AMAZALERT Delivery Report

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First author	Celso von Randow (INPE)
Co-authors	
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Name leading Work Package Leader	Dorian Frieden/ Gudrun Lettmayer (JOANNEUM RESEARCH)
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Special issue on results related to AMAZALERT

The process to organise a special issue was started in May 2014. Several journal have been approached (Table 1) and AMAZALERT project partners were invited to submit titles and abstracts. The response in abstracts was good (see table 2 below), and during a (partly on-line) AMAZALERT workshop a coherent publishing strategy was discussed, which met a good deal of enthusiasm among particpants. Unfortunately, so far (30/11/2014) no deal has been struck yet with a journal, but these attempts will not end here. In what follows the rationale and offer to journals is given, as well as a listing of journals and paper plans.

The Amazon region is under pressure of deforestation and climate change, and several studies point to significant risk of strong changes as a result of these pressures over the 21st century.
The EU-FP7 funded project "Raising the alert about critical feedbacks between climate and land use change in Amazonia" (acronym: AMAZALERT) aims to investigate the likelihood of critical transitions occurring in the Amazon region, in both the biophysical and the socio-ecological context. On the basis of an updated risk assessment, an early warning system, providing forecasts of transitions such as progressive forest decline, rainfall changes and severe changes in river discharge regimes, will be designed which may potentially be implemented at a later stage. The current state-of-the-art and AMAZALERT Earth System models are suggesting that the Amazon forests may be more resilient to the described stress factors than previously assumed.
To outline the main findings to date on these risks and present different aspects of a possible Early Warning System for loss of amazonian ecosystem services, a special issue integrating results related to AMAZALERT is currently being proposed to different journals.
The likely consequences of critical transitions for ecosystem services in the Amazonian region, as well as potential response and adaptation to these, will be discussed.

List of possible papers / subjects include:
- effects of climate and land-use change on degrading forest services, including development of fire parameterizations in the models
- ensemble of models of different complexities (ranging from simple conceptual and one-dimensional surface-atmosphere model to fully coupled Earth System models) evaluating the likelihood of critical transitions and feedbacks in the climate system.
- assessment of uncertainties and improvement of hydrology and dynamic vegetation models and of understanding of the processes through which climate and land use change affect the Amazon
- impacts of land use/land cover scenarios on basin hydrology and feasibility of hydropower dams
- improved scenarios of land use change developed from direct consultation with relevant stakeholders,

- exploration of development from policy, scenario development, land use/land cover projection, effects on ecosystem services and possible feedback to new policy response
- technical and theoretical general framework for an early warning system for loss of ecosystem services in Amazonia

The proposed timetable for submission and review of papers is as follows

Stage	*Proposed timetable*
Submission of papers	*December/2014 - April/2015*
Reviewing process and revision submission	*Deadline in September/2015*
Production process (online publication)	*December/2015*

In response to the rising concern over the future viability of the Amazon forest, together with a growing recognition of the ecosystem services provided by its ecosystem, the project intend to present a collection of results in this proposed special issue and to advance science of Amazonia as well as practical policy insight on how to address threats to the forest functions and services.

Table 1 shows the list of contacted journals for the AMAZALERT special issue. Table 2 shows a list of possible papers to be submitted.

Table 1. List of contacted journals for possible AMAZALERT special issue.

Journal	Publisher	Impact Factor	Status of proposal for special issue
Global Environmental Change - Human and Policy Dimensions	Elsevier	5.236	Proposal submitted. Under review by journal
Global and Planetary Change	Elsevier	3.155	Journal requested additional details, to be submitted
Environmental Research	Elsevier	3.238	Proposal to be submitted
Environmental Science & Policy	Elsevier	2.978	Under review by journal
Climatic Change	Springer	3.634	Proposal was evaluated as not well suited for the journal
International Journal Earth Sciences	Springer	2.261	Proposal to be submitted
Earth System Dynamics	EGU / Copernicus Publications	2.771	Proposal to be submitted

Table 2. List of possible papers to be submitted for the AMAZALERT special issue.

Authors involved	Topic / provisional title	(Short) description / abstract
C. von Randow, A. Aguiar, K Thonicke, D. Frieden, N. Bird, DGVM groups	Linking policies / scenarios / land use change / impacts in provision of ecosystem services	A great challenge faced by the Amazon region is to maintain the ecosystem services provided by the pristine forest and its complex ecological processes, as well as the needs of the growing human population in the region, in face of global environmental changes and growing demands for land use. In this study we analyze two different storylines linking different land use scenarios to possible impacts on the provision of ecosystem services in Amazonia: a sustainable, environmental development scenario and a chaotic, uncontrollable deforestation scenario. In both cases, a land use model is used to project future land cover maps, which are then used as inputs to drive 4 biosphere models that simulate changes in evapotranspiration and carbon fluxes and stocks. Finally, overlaying the biosphere model outputs with maps of roads or protected areas in the region, we analyze how the two land use scenarios will possibly affect the provision of key ecosystem services in the region
B. Kruijt, P. Good, G. Kay, C. von Randow, G. Sampaio,	Early warning system for critical thresholds in Amazonia	The Amazon rainforest may be under threat of future critical change from anthropogenic activity. The expected critical change could consist of loss of a significant fraction of forest, which is the most visible change as perceived by the public and international community at large. It is however more useful to attempt and express in more precise terms exactly which functions, services and benefits of the Amazonian region would be affected most and have the greatest impact. Once this has been specified, it is useful to explore what such changes would look like and how society may be able to forecast their imminence. Mitigation policy action needs to be taken early enough to avoid critical change, given the various time-lags, and needs to account for scientific uncertainties. For policy it is important to distinguish different levels of threshold crossing and associate mitigation measures of , and also, adaptation to, change, such as a focus on mitigating the causes of changes or the direct effects. During the approach to critical change, there would be several different moments that 'thresholds' are crossed, and different policy actions are appropriate for these. To this end, there is a need to understand how the risk to the Amazon may increase in the future, and which are the likely pathways that the region's ecosystem services may approach critical change. Here we review current literature and present some new results. Previous and future reports address principles and possible logistical implementation, among others.
H. De Deurwaerder, H Verbeeck, …	On the ambiguity of historical drought events in the Amazon and the impact on the C cycle using several dynamic vegetation models	This study will give an overview on the current status of Amazon drought response research by synthesizing what we have learned from recent observational data on historical droughts and by analysing new DGVM runs for the period 1970-2008. This synthesis aims to address the following research questions: (1) Can we find a generic definition for Amazon droughts or does it cover a multitude of events? (2) Are the necessary meteorological datasets available for an appropriate representation of drought events in DGVM drivers input? (3) Are current forest observational studies and experiments appropriate to study the impacts and temporal/spatial scale of the droughts that we can distinguish in the meteorological data? (4) Are DGVMs, in their current structure, capable of representing drought responses?

B. Christoffersen, D. Galbraith, …	Constraining uncertainties in simulated changes in Amazonian ecosystem function	Quantifying uncertainty as to the future state of ecosystems in global change research has typically focused on one process: emissions, climate response, veg response, or their feedbacks. An exception to this is model simulations in which each of the uncertainty components is quantified via a fully factorial set of drivers and models. However, such an approach typically focuses on the modeled spread ('model democracy' view) as a means for a quantification of uncertainty. Here we adopt a different approach to highlight and review how, in Amazonia, recent model evaluation and/or benchmarking activities across all processes (both climate and vegetation responses) provide important critical constraints on the range of uncertainty regarding 'Amazon dieback'. A theme which emerges is that the 'model democracy' view often either under- or over-estimates the range of possible outcomes. We stress the importance of measurement campaigns as well as model-data intercomparisons to provide important insights as to the range of potential outcomes. Importantly, we highlight how observations challenge the paradigm of 'Amazon dieback' as a binary outcome, arguing for a continuum of alternate stable states, among which full dieback remains an extreme end point of several possibilities
M. Johnston, T. Baker, DGVM modelers.	Variation in stem mortality rates, functional composition and woody NPP determine aboveground biomass in Amazonian forests: implications for dynamic global vegetation models	Understanding the processes that determine aboveground biomass (AGB) in Amazonian forests is important for predicting the sensitivity of these ecosystems to environmental change and for designing dynamic global vegetation models (DGVMs). AGB is determined by the balance of inputs from woody productivity (woody NPP) and losses from tree mortality. Here, we test whether variation in stem mortality rates or woody NPP is the main control on AGB from observations from 167 plots in intact forest across Amazonia and the Guiana and Brazilian Shields. We then compare these relationships with predictions for the same region from four DGVMs. Mortality, rather than growth, is the main driver of variation in AGB due to a strong negative relationship between stem mortality rates and AGB. However, the intercept of this relationship varies across Amazonia, suggesting that differences in the functional composition among regions, related to variation in wood density and height/diameter relationships, also have an important influence on AGB. There is an independent, weak positive relationship between woody NPP and AGB; woody NPP and stem mortality rates are uncorrelated. In contrast to the observations, DGVMs typically show strong positive relationships between woody NPP and AGB and poorly represent both the spatial patterns and basin-wide mean of AGB and woody NPP. Overall, ORCHIDEE model performs best as it captures the spatial pattern of AGB and also the observed variation in the relationship between AGB and woody NPP, possibly because of its more realistic representation of the functional diversity of Amazonian forests. Extending observational datasets to ecosystems with low AGB and incorporating mechanistic models of mortality in DGVMs are priorities for future research
M. Guimberteau, P. Ciais, A. Ducharne, J.-P. Boisier, H. Biemans, R. von Randow, D. Rodriguez, …	Uncertainties in modelling future hydrological change due to land cover change over the Amazon basin with a set of dynamic vegetation global models and an hydrologic model	The fate of the Amazon basin hydrology which faces the climate change and significant deforestation is still unknown. Estimation of this uncertainty in modelling the change in hydrology for the end of the XXIst century requires a multi-model approach. Here, we used four dynamic vegetation global models (DVGMs) and one hydrological model to simulate the water cycle components and to compare them with several data sets at sub-basin scale. Using bias- corrected AR4 Global Climate Models (GCMs) data sets and new large-scale land cover change (LCC) scenarios, we estimated the Amazon water budget disturbances in the future without atmospheric feedbacks, according to different potential deforestation story lines (between 7% and 35% of total tree area decrease in the Amazon basin).

Author	Title	Abstract
R. von Randow, D. Rodriguez, J. Tomasella	Vulnerability of hydropower generation in Amazonas' tributaries under global change scenarios	When a hydropower plan is considered to be built, the natural characteristics of the region is taken into account, considering that the rainfall regime follows certain stationarity. However, under the possibility of global change it becomes difficult to predict if the natural regime of the region in study will continue providing the natural resources necessary to maintain the products that the hydropower was built for. The objective of this study is to evaluate if the current hydropower plans for Tocantins and Madeira basins, two sub-basins of the Amazon, can maintain their functionality under global change conditions. For that, we will infer the plans of operation of the these hydropower dams based on the discharge data and hydropower information available by Brazilian National Agency of Water and Energy, and insert the plans of operation in the Distributed Hydrological Model for Large Basins developed at the Brazilian's National Institute for Space Research (MHD-INPE). MHD-INPE wil be calibrated through observed discharges for 1970-1990 using current land use conditions, and will be driven by dynamics downscaling from the regional atmospheric model Eta-CPTEC and land use scenarios from LUCC-ME/INPE, both from 2000 to 2050.
H. Biemans, A. Rammig, K. Thonicke, F. Langerwisch	Assessing the impacts of land use change and climate change on potential hydropower production in the Amazon	This paper will discuss changes in large-scale basin hydrology due to climate and land use change and the effects on potential hydropower production
B. Kruijt, S. Vasconcelos, W. Jans, P. Meir, E. Tribuzi	Temperature dependence of photosynthetic capacity in Amazon forest trees	
G. Kay, L. Alves, J. P. Boisier, G. Sampaio.	Likelihood of irreversible colapse	The Amazon forest, like many other forests across the globe, is subject to increasing pressure from multiple anthropogenic and natural sources, such as deforestation, agriculture, pests and diseases, fire, and extreme climate events. There has been rising concern over the future viability of the Amazon forest, together with a growing recognition of the ecosystem services provided by the Amazon. This has prompted research into the potential nature of environmental change and response of the Amazon forest, within the context of other pressures. Here, we present an assessment of the likelihood of Amazon forest collapse. It is based on current best understanding of how anthropogenically-driven change in the Earth system may evolve and interact with the Amazon forest, drawing on novel AMAZALERT work and the wider body of Amazon research. Here we present a range of different types of information relating to the likelihood of Amazon dieback. Current climate-vegetation models do not have the sophistication and accuracy required to produce a fully quantitative probabilistic assessment for such an event and so this assessment relies on semi-quantitative and qualitative results based on the available imperfect set of model simulations. A range of simulated forest responses are given, but also ranges of the drivers of forest change. The latter has value, as while not directly quantifying forest change, they may be more reliably simulated than the final forest response. An expert elicitation was also carried out as an alternative view on risk. Therefore we present different levels of information, both quantitative and qualitative, which overall give a qualitative picture of risk. This can be updated as knowledge increases and more information becomes available and moreover, it can be used to help identify and prioritise further scientific developments.

J. P. Boisier, …	Multimodel rainfall projections in Amazonia: Emerging constraints based on observed present-day variability	
G. Sampaio, M. Cardoso, …	Quantifying sinergistic effects of climate change, fire and land use change on Amazonian regional climate	
Kok, Helfgott, Zanetti, Batistella, Aguiar, Frieden, Lettmayer	What stops deforestation? Participatory land use change scenarios for the Brazilian Amazon. Perceptions from Europe and Brazil.	Land use change and deforestation have changed magnitude very rapidly in recent years in the Brazilian Amazon. The underlying reasons are unclear, and might be related to successful implementation of recent policies or to the economic crisis. Scenarios are a good tool to structure these types of uncertainties. Work has been carried out in two large European projects (Amazalert and ROBIN) at local and regional scale. Additionally, scenarios have been discussed with Europena stakeholders. This paper provided an overview of the various methods (interviews and workshops) used and main results obtained (Fuzzy Cognitive Maps; storylines; mental models; etc.). Results indicate how policies are mostly considered as the main factor behind the current reduction in deforestation.
Aguiar, Kok etc.	Patterns of Land Use change	This will be a paper that describes the quantitative land use change projections using LuccME model and participatory scenarios with relevant stakeholders
E. Robertson & P. Good	Understanding the threshold of tropical forest sustainability in HadGEM2-ES	
P. Good & co-authors	The drivers of fire-related tropical tree mortality, and multiple stable states	