New study finds that sharing genetic resources key to adaptation to climate change in Africa

June 17 2009

As rapidly rising temperatures in Africa threaten to scorch local varieties of maize and other food staples, the food security of many Africans will depend on farmers in one country gaining access to climatically suitable varieties now being cultivated in other African nations, and beyond, according to a peer-reviewed study published in *Global Environmental Change*.

But the study, conducted by researchers at Stanford University's Program on Food Security and the Environment and the Rome-based Global Crop Diversity Trust, warns that long-standing neglect of African crop collections held in genebanks means that breeders today don't have access to all of the varieties of Africa's primary cereal crops—maize, millet and sorghum—that are likely to be most helpful in allowing farmers to adapt to climate change.

"When we looked where temperatures are headed, we found that for the majority of Africa's farmers, climate change will rapidly move conditions beyond the range of anything they've experienced," said Marshall Burke, Program Manager at the Program on Food Security and the Environment at Stanford University. "A central challenge will be finding crop varieties that can thrive - or at least survive - at these hotter temperatures."

Many African farmers could potentially find crop varieties in other

African countries where current temperatures and conditions are similar to what they will face in the future. But researchers are particularly concerned about six countries—Senegal, Chad, Mali, Burkina Faso, Niger and Sierra Leone—where future conditions will be unlike anything African farmers have ever encountered. And they said immediate action is needed to develop new crop varieties that will allow these countries to adapt.

"This is not a situation like the failure of the banking system where we can move in after the fact and provide something akin to a bailout," said Cary Fowler, head of the Global Crop Diversity Trust. "If we wait until it's too hot to grow maize in Chad and Mali, then it will be too late to avoid a disaster that could easily destabilize an entire region and beyond."

The release of the study comes amid growing concerns that an international climate change agreement to be finalized this December in Copenhagen will focus mainly on carbon emissions and not on helping poor populations adapt to such things as dramatically altered growing conditions.

For example, at an international conference last week in Bonn, the executive secretary of the United Nations Framework Convention on Climate Change noted that while Africans will bear the brunt of the impact, they have "benefited the least from the current climate change regime." He pointed out that funds established to help developing countries adapt to climate change "remain largely empty."

Researchers from Stanford and the Global Crop Diversity Trust said there is a particularly urgent need to address the situation in Africa because the potential changes are so dramatic and are likely to occur even if there are steep reductions in carbon emissions.

At issue is the fact that most crop varieties cultivated on African farms are "landraces"—or traditional varieties—that have been selected by farmers over the centuries due to their unique suitability to local growing conditions. But Burke and his colleagues report that by 2050, due to global warming, temperatures during the growing season in nearly all African countries will be "hotter than any year in historical experience" for that region, leaving that once well-adapted local variety suddenly unable to cope, or at least adapt quickly enough.

Seeking a potential solution to this problem, the researchers documented the "novel" climates expected to emerge in each African country by 2050 and compared them with present conditions across the continent. What they found is that for the majority of countries, while those novel climates will be different than anything they've ever experienced within their borders, in many cases the climates will be similar to what exists today in other nations.

For example, in Lesotho, a country with one of Africa's coolest climates, farmers may find their local varieties of maize suffering in the increasing heat. The answer to their problems might lie in the maize varieties now being cultivated in Mali, one of Africa's hottest countries.

"We know there are local varieties of maize, millet, sorghum and other crops genetically endowed with traits that would be of enormous benefit in helping African farmers in that country and others, adapt to climate change," said Luigi Guarino, Senior Science Coordinator at the Global Crop Diversity Trust. "But the genebank collections from many areas that are likely to have the widest range of diversity are either incomplete or non-existent."

The researcher found that there is a "set of countries whose current climate" is very similar "to many future climates." But they note that the landraces from these countries, which include Sudan, Nigeria, Cameroon

and Mozambique, "are poorly represented in national and international genebanks." For example, there are ten African countries where the current growing conditions for maize are very similar to what many African countries will soon face. But few landraces from these areas are to be found in major genebanks.

"These countries are particularly high priorities for urgent collection and conservation of maize genetic resources," the researchers advise.

Meanwhile, the study identified a "worrying set" of six countries—Senegal, Chad, Mali, Burkina Faso, Niger and Sierra Leone—where future climates may end up warmer than anything currently found on the continent. According to the study, "for these countries, there is a much smaller potential pool of foreign genetic resources in which to seek heat tolerance, at least within Africa." One consequence, the researchers note, is that the countries may no longer be able to grow maize, which is generally more heat sensitive, and have to switch to food crops like sorghum and millet that are often more heat-tolerant.

Nonetheless, the study concludes that for most countries, there are solutions available, if the collective plant genetic resources of Africa can be effectively "managed and shared."

"We have seen in recent years substantial progress in conserving and sharing plant genetic resources, but the problems we are facing with climate change demand a much stronger commitment to international collaboration," said Fowler. "This study makes it clear that crop diversity is a prerequisite for successful adaptation to climate change in Africa."

Citation: New study finds that sharing genetic resources key to adaptation to climate change in