OUR COMMON FUTURE UNDER CLIMATE CHANGE

International Scientific Conference

ABSTRACT BOOK

7-10 July 2015 • Paris, France

This Abstract book is based on a compilation of all abstracts selected for oral and poster presentations, as of 15 May 2015.

Due to the inability of some authors to attend, some of those works will therefore not be presented during the conference.

OUR COMMON FUTURE UNDER CLIMATE CHANGE

Welcome to the Conference

Welcome to Paris, welcome to 'Our Common Future under Climate Change'!

On behalf of the High Level Board, the Organizing Committee and the Scientific Committee, it is our pleasure to welcome you to Paris to the largest forum for the scientific community to come together ahead of COP21, hosted by France in December 2015 ("Paris Climat 2015").

Building on the results of the IPCC 5th Assessment Report (AR5), this four-day conference will address key issues concerning climate change in the broader context of global change. It will offer an opportunity to discuss solutions for both mitigation and adaptation issues. The Conference also aims to contribute to a science-society dialogue, notably thanks to specific sessions with stakeholders during the event and through nearly 80 accredited side events taking place all around the world from June 1st to July 15th.

When putting together this event over the past months, we were greatly encouraged by the huge interest from the global scientific community, with more than 400 parallel sessions and 2200 abstracts submitted, eventually leading to the organization of 140 parallel sessions.

Strong support was also received from many public French, European and international institutions and organizations, allowing us to invite many keynote speakers and fund the participation of more than 120 young researchers from developing countries. Let us warmly thank all those who made this possible.

The International Scientific Committee deserves warm thanks for designing plenary and large parallel sessions as well as supervising the call for contributions and the call for sessions, as well as the merging process of more than 400 parallel sessions into 140 parallel sessions. The Organizing Committee did its best to ensure that the overall organization for the conference was relevant to the objectives and scope. The High Level Board raised the funds, engaged the scientific community to contribute and accredited side events. The Conference Secretariat worked hard to make this event happening. The Communication Advisory Board was instrumental in launching and framing our communication activities on different media. We are very grateful to all.

We very much hope that you will enjoy your stay in Paris and benefit from exciting scientific

interactions, contributing to the future scientific agenda. We also hope that the conference will facilitate, encourage and develop connections between scientists and stakeholders, allowing to draw new avenues in the research agenda engaging the scientific community to elaborate, asses and monitor solutions to tackle climate change together with other major global challenges, including sustainable development goals.

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K-2224-02

Innovative adaptation of pastoral systems to climate change: - Case study in Mongolia -

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Synergy of scientific, technological, governance and financial dimensions is required for adaptation of pastoral social-ecological systems to climate and global changes.

- Scientific understanding of vulnerability and adaptive capacity of local and regional social-ecological systems is the basis for success of response actions.
- Application of advanced technologies with co-benefits for mitigation and adaptation is one key for responding to climate change;
- Without financial mechanism, which enables application of innovative technology, there will be no technological advancement with improved adaptation and mitigation;
- Governance for sustainable development, integrating environmental, social and economic dimensions, is another key for adaptation towards sustainability;

We will demonstrate a case study in Mongolia, integrating all four dimensions.

Permafrost melting due to global warming impact is likely to be critical slow variable leading towards desertification of rangelands in Mongolia, reducing water availability for plant growth in the spring - critical season for pastoral systems. Pastoral systems are becoming vulnerable because of interacting dynamic factors such as drought, overgrazing and "zud" (severe winter condition for livestock).

Improved early warning systems with ICT technology based on drought/grazing impacts and winter forecasting are critical for early harvesting of livestock and preventing of livestock loss during "zud". Innovative meat storage systems with application of renewable energy-based freezing system is going to be demonstrated in Mongolia which will be co-benefiting mitigation and adaptation.

The Government of Japan and the Government of Mongolia signed the agreement on Low Carbon Development Partnership, using the Joint Credit Mechanism (JCM). The Parliament of Mongolia passed Green Development Policy in June 2013, which serves bases for governance towards sustainability. Climate compatible development, integrating adaptation, mitigation and sustainable development, was a core of the policy document.

It is a challenge to demonstrate and observe how technological, governance, financial and scientific factors will work at local community level. Management of innovative technology as new commons by local pastoral community is critical for strengthening the traditional adaptive capacity and resilience of pastoral systems in Mongolia.

K-2224-03

Coupled Biological and Cultural Systems under Himalayan Climate Change: Perceptions, Adaptations and Mitigations

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Recent, rapid Himalayan climate change includes rising temperatures, increasing and unpredictable precipitation, glacial retreat, glacial lake formation and outburst, and altering natural resources. Our 1500 km transect across the eastern Himalaya, with intensive, longitudinal ecological alpine plant monitoring (4-5000 masl), shows gradually increasing plant richness, biodiversity and endemism, especially at higher elevations. Comparatively, participatory methodologies of mapping, calendars, photographs and interviews with Himalayan peoples indicate their keen perceptions of and dramatic adaptations often based on traditional ecological knowledge both to climate change and to interacting socio-economic changes. Himalayan peoples recount rapid changes in Himalayan environments, agro-pastoralism and cultural adaptations, indicating dramatic tipping points of production and land-use systems, of subsistence and cash/tourist economies, and of traditional and contemporary cultural contexts . New fruit and vegetable crops are grown, but mostly for tourists, while locals retain their traditional diets. Yak herding now takes time from lucrative tourism. Lucrative chung cao (Ophiocordyceps sinensis) harvesting, once traditional, now commercial, dominates the early spring calendar. Both traditional spiritualism and tourism are threatened by snowless mountains, diminished glaciers and the disappearance of sacred cranes. With increased precipitation, traditional mud roofs are collapsing and being replaced by economical corrugated coverings. Traditional yak robes are too warm, while contemporary, light weight hiking gear is nationally produced and inexpensive. Road incursions into the Himalaya bring more tourists, tourism conglomerates and commercial goods, while undermining traditional ways of life and increasing carbon footprints. Traditional ecological knowledge and economic savvy prescribe rival adaptations for Himalayan peoples; traditional culture and economics become competing paradigms for the Himalayan climate change. Local mitigations of climate change are varied and potentially generalizable, but contextually in decline. Systems dynamics between biological and cultural diversity - models of biocultural diversity and interrelatedness - are transforming and potentially threatening the remarkable Himalayan biocultural diversity. While Himalayan plants seem to be adapting slowly to climate change, Himalayan peoples struggle. Climate change policy needs to incorporate indigenous peoples and their knowledge to support sustainable livelihoods and food sovereignty.

K-2224-04

Climate variability as experienced by farmers

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The typical approach of estimating crop response to future climate scenarios may be inappropriate in the case of smallholder multi cropping rain-fed agriculture. Indeed, a crop-by-crop simulation, based on current varieties, cannot take into account the dynamics among crops as well as within crops i.e. among varieties, in time and space. We implemented a comparative study to understand interactions between cropping system dynamics and past climate variations, taking into account the diversity of farmers' experiences and socio-cultural organization.

In Kenya, farmers who adopted maize a few years ago are still cultivating traditional sorghum and pearl millet varieties, while others abandoned them earlier in favour of maize. Farming systems were thus dynamic, with different crop assemblages over time. Thus, retrospectively, farmers' capacity to mitigate crop failure risk due to extreme rainfall events has never been constant. Has the farming system lost part of its capacity to cope with climate variability, as maize is known to be less resistant to drought than sorghum and pearl millet? While this is usually demonstrated using yield parameter, we used seed losses, which is consistent with a multicrop system.

Combining ecological anthropology and climatology, we confronted the results of a retrospective survey of farmers' seed loss reminiscence about the period 1961-2006 and climatic records for three altitudinal levels on the eastern slope of Mount Kenya were analysed. Over the period, 3204 seed loss events were reported independently by 208 farmers, for eight main crops of their rain-fed farming systems. The causes given for these losses according to farmers' experience and knowledge were recorded yearly. We first assessed whether these causes were related to recorded rainfall values, and, second, analysed the proportion of lost seed on a yearly basis, crop by crop and on the whole farming system, using logistic regression.

Drought was mentioned 73.5% of the time whereas 8.5% of the losses were attributed to heavy rainfall. Farmers recalls coincided on drought years associated with crop diversity losses: conditional Chi-square tests based on Monte Carlo simulation clearly rejected independence (p = 0.001) between climatic reasons given by farmers and recorded rainfall, for both droughts and heavy rainfall. Farmers' retrospective perception of drought corresponds to major droughts reported for Kenya.

By favouring maize at the expense of sorghum and pearl millet, cropping system dynamics have promoted an increasing risk of drought-associated seed loss. The probability to lose sorghum seed (0.056- 0.065) was significantly lower than the probability to lose maize seed (0.071-0.087). All crops were affected more by droughts than by heavy rainfall. Seed loss probability increased for a rainy season shorter than 50 days, with less than 28 rain days, and with a precipitation under 400 mm. Logistic regression confirmed that a change in cropping systems increased the risk of seed losses due to drought over the 46-yr period.

Farmers experienced climate variability differently, with greater negative impact on farmers cultivating maize. Ecological and social components thus cannot be analytically isolated but have to be considered as parts of a socio-ecological system. While usual approaches consider present-day characteristics of agricultural systems to assess their adaptability to hypothetical rainfall variability (projection into the future), our study used farmer experiences to look into the past. In our approach, past rainfall variability is already known, not hypothetical, while farmers' experiences can allow assessment of the evolution of their agricultural systems, which can be monitored over time, and related to climate variability.

The cropping system dynamics, by favouring maize at the expense of sorghum and pearl millet are partly related to agricultural policies that positively valued maize, whereas sorghum and pearl millet were devalued, being perceived as ''poor people crops''. The current dynamics of agricultural systems thus imply many dimensions, not only economical, political, and agronomical, but also cultural.

K-2224-05

Adaptation of Irrigated agriculture to climate CHAnge: trans-disciplinary modelling of a watershed in South India

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In the context of climate change and of agriculture increasingly relying on groundwater irrigation, it is crucial to develop reliable methods for sustainability assessment of current and alternative agricultural systems. The awareness that prediction of impact of climate change for water resource management must account for interactions and feedbacks between biophysical processes determining movement of water, and human behavior in a given socio-economic context has gained significant recognition among scientists in the past few years, including the recent advocacy for the development of the new science of "socio-hydrology", dedicated at studying the "co-evolution of coupled human-water systems". Recently, "Change in hydrology and society" was proposed by IAHS as the main research theme for the decade 2013-2022.

In this talk, we introduce the Indo-French CEFIPRA project "AICHA" (Adaptation of Irrigated agriculture to climate CHAnge, 2013-2016), based on the analysis of an agricultural watershed in South India, where a long term environmental observatory has been setup. We describe the trans-disciplinary approach that is developed to analyse the agro-hydrological and socio-economic drivers of groundwater sustainability and farmer adaptation, using integrated modelling.

In the studied watershed, spatial heterogeneity in groundwater gradients has resulted from intensive groundwater pumping in the villages in valley that started in the early 1990s. The decline in groundwater level provoked the disconnection between the groundwater and the river bed, and the main permanent rivers turned into ephemeral streams. Wells are being recently drilled in the upland areas and groundwater irrigation is increasing. Our analysis suggests that these contrasted evolutions are closely linked to the spatial distribution of soil types and groundwater availability, besides access to market and knowledge.

We hypothesize that feedbacks between the biophysical-social system and spatial interactions must be accounted for in order to be able to study scenarios of agricultural evolution and water management policies, not only in terms of sustainability at the scale of the watershed but also in terms of spatial variability of both the groundwater resource and the evolution of socio-economic inequity over time. Consequently, we propose to develop a model framework that combines hydrology, agronomy and economy.

We will also insist on one of the critical challenge in implementing such integrated models, which is to develop the human component of this framework to account for farmer decision that occur at different time scales. We propose to base this module on decision rules to allow the representation of farmer adaptation to a changing environment.

K-2224-06

Adaptation of Irrigated agriculture to climate CHAnge: Retrieving relevant information for distributed modelling of impact of Climate Change of water resources

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Developing integrated assessments of the sustainability of irrigated agriculture is critical in the context of ever growing pressure on water resources. A wide variety of models have been developed for simulating future scenarios of land-use change, climate change or ex-ante evaluation of management policies. Such models usually fail to account for feed backs of shrinking water resources on farmer strategies, and tend to neglect the biophysical and socio-economic interactions spatially and temporally within the watershed.

In this talk, we will present innovative approaches that are conceived and tested within the Indo-French CEFIPRA project "AICHA" (Adaptation of Irrigated agriculture to climate CHAnge, 2013-2016) based on a watershed in South India where a long term environmental observatory has been setup.

One of the critical challenge is to implement the integrated agro-hydrological model in a distributed way over the whole watershed. We propose to use methods based on remote-sensing to collect data on land use and soil properties.

One of the challenges of using such models for scenario testing in a distributed way is the need for accurate knowledge, for example for soil and crop parameters (Launay and Guérif, 2005) which are scarcely available for tropical conditions. As an example of the development of innovative methodologies fostered by the project, we present a method to retrieve soil parameters using remote sensing and crop model inversion (Sreelash et al., 2012; 2013).

Further, another challenge is for developing future projections of water balance components based on such an integrated agro-hydrological model would be the choice of the climate model forecasts to drive the model. This is commonly achieved by driving the agro-hydrological model with the bias-corrected precipitation data from the GCMs. The approaches that are being used for disaggregate and bias-correct the precipitation from the GCMs of CMIP3 will be presented.

2224-POSTER PRESENTATIONS

P-2224-01

Strategies of farmers to rainfall variations in the municipality of Zè in Benin

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