionally be related to these means, needs and problems.

The recommendations based on this introduction are that (a) dialogues with farmers, of each farming system distinguished in the region, are the very beginning of preparing for agrometeorological services, (b) for various groups of farmers involved, income levels must be considered as well as occupation, where applicable and (c) an inventory of best practices for natural risk reduction, that have actually made a difference in the livelihood of farmers, should be established.

Questions and Answers

Questions

In the remainder of this paper we are going to ask ourselves four questions:

- what is sustainable development?
- what is the role of agricultural meteorology?
- what about the explicit role of research?
- can development be sustainable when the climate is not sustainable?

Sustainable development

The idea of the inventory of best practices could be found in WMO's Annual Report 2004: "Sustainable development in the information age" (WMO, 2005). "Information age" sounds good, but "what information for whom"? CNN gives information, newspapers give information, but we need information useful for farmers etc. We must produce information that different categories of users need!

However, availability of information also demands transfer and absorption. Transfer demands suitable means, adapted to the users' possibilities. Absorption demands client friendliness of the products and education. Sustainable development means socio-economic progress of large parts of a population, including the poorer layers, without wrecking the future. This asks for general education as well as for special extension education. Means of communication & education are therefore part of sustainable development.

The role of agricultural meteorology

WMO (2005) is symptomatic in reporting that interrelationships of weather, climate, agriculture and farmers did not yet belong to the primary areas of activity although information applications did. How can it be that in dealing with information aspects of the interaction of weather, climate and agriculture, the farmers are insufficiently considered? Because it is true (KNMI, 2006), this has to be explained at length.

At least this WMO (2005) said: "there is a need to improve agrometeorological services, both to enhance production and to conserve the environment". Here we have made school (Stigter, 2006a; WMO, 2006). INSAM attempts to collect best examples of such agrometeorological services slowly become successful (INSAM, 2006-2008). We earlier defined belonging to *agrometeorological services*: all agrometeorological & agro-climatological knowledge and information that can be directly applied to try to improve and/or protect the livelihood of farmers with respect to yield quantity & quality and income, while safeguarding the agricultural resource base from degradation (e.g. STIGTER, 2004; 2006a).

I have developed and used during many lectures since 1999 an "end to end" system for the build up and transfer of agrometeorological/climatological information (Fig. 1). I use this diagnostic and conceptual framework also to explain the lack of operational agrometeorological services and information that make a difference in the livelihood of farmers. It guides the understanding of difficulties experienced (STIGTER, 2004; 2005; 2006a; 2007b).

Problem solving in the livelihood of farmers needs another increase in the operational use of knowledge by applying the B-domain mixture into actual agrometeorological services, supporting the decisions and actions of producers, whatever climate conditions they face. Preferably we use the expression: "agrometeorological services to prepare farmers for climate extremes and climate use". This is closer to reality!

Sustainable development in agricultural meteorology would mean the existence of agrometeorological services to establish best practices of risk preparedness reducing losses as routine operational activities. This means in practice dealing with "response farming" in all its forms. So in conclusion, sustainable development starts with:

- adequate understanding of the information needs of intended users as decision makers
- consideration of the conditions of farming systems and farmers for the absorption and use of climate (forecast) information in the long run.

In this context one has to realize that most resilience to disasters was built up from local adaptive strategies to cope with climate variability, based on traditional knowledge and indigenous technology. This also is a cornerstone of the approach we advocate with introducing the B-domain (Figure 1).

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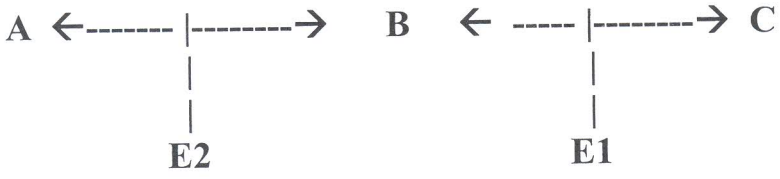
A = Sustainable livelihood systems

B = Local adaptive strategies (knowledge pools based on traditional knowledge and indigenous technologies)
+ Contemporary knowledge pools (based on science and technology)
+ Appropriate policy environments (based on social concerns and environmental considerations, scientifically supported and operating through the market where appropriate)

C = Support systems to agrometeorological services: data + research + education/training/extension + policies



E1 = Agrometeorological Action Support Systems on Mitigating Impacts of Disasters

E2 = Agrometeorological Services Supporting Actions of Producers

Figure 1. Conceptual and diagnostic framework as an "end to end" information flow scheme and to explain why special measures have to be taken to get services through to farmers in developing countries (e.g. Stigter, 2004; 2005; 2006a).

The role of research

Level and scale of basic and applied research and the use that is made of their results, locally or elsewhere, greatly differ between countries. They particularly differ between industrialized and non-industrialized countries. In highly organized countries, direct contacts or various relatively well-organized channels exist, between farmers and those in agriculture related supportive industries, along which information is exchanged or at least can flow (e.g. Stigter, 2006b).

Public institutions, interest groups & private initiatives on commercial basis stimulate this in "stronger" countries. Intentionally enabling public institutions and biased global markets make well-organized producers, that use available or new knowledge, survive in such countries. History shows that farming was able to cope with often painful adaptations to changes, because of these institutions and conditions, but the resource base is endangered in many places (e.g. Stigter, 2006b).

In developing countries (long ago called "soft states") public institutions are seldom sufficiently helpful, rarely sufficiently organized and often not intentionally enabling its own officers or others to meaningfully support agricultural producers in decision making and in improving and protecting yields and their resource base, while markets are not conducive to production improvements. To a large extent only richer farmers are able to make use of whatever support systems are organized while the majority of marginal farmers are left in misery. Moreover, at best only very modest structures are in place that can deliver suitable info, or use existing info, to create appropriate services for farmers (e.g. Stigter, 2006b).

Translated to our fields of work, this especially means that *no "extension agrometeorology" or "extension agroclimatology" were developed* to assist this majority of marginal farmers in the design of their production systems. Further environmental deterioration and alienating poverty are often a consequence of that absence of focused assistance, where traditional knowledge and indigenous technology can no longer cope with the dynamics of environmental and other changes.

So this is the opposite of sustainability! Society as a whole must want to focus on rural as well as industrial development. This means change and support of changes that most people can bear. No policies, no cure, also in research!

Can development be sustainable when the climate is not sustainable?

Climate change and increasing climate variability may seriously complicate sustainable development. New or adapted preparedness strategies have to be developed as responses! But once response farming is aimed at, this remains the same approach but to more varying conditions. Principles, organization, role of research & communication infrastructure, education and extension approaches etc. etc. will not differ, but may be complicated by change.

Now, if climate changes in several points, it changes everywhere!!! In developing a response farming approach with forecasting capabilities that change and improve in the course of time, this can be tried to get solved. *It is a condition for sustainable development.*

Conclusions and recommendations

From the above we derive as overall conclusions:

- Means of communication & education are part of sustainable development.
- To a large extent only richer farmers are able to make use of whatever support systems are organized while the majority of marginal farmers are left in misery.
- Developing a response farming approach with forecasting capabilities that change and improve in the course of time, is a condition for sustainable development.

And we derive as overall recommendations:

- Use the expression "agrometeorological services to prepare farmers for climate extremes and climate use" because it is closest to reality.
- New or adapted preparedness strategies have to be developed as responses to increasing climate variability, but once response farming is aimed at, this remains the same approach but to more varying conditions.
- Society as a whole must want to focus on rural as well as industrial development.

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