Summary

The Amazon is under threat through the combined effects of unsustainable regional development and climate change. As summarised in the IPCC reports of 2007 and 2014, studies in the past ten years have indicated that these effects can lead to deforestation, regional disturbance of temperatures and the water cycle, as well as loss of carbon stocks and biodiversity. In turn, these changes can lead to forest loss, droughts, low river levels, floods, loss of hydropower energy and many other ecosystem services and even enhanced risk of diseases and loss of agricultural productivity.

The AMAZALERT project (2011-2014) has: i) addressed and quantified uncertainties in future changes in the Amazon as a consequence of climate change and deforestation; ii) improved the projections of the impacts of these changes; iii) identified potential effective regional and global policies and iv) analysed the possibilities for warning and prevention of large-scale loss of ecosystem services.

The forests of the Amazon are essential in the hydrological cycle to maintain rain, control floods and droughts, store CO2 from the atmosphere, and protect many other ecosystem services. Stakeholders pointed out the importance of the practical services 'near to the people' to local populations such as food security, river transportation, hydropower and disease control.

The overall conclusion of AMAZALERT has been summarised as follows:
MOST OF THE AMAZON IS NOT LIKELY TO DEGRADE SEVERELY AS A RESULT OF CLIMATE CHANGE THIS CENTURY, IF DEFORESTATION IS KEPT LOW. THE SOUTH-EAST IS MORE VULNERABLE. UNCERTAINTIES ABOUT THE EFFECTS OF CO2 AND TEMPERATURE INCREASES, DROUGHT AND POLICIES ARE HIGH AND AMAZON FORESTS NEED TO BE MONITORED TO ENSURE EARLY PREDICTION OF DEGRADATION.

AMAZALERT brought together a range of global climate predictions from the CMIP5 studies, improved several atmospheric and land surface models and combined them with new scenarios for regional land-use change to assess the likely impact on vegetation and water in the Amazon, in the 21st century. Scenarios were developed through a participatory process, also evaluating policy options, and essential new data have been collected on drought- and temperature dependence. A proposal has been made for an early-warning system for Amazon degradation.

The current generation of climate models (CMIP5) simulates warming of up to 5 - 6°C over Amazonia, by 2100. Although projections of annual rainfall changes are mixed, >80% of models project drier and longer dry seasons, especially in the south and east. Dry season length has a strong relationship with forest area, and the region with a long dry season is projected to expand in the future.

For deforestation, two opposite scenarios were transformed to explicit land-use models. The resulting land-use maps were used to explore the interactions between deforestation with the dynamics of the vegetation, hydrology and climate, using various Earth system models. Imposing high deforestation rates on coupled models resulted in reductions in evapotranspiration and precipitation in Amazonia. Results show that biomass increases in the northern Amazon but in the vulnerable south-east it declines, even in intact forests. Further, the combined effects of land-use change, climate change and fire were investigated. Results show that impacts of climate change including higher temperatures and increased dry season length are enhanced by including land-use change and fire. Results also show a clear impact of land-use change on the water cycle in the entire Amazon basin. However, the magnitude and spatial pattern of the simulated impact is model dependent, which means that there is still substantial uncertainty.

Coupled climate-vegetation models show that if deforestation is low, widespread die-back from climate change alone by 2100 seems unlikely . However, rapid decline cannot be ruled out, because uncertainties remain regarding the sensitivity of Amazon forests to climate and land use change, particularly related to CO2 fertilisation, fire dynamics, incidence of drought and socio-economic developments.

The stakeholder processes carried out within AMAZALERT indicate that compared to other countries importing Amazon goods, and compared to domestic consumption by Amazon nations, in particular Brazil, Europe has a significant but limited direct impact on Amazon deforestation. Particularly, the importance of the EU's involvement in international initiatives, through influencing trade and domestic processes in Amazon countries, has been highlighted.

In Brazil, stakeholders indicated that actions are needed in the environmental, social, and economic sectors. In particular, a range of current policies needs to be maintained and enforced, including protecting Conservation Units, PPCDAm, and the Forest Code. Also, valuing forests (PES), diversifying the local economy, and education were singled out as important elements.

AMAZALERT has shown that severe degradation of the Amazon is likely to occur when the climate changes severely and deforestation progresses at the same time. However the type of change can vary strongly and the onset of change can be difficult to anticipate, because it may come too late. Early warning of such change will therefore have to be approached from a broad perspective, combining new

and existing networks. Thresholds should be defined that account for society’s coping capacity as well as with the uncertainty in prediction of degradation.