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## U.S., India Working Together to Address India's Water Needs Columbia Water Center partnerships focus on agricultural innovations

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New York — The rice and wheat fields that cover the lands of Punjab have successfully fed the people of India since the nation's Green Revolution of the mid-1960s. But how to feed those crops without completely starving India's water resources is a challenge that partners in India and the United States are working on.

Columbia University's Columbia Water Center (CWC), based in New York, has partnered with Punjab Agricultural University to devise innovative farming solutions that take aim at water overuse and scarcity, an environmental issue with a profound impact on sustainable productivity and a population's well-being.

Some of the new methods are being used in the 2010 planting season, with more than 500 farmers participating in different field experiments.

"We're looking at how agriculture influences groundwater depletion and what types of changes would, at bare minimum, slow down groundwater depletion, hopefully stabilize it, and over time hopefully increase the groundwater table," said Dan Stellar, assistant director at CWC.

Founded in 2008, CWC is a division of Columbia University's Earth Institute, which focuses on sustainable development throughout the world. As part of its work, in March 2010 the center collaborated with NASA, the U.S. Agency for International Development (USAID), the U.S. Department of State and Nike Inc. on the LAUNCH initiative, to identify emerging technologies that can help combat water scarcity worldwide.

Since its inception, CWC has worked to bring such technologies to Punjab. Funding from a three-year, \$6 million grant from the PepsiCo Foundation supports CWC's efforts in Punjab. The same grant also supports CWC projects being developed in the Indian state of Gujarat.

### ALTERNATIVE FARMING APPROACHES IN PUNJAB

Known as India's "breadbasket," Punjab produces nearly half of the total grain purchased by the Indian central government, according to CWC. As a result of the government's reliance on the region's farmers to feed the country, the farmers have a guaranteed market for their crops. CWC and PAU have taken this economic reality into consideration, and are therefore focusing on methods that allow for continued high-volume production of rice and wheat, but with less water consumption.

One such water-saving solution involves experimenting in cutting back on the number of times rice farmers flood their fields each season as a means of irrigation.

"Pumps connected to groundwater send water splurting out into canals that lead into the fields, sometimes 35 to 40 times a season," Stellar said. "Some really simple

things are: Could you irrigate fewer times? Twenty-seven times instead of 32? That right there is a huge savings in water."

Less flooding of the fields would greatly increase the amount of water available to citizens.

"Just saving one or two irrigations is very significant, especially when you convert it into domestic use," Stellar said.

While some farmers will minimize flooding practices, other farmers are trying a method called direct seeding: instead of flooding the field before planting, the farmer plants the rice directly into the soil and waters as needed. Stellar explained that the farmers participating in this experiment will use tensiometers, soil moisture probes, to gauge the precise level of moisture in their soil before they irrigate so that they only water when the soil is truly dry. Presently, farmers work by sight and flood the field whenever it appears dry to the naked eye.

CWC plans to calculate the water savings from fewer irrigations and the use of the tensiometers and assess this data in relation to farmers' productivity. The goal of these methods is to save water without reducing farmers' yields or the quality of their product, Stellar said.

#### DIFFERENT CROPS, LESS WATER

CWC and PAU are working with other farmers to grow entirely different crops that naturally use less water for their production. In partnership with FieldFresh Foods, a joint venture between Indian business conglomerate Bharti Enterprises and American food producer Del Monte Foods, CWC and PAU are helping about 100 farmers shift from rice and wheat to vegetable crops including corn, baby corn and green beans. These are crops that FieldFresh has already begun to promote as other potential cash crops for the region.

While shifting to other crops will save water (CWC hopes to calculate how much this season), the market remains a barrier to the success of the new crops.

"We're working with corporations to try to set up contracts so farmers know they'll be able to sell their crops," Stellar said. "We want to give farmers the same level of guarantee they have from the government [for rice and wheat]. If farmers could make more money and use less water to grow these crops, it's potentially a true win-win."

If successful, CWC and its Indian partners hope to increase the amount of crop varieties in Punjab and help shift rice and wheat to other regions of the country with more substantial groundwater supplies that could benefit economically.

"We don't want the overall production of rice and wheat to suffer," Stellar said.

With the planting experiments in Punjab just underway, CWC aims in six to nine months to have quantifiable data on the efficacy of the water-saving technologies they are trying.

"It will be a really exciting season for us because we hope to get a lot of answers to questions," Stellar said.

#### RELIEVING CRITICAL WATER SHORTAGE IN GUJARAT

South and west of Punjab, in the state of Gujarat, groundwater depletion has reached a dire state, according to CWC.

"There is a very serious risk of salt water entering the groundwater system because they are digging so low to pump water now," Stellar said. "If salt water comes in, they will no longer be able to use that water for irrigation."

CWC has partnered with the Gujarat government and Sardarkrushinagar Dantiwada Agricultural University to devise a three-phase solution, set to begin in September 2010. The process involves an awareness campaign to familiarize farmers with the reality of the groundwater situation, explain the possibility of irreversible damage, and emphasize the risk to their livelihoods if salt water enters the irrigation system.

Next, the U.S. and India partners will review potential water-saving technologies and

use that data to explain the benefits of each technology to the farmers.

Finally, CWC and its partners will work to reform an energy subsidy farmers receive to pump their water. At present, the state pays more than twice the amount in subsidies that a farmer earns for selling a rice crop, Stellar said. CWC wants to design an incentive-based system that would benefit all parties, allowing farmers to save water and energy while earning larger profits and saving the state considerable money.

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