

The **Training Institute on Remote Sensing Application to Hydrology in Semi-Arid regions** will address an important global change science theme. The Training Institute (TI) will complement other activities on hydrology and land use in the semi-arids, such as a policy workshop held in 2006 with the National Center for Atmospheric Research (NCAR) on policy and water management in semi-arid regions of the US, the upcoming IAI-NCAR joint Colloquium "Seasonality and Water Resources in the Western Hemisphere" to be held in Mendoza, Argentina in October, 2008, and a current CRN II project on land use change, climate and hydrology in the La Plata region. The TI will be held in the largest semi-arid region in Latin America - Northeastern Brazil.

This activity is part of the IAI proposal for Training Institutes in interdisciplinary global environmental change sciences in the Americas with policy and societal relevance. Given the multidisciplinary nature of the TI on Remote Sensing Application to Semi-Arid Hydrology the course will be opened to professionals from different fields, such as: agriculture, hydrology, remote sensing, ecology, geography and economics, and will have the active participation of universities, research centers, governmental and non-governmental organizations. The TI will include lectures, discussions, case studies, working groups, a field trip, and hands-on exercises on remote sensing analysis. The TI aims at linking science and policy concerns such as land use planning and water management, and developing mechanisms to make this link more natural and integrated.

Training Institute on Remote Sensing Application to Hydrology in Semi-Arid regions (carried out in cooperation with Brazil's National Institute for Space Research- INPE, the Federal University of Rio Grande do Norte-UFRN and the Brazilian Agriculture Research Institute - EMBRAPA).

April 20-24, 2009, Natal, Brazil, to be held back to back with the XIV Brazilian Remote Sensing Symposium (April 25-30, 2009, Natal, Brazil).

Background and justification

The Training Institute on **Remote Sensing Application to Hydrology in Semi-Arid regions** will address the theme – how to assess regional water availability and vulnerability of communities in the context of basin hydrology. Water needs for agriculture, irrigation, cities and industry will be related to potential changes in watershed function under land cover change.

Vulnerability to water shortage is not only the result of the natural setting, but is also related to shortage of information on changes in space and time of basin hydrology in response to climatic, geological and human factors. In most semi-arid regions there is lack of quality information on natural resources. In order to fill this gap, the training activity will focus on the use of remote sensing to obtain crucial hydrological information enabling natural resources managers and local communities to a more efficient use of water. The training course will be customized to look at the relationship between time changes in water availability in the Brazilian semi-arid Northeast for crop production. Agriculture in the semi-arids takes place in valleys with greater water availability. In spite of the importance of those valleys to local economy and food security, there is a complete lack of information on the amount of valley area available for crop. Moreover, there is little information on the inter-annual changes in the moisture retained in those valleys in response to climate, vegetation degradation, diversion or impoundment of water. Taking into account the multidisciplinary nature of the issues to be addressed in the training

institute, the course will be opened to professionals from different fields, such as agriculture, hydrology, remote sensing, ecology, geography, economics, etc.

In this course, the participants will be able to learn how to use Shuttle Radar Topographic Mapping mission (SRTM) data to map valleys and compute their extent in different landscapes. They will also learn how to assess seasonal changes in the water availability within the valleys by using time series of soil moisture and vegetation indexes derived from MODIS data, among others. The IAI Training Institute on Remote Sensing Application to Semi-Arid Hydrology is an effort to assist policy and decision-makers to take advantage of the available remote sensing technology for obtaining the necessary information to prepare better responses to the challenges of planning environmental control policies to increase food security in semi-arid regions.

Objectives: The main objective of the training institute is to expand our understanding of how remote sensing information can provide information that will help assess the impacts of global change on the hydrology of semi-arid regions based on the example, of time changes in water availability in valleys in response to inter-annual variability of precipitation. Other objectives are: 1) to bring multidisciplinary approaches to the use of remote sensing to hydrology, including in the analyses of the physiographic variables affecting water; 2) to give background information to the participants on hydrology and its connections with other environmental and socioeconomic factors; 3) to give background information on remote sensing to encourage them to widen the application to various information needs; 4) to prepare them to use research to shape policies for sustainable use of water resources for agriculture or for multiple uses; 5) to identify information on remote sensing data sources, 6) to develop a regional and international knowledge network to make operational use of remote sensing technology for water management.

The **Program** will address: 1-basic scientific aspects of semi-arid regions; 2- a review of factors contributing to the setting of semi-arid landscapes; 3- an overview of the multiple uses of semi-arid resources concerning water and land use, based on the experience of experts, governmental agencies, and NGOs, with emphasis on agriculture, irrigation and biodiversity; 4- basic concepts on hydrology with emphasis in semi-arid regions, on hydrological modeling and on scenario generation; 5- basic concepts on remote sensing, digital image processing and geoprocessing with emphasis in the case study selected for the program; 6- case study using SRTM data and MODIS data to generate a map of monthly variation of water availability using vegetation indexes as proxies; 7- hands-on training in assessing accuracy of remotely sensed information: visit to a pilot area to look at the features mapped on the images; 8- hands-on training on remote sensing techniques.

Methodology: The training institute will be developed in two phases. In the first phase the training will be carried out as an intensive course covering the issues addressed in the program and will have various interacting components: lectures, discussions, laboratory hands-on training, and a field trip to an area selected as pilot project. In the second phase the participants will be directed to two-day training activities (April 25-26, 2009) offered by the Brazilian Remote Sensing Symposium in order to improve skills in specific remote sensing approaches to be used for filling gaps of information on semi-arid regions. The following courses area offered: *Climate Change and Environment Quality: The Role of Remote Sensing; Methods in Remote Sensing Digital Image Processing and Classification, MODIS Data: Applications in Agriculture and Forestry; Remote Sensing: Principles and Applications; Radar: Principles and Applications; Geostatistics and Geoprocessing*

Applications; Training Course in SPRING. The participants will also attend the XIV Remote Sensing Symposium (April 25-30, 2009) and profit from the contact with remote sensing specialists and to a series of workshops, oral and poster technical sessions in which several applications of remote sensing technology will be addressed.

Participants: 20-25 participants with previous basic knowledge and interest in remote sensing technology and willing to improve their skills to obtain quality information to help water conservation activities, and application in semi-arid agriculture. Participants may include 1) local practitioners working on water resources management and agriculture; 2) decision-makers and natural resources managers at the local, state or federal level; 3) stakeholders, particularly members of NGOs that promote the interface between local communities and governmental institutions; and 4) scientists and technicians from Brazil and other semi-arid regions in Latin America, especially technicians of governmental agencies and university professors at graduate level.

Planning: a steering committee will be set up to develop the program of the TI. Potential members are: Evlyn Novo (INPE), Miguel Cuellar (INPE-Natal), TBA (Federal University of Rio Grande do Norte-UFRN), Luciano Accioly (Brazilian Agriculture Research Institute - EMBRAPA), and Holm Tiessen and Marcella Ohira (IAI).

Collaborators: INPE, UFRN, EMBRAPA, Land-Ocean Interactions in Coastal Zone-LOICZ, International Geosphere-Biosphere Programme-IGBP, and the Global Water System Project- GWSP.

Expected results: it is expected that participants will be able to identify information gaps regarding the hydrology of semi-arid regions which maybe filled with remote sensing data. It is also expected that they will be able to locate datasets to respond to their information needs also to identify approaches to processing the data to derive the desired information. Participants will be asked to bring information from their home country and study areas so they can use them as test sites for hands-on exercises (e.g. development of maps, application of remote sensing and GIS on the study area, etc). In addition, participants will be asked to prepare a draft paper comparing different semi-arid sites.

Assessment activity: an exit evaluation will be carried out at the end of the TI and a follow up survey will be done to evaluate the application of the training 9-12 months after the event. TI participants may participate again in the 2010 Remote Sensing Symposium and this may be an interesting venue to also assess the impact of the training a year later.

Date and site: Training Institute: April 20-24, 2009, Natal, Brazil, combined with the Remote Sensing Symposium: April 25-30, 2009, Natal, Brazil. INPE's regional center in Natal will be the local host.