Agro-climate tools for a new climate-smart agriculture

The way we produce food must adapt to a variable and changing climate. And key to achieving this is to improve the link between climate information and agricultural practices, especially those of smallholder farmers in developing countries. 'Agro-climate tools' do just that and some are introduced here. This is also a call to government ministers and donors to consider investing in such tools as relatively low-cost means to rapidly and effectively improve food security in an increasingly uncertain world.

Photo: CIAT International Center for Tropical Agriculture

What is climate-smart agriculture?

The world population passed seven billion on the 31st of October 2011, but almost one billion of us may not have enough to eat today. Food insecurity, one of the most pressing problems facing humanity, is now further challenged by climate change and a growing population that is expected to pass 9 billion by 2050. The World Bank and a growing number of voices are calling for a new 'climate-smart agriculture' as part of the solution. This addresses the triple challenge of sustainably increasing productivity, strengthening resilience to climate change (adaptation), and reducing and removing greenhouse gas emissions.

Climate risk management as a component of climate-smart agriculture

Farmers are 'weather-watchers,' and they use their experience to adapt their agricultural practices accordingly. But changing climates are affecting this age-old way. Extreme weather events such as droughts or floods are becoming more frequent with climate change, and the damage they cause to agriculture, human health, productive assets and infrastructure affect livelihoods long afterwards.

Managing the risks associated with increasingly variable climate is key to successfully adapting agriculture, and to reducing the cycle of poverty, vulnerability and dependence brought about by climate-related disasters. Innovations in climate risk management offer win-win opportunities that contribute immediately to agricultural development and improving food security, while building agricultural resilience to changing climates. These include new varieties and production practices, adaptive management in response to seasonal climate forecasts, weather index insurance, and improved early warning and early response systems.

> ***"Although farmers often know a great deal about the risks they face and how to manage them, the rate of change can outpace traditional knowledge about the climate and how to deal with climate risk."***

What are agro-climate tools and how are they helping?

In the developing world where vulnerability is greatest, promising climate risk management innovations are underutilized because of the lack of *actionable* information that can be interpreted and used. The internet provides free access to masses of information about climate and the environment, and increasingly accurate weather and climate predictions. But ways are needed to better translate raw information into accessible forms that are understandable and relevant to decision-making.

By translating climate information into actionable climate knowledge, innovative 'agro-climate tools' are bridging the gap. They address a range of climate-sensitive decisions spanning a range of scales, and generally share two common features.

- They translate climate and other data into estimates of impacts on various aspects of agricultural systems.
- They allow decision-makers to explore the risks and potential consequences of different decisions before they have to put their own livelihoods, or the livelihoods of others, on the line.

Adapting or creating appropriate agro-climate tools is vital to unlocking the potential of climate-smart agriculture in developing countries.

Examples of agro-climate tools and systems – and their application

Here are a few proven data-intensive software tools that are filling gaps between climate information and practical action.

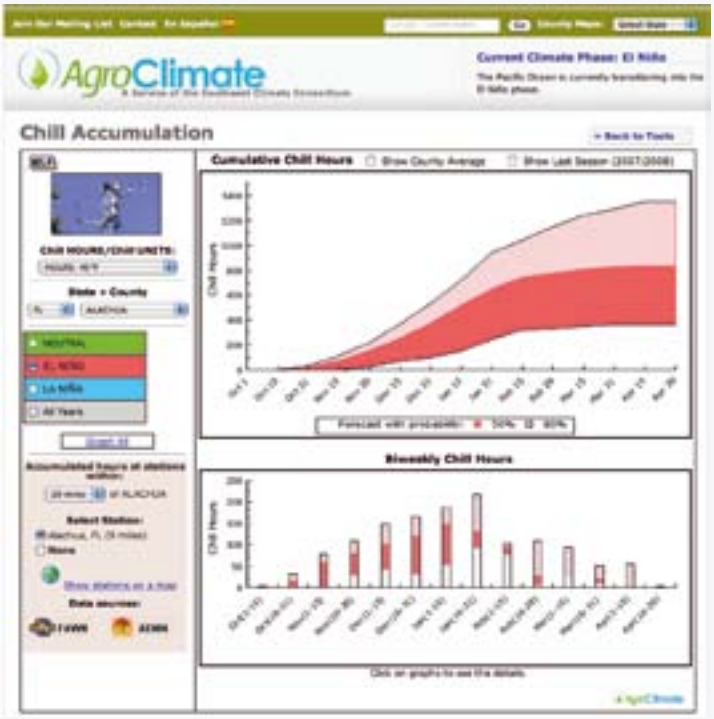
Yield Prophet

Yield Prophet is a web interface built around a cropping systems simulator (www.yieldprophet.com.au) and has supported Australian cereal farmers since 1994 in their struggle to manage risks associated with a variable climate. It provides field-specific soil, crop and management data that can almost double water limited yield potentials. A not-for-profit agricultural research organization led by farmers helps users select appropriate long term daily climate data and soil types, adding daily weather records and seasonal climate forecasts.

It produces the comprehensive 'crop report' based on simulated growing conditions until harvest using a hundred years of weather data, and is compatible with smart phones and tablet devices. It gives the latest seasonal climate forecasts and estimated impacts on crop yields, including updates on yield potential, growth stage, crop water and nitrogen stress indices, available soil water and nitrogen, and risks of exposure to frost during flowering and to heat stress during grain filling. Other reports detail 'what if' scenarios, such as relative profitability of adding nitrogen fertilizer and supplemental irrigation, monitoring soil water and nitrogen, or options for best sowing times. Similar outcomes could be expected in developing countries by integrating such a decision support system into existing agricultural knowledge networks.

Photo: Tim McClelland

"Agro-climate tools such as these are helping farmers and governments manage climate-related risks in agriculture."



AgroClimate

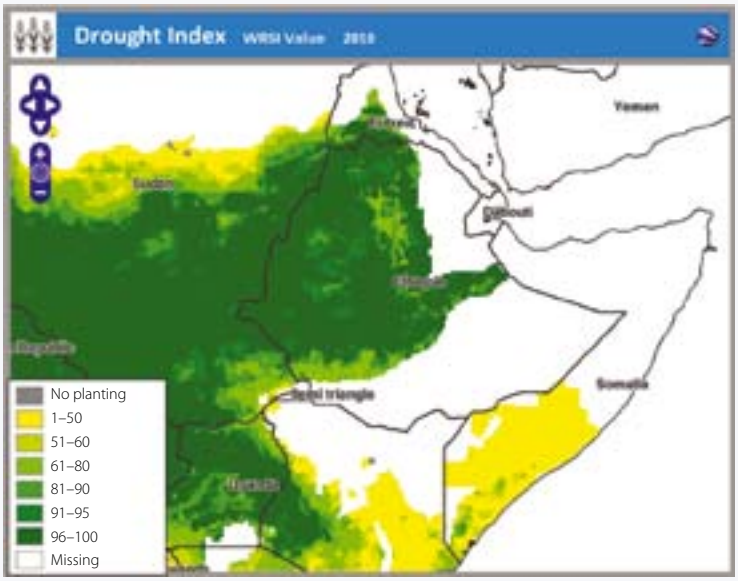
AgroClimate is a web-based climate information and decision support system (www.agroclimate.org). It helps the agricultural community, extension services and natural resource managers in the southeastern USA make more informed decisions to reduce risks associated with climate variability. It was designed and implemented by the Southeast Climate Consortium in partnership with the Florida Cooperative State Extension Service. Seasonal forecasts and monthly climate outlooks include brief discussions of anticipated climate patterns in the region and how they match with current conditions, anticipated impacts of climate patterns on agricultural commodities, El Niño/La Niña events, and discussions on seasonal climate issues such as hurricanes, wildfires, drought and extreme temperatures.

It is aimed at the county or station level, using climate forecasts and outlooks combined with dynamic risk management tools linking climate, crop development, crop diseases, crop yield and drought data, including information on selected agricultural crops, trees, livestock and fodder. An advantage is its 'modularity', and that it is easy to add new topic areas, commodities and risk management tools. Administration is also modular, being decentralized to the different groups involved, and needs no knowledge of web-programming languages.

Africa RiskView

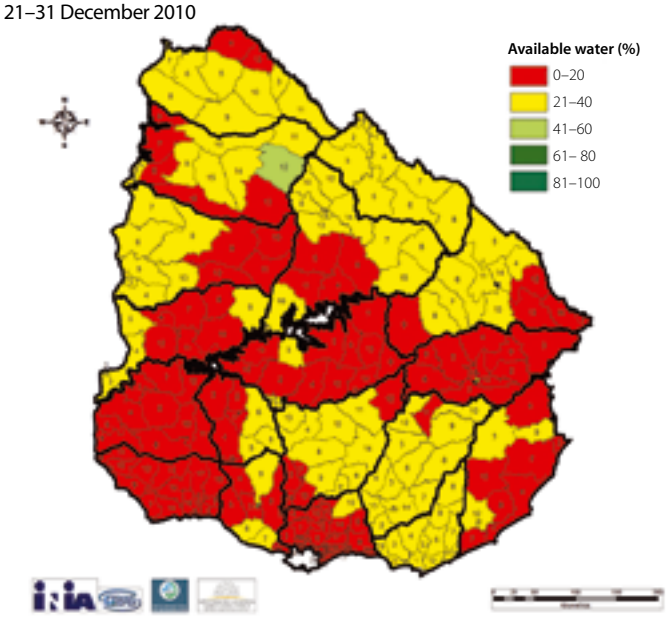
Africa RiskView is available as an online tool and a more flexible desktop application (www.africariskview.org). It was developed by the World Food Programme to translate globally-available rainfall data, crop parameters and livelihood information into food security outlooks. It also calculates response costs to aid financial planning and facilitate better resource allocations before on-the-ground needs assessments are produced. Governments also use Africa RiskView to understand the cost of different risk transfer options. It also serves as a component of a technical support package being provided for a potential pan-African Disaster Risk Pool, allowing participating countries to immediately access funds in the event of an extreme drought, flood or storm.

To estimate the risk of a region becoming food-insecure due to drought, it uses satellite rainfall estimates to calculate a Water Requirement Satisfaction Index, considered a better indicator than cumulative rainfall. Once the magnitude and extent of the impacts of weather shocks on food crops and rangelands are estimated, Africa RiskView accurately estimates the number of people potentially affected, and the range of potential response costs at the continental, regional and country levels, given a specified cost per beneficiary for a given level of food assistance (e.g. food aid, cash vouchers).



"The last decade has seen an unprecedented explosion of accessible information, but a wide gap remains between what is available, and effective action. To fill this gap, climate data and information must be translated into what has been described as 'climate knowledge', expressed in ways that are understandable by those who need it to make decisions."

Estimated available water in Uruguay soils by political division, 21–31 December 2010



Uruguay's National Agricultural Information System

Uruguay's climate information and decision support system (IDSS) is a collection of spatial information and tools developed by the National Institute for Agricultural Research (INIA) in partnership with the International Research Institute for Climate and Society (IRI). It integrates monitoring of weather and vegetation conditions, seasonal climate forecasts, soil water and water stress estimates within an internet-based GIS platform (www.inia.org.uy/gras/), informing climate risk management decisions from farm to national level. In 2010 for example, the Ministry of Agriculture provided low-interest loans and encouraged the planting of drought resistant crops in response to a seasonal forecast of an enhanced probability of below-average rainfall. Three months later, official drought emergencies were declared, and farmers used the system to adjust agronomic practices and when to buy and sell livestock.

The new Minister of Agriculture defined two goals, the sustainable use of natural resources and adaptation of the agricultural sector to climate change, with a World Bank loan of US$49 million to help implement the resulting strategy. Of this, 11% was devoted to establishing a National Agricultural Information System to further support agricultural decision-making and help assess the feasibility of climate-smart investments under the loan. Building on the initial system, it incorporates improved agricultural data, outlooks, forecasts, tools and climate risk assessments, supported by a research team from IRI, INIA, the Ministry of Agriculture and the University of Uruguay. The high level of government support has been attributed to three factors. The first is the great demand and use of the initial system in public and private sector decision-making. The second is the commitment to agricultural policies based on objective, scientifically sound information and tools. Finally, Uruguay has a strong national agricultural research system well connected with public policy, the private sector and the international research community.

Developing tools for a more climate-resilient agriculture

Experience in countries such as Uruguay, Australia and the USA provide useful lessons on how agro-climate tools can contribute effectively to climate-smart agriculture, though each will require significant investment and research partnership.

The Noula Platform – an example of mobile telephones as a promising delivery mechanism

An innovative SMS-based flooding early warning system was developed in Haiti to provide information based on weather forecasts, in the local Creole language as well as in French. In partnership with one of the country's largest service providers, selected mobile telephone towers were targeted with text messages. By calling a short code, the public could also ask for more information, or report other emergencies. The system proved to be quick and effective, and could be adapted for informing farming communities about pending risks and possible management options.

Agro-climate tools are contributing to climate-smart agriculture by closing the divide between information and effective action. By acting as 'discussion support systems', they are fostering new ways of thinking by promoting dialogue between groups that may not have previously interacted. By enabling more effective management of current climate risk, they are helping to bridge the gaps between climate change and development agendas.

"We are drowning in floods of climate information, but starving in a drought of climate knowledge."

- **Tools will only be used where they meet a recognized demand, and are tailored to the needs of target decision-makers.**
- **They will be most successful where they act as 'discussion support systems', promoting dialogue and shared learning.**
- **Their implementation and effective use requires an enabling institutional and policy environment, including strong partnerships between information providers, government decision-makers, researchers and the private sector.**
- **Any constraints in data infrastructure, data management and data policy must be addressed.**
- **There must be a sustainable plan for incorporating user feedback into maintenance and support.**
- **Tools that target farmers and rural communities require effective delivery mechanisms, and could exploit advances in rural information and communications technology (e.g. cellphones).**

For more information, contact Jim Hansen (jhansen@iri.columbia.edu) or Kevin Coffey (kcoffey@iri.columbia.edu).

The brochure is produced by the International Research Institute for Climate and Society (IRI), in partnership with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). IRI (http://www.iri.colombia.edu/) uses a science-based approach to enhance society's capability to understand, anticipate and manage the impacts of climate in order to improve human welfare and the environment, especially in developing countries. IRI is a member of The Earth Institute at Columbia University, New York. CCAFS (www.ccafs.cgiar.org) is a strategic partnership of the CGIAR and the Earth System Science Partnership (ESSP) which brings together the world's best researchers in agricultural science, development research, climate science and Earth System science, to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security. Material was contributed by James Hansen, Senthold Asseng, Pai-Yei Whung, Walter Baethgen and Clyde Fraisse.

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