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ABSTRACT BOOK

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2244 - Climate Change Biodiversity and Human Well-Being : illustration from forests and agro-forests systems

ORAL PRESENTATIONS

O-2244-01

Exploring causes, risks, and consequences for ecosystem services of tipping points in Latin American forests - the role of biodiversity

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This paper presents some key findings from the EU-FP7 funded projects AMAZALERT and ROBIN (Role of Biodiversity in the Climate Change Mitigation), both focusing on the effects of future climate change and land use change on ecosystem services provided by tropical forests in Latin America. New research has demonstrated that a complete dieback of the Amazon rainforest within the 21st century caused by climate change alone is unlikely; however a risk of forest dieback or other forms of irreversible ecosystem degradation on a lower spatial scale still exists. Because of the potentially severe consequences of such ecosystem degradation for the many important services they provide, on various spatial and temporal scales, it is wise to be prepared for the unexpected. Joining the outcome of the two projects, we will present a map of risk of ecosystem degradation, the main factors involved and most useful monitoring and warning mechanisms. We will evaluate the role of biodiversity in degradation as well as its potential to provide critical indicators of ecosystem decline.

Our models show forecasted changes in the biophysical state and the ecosystem services that the environment provides, under future scenarios. These allow us to compare severity of climate change, the influence of socio-economic context, and the implementation of different levels of policy protection of biodiversity and ecosystem services in alternative futures. The models suggest that there may be difficult trade-offs to take into account among ecosystem services, carbon and biodiversity, under these contrasting scenarios.

In combination, climate change (warming, drying, extreme events) and land use change (deforestation, fragmentation) could have a profound effect on the ecosystem, changing carbon cycle, water cycle, nutrient cycle and biodiversity in an irreversible way: from a wet, high biomass high biodiversity system to a much drier low biomass low biodiversity system. As trees and precipitation are bound together in a positive feedback loop (trees cause precipitation, trees need precipitation - in a hydrological cycle with evapotranspiration) and trees and fire in a negative feedback loop (intact rainforest is fireproof, dry forest and savannah are prone to fire causing more tree mortality), the system has multiple steady states and a critical transition from one state to another would be hard to reverse. If and when such degradation would occur, an Early Warning System (EWS) that would detect the imminent change would help to minimise its impacts.

Although earlier work suggested that early warning signals might exist, such that the onset of large scale dieback could be detected and potentially halted before irreversible critical transitions could occur, current work suggests that there is uncertainty whether critical degradation would show any critical 'tipping point' behaviour, and whether such change would be associated with detectable early-warning signals, such as enhanced but slowing down variability in variables ahead of thresholds that are associated with the change. Because of this, monitoring for early detection and warning of change is essential, both on the ground and using satellite images, as monitoring is prerequisite for finding solutions and early adaptation. Due to time lags between the system reaching adverse conditions and the response of the system to these adverse conditions (ecosystem degradation) we might be able to reverse the process before it becomes irreversible.

Since much of any critical change would occur through changes in the hydrological cycle, river levels, rainfall amount, soil moisture and temperature range appear among the most important candidates for monitoring, along with biomass, carbon exchange and energy budgets, but monitoring needs may differ according to the specific risk in a subregion. Local communities will be the first to notice subtle change in processes in their home territories, e.g. changes in ecosystem services provision, so combining high tech knowledge like satellite imagery with low tech on the ground observations should be the most promising way forward.

Actions against ecosystem degradation include reforestation, agroforestry production systems without burning, and agricultural no-tillage system.

O-2244-02

Threat to Farmland Riparian Biodiversity in Tankwidi Agroecosystem in the Sudanian Savanna of Ghana – Implication to Managing Risks to Climate Change

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Riparian forests (RF) are integrative part of the agroecosystem as they improve water quality and serve as habitat for fauna such as birds, insects and other organisms that are essential for crop pollination, seed dispersal and nutrient cycling. Despite their importance, RF are under the threat of deforestation from agricultural intensification in catchment areas. In order to ascertain the impact of the deforestation on the riparian area, this study used remote sensing techniques and field inventorying to assess riparian forests diversity on communal farmland (FA) and protected forest reserve area (FR) along Tankwidi rivercourse in the Sudanian savanna of Ghana. The paper also discusses the findings of the research in the light of managing risks of climate change effects on farmland riparian biodiversity in the savanna zones of Ghana.

Post-classification analysis of Landsat images revealed a reduction in forest cover from 1985 (23%) to 2013 (7%) in the river catchment. This forest loss is likely to affect elements such as light and wind leading to changes in the microclimatic conditions of the forest remnants to exert a strong effect on biodiversity in the catchment.

Further, a ground survey of sixty randomly selected plots (500 square meters per plot) equally divided between