Obtaining information to subsidize annual production units definition in forest management plans through the combination of ground plots, LiDAR data and satellite images

Marcus d'Oliveira[1], Evandro Figueiredo[1], Daniel Papa[1], Nara Pantoja[2]
[1]Embrapa Acre, Rio Branco, Brasil; [2]MMA, Brasilia, Brasil (marcus.oliveira@embrapa.br; evandro.figueiredo@embrapa.br; daniel.papa@embrapa.br; narapantoja@gmail.com)

The objective of this work was to optimize the design of the Annual Production Units (APU) in forest management plans, through the combination of field and remote sensing data. The study was carried out in the Antimary State Forest (ASF) located in Acre State, Southwestern Brazilian Amazon. As this area already have a forest management plan our study was limited to the identification of the UPA forest structure and relief. A high resolution biomass map was elaborated trough the upscaling of biomass models from ground plots (permanent sample plots) to LiDAR data and from LiDAR to Landsat-OLI and ALOS-PALSAR images. To the identification of the , watersheds, restrict access areas (RAA) and permanent preservation areas (PPA) a digital terrain model (DTM) was elaborated through the use of ground information (GPS), LiDAR and ALOS-PALSAR images. The biomass map was used to the forest stratification in three forest typologies, used to identify the forest areas timber production potential. For each APU we determine: i. the APP and watershed areas and location; ii. restricted access; areas iii. forest stratums and dried above ground biomass stocks. The APU shape, size and distribution must be defined in a way to promote similar annual costs and timber production, minimizing environmental damages. This procedure can be used as a method to define APU in forest management plans in the Amazon.

An overview on the use of active and passive remote sensors to estimate carbon stocks, structure and diversity in forests

Luiz Carlos Estraviz Rodriguez[1], Thaís Hudari Abib[1], Juliana Vicentini[1]
[1]Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Piracicaba, Brasil (lcer@usp.br; thais.abib@usp.br; ju_vicentini@yahoo.com.br)

Remote sensing techniques used to quantify forest biomass or to assess the structural diversity of forests have become ubiquitous. Based on a collection of scientific papers published over the last twenty years, we categorize the use of active and/or passive remote sensors to provide some sort of estimate about forest biomass and forest structural diversity. The method used to categorize these historical contributions consists on classifying the estimate according to the type of sensor used to collect data (for instance, optical, radar, lidar, multispectral, hyperspectral etc.); the type of platform used to fasten the sensor (fixed, mobile, terrestrial, aerial, orbital etc.); the scale of the estimate (local, regional, global), the methodological approach and type of algorithms used to process the estimates (empirical, model based etc.); the type of estimate (biomass allocation, carbon stock, etc.) and allocation (total, above or bellow ground, per vegetation type etc.). The assessment tries to identify the set of essential questions and hypothesis proposed by the many authors and the seminal contributions and technological breakthroughs observed in the period. The review presents a table with some open questions still not sufficiently explored that might offer interesting opportunities for researchers. The fast pace evolution of new technologies and data analysis make projections difficult, but we prospectively comment on some new approaches that will make the future monitoring of our forests very promising.

B4I: CLIMATE SMART FORESTRY OR HOW TO INTEGRATE ADAPTATION, MITIGATION AND SUSTAINABLE FOREST MANAGEMENT

Varying effects of tree composition, diversity and structure on the microclimate of European forests

Radim Matula[1,2], Martin Svátek[2], Roman Gebauer[2], Roman Plichta[2]
[1]Czech University of Life Sciences, Prague, Czech Republic; [2]Mendel University in Brno, Brno, Czech Republic (radimmatula@gmail.com; msvatek@centrum.cz; gebo@email.cz; plichta.roman@gmail.com)

Due to climate change, European forests face rising temperatures and increasing severity and frequency of droughts. However, forests itself may potentially buffer a great part of the negative climate-change effects. These buffering effects likely depend on forest structure, composition and diversity, which in most European forests can be manipulated by forest management to support these climate-change mitigation functions. Here, we present results of the project in which we measured soil moisture, temperature and air temperature in 200 research plots with varying species composition and species mixtures spanning from boreal to Mediterranean forests.The most pronounced difference was found between coniferous and broadleaved trees species, which, in comparison with conifers, had greater summer maximum and winter minimum air and soil temperatures but conserved better soil moisture, especially in late summer and the autumn. Mixed stands had an intermediate microclimate. Increasing tree density reduced temperature extremes but decreases soil moisture. These results suggest that by varying tree composition and structure, foresters may influence forest microclimate but the species that mediate temperature extremes may be different from species the best conserve soil moisture. The great microclimate variation observed in our study also indicates that the typical use of one climate dataset from the nearest climatic station (usually located outside forest) for all study site may be inaccurate. This also means that the quantification of the effects of droughts for forest on the small and medium spatial scale may be significantly biased without local data.

Consistent carbon equivalents for pricing the warming power of surface albedo according to its social cost

Jussi Lintunen[1], Aapo Rautiainen[1]
[1]Natural Resources Institute Finland, Helsinki, Finland (jussi.lintunen@luke.fi; aapo.rautiainen@luke.fi)

Optimizing forest management for timber and climate benefits means choosing a management schedule that jointly maximizes the net present value of both ecosystem services. Forests affect the climate through various channels. Here, we focus on carbon storage and surface albedo which tend to force the climate in opposite directions. The accumulation of biomass in boreal coniferous forests increases carbon storage (cooling effect) but also reduces Earth's surface albedo (warming effect). Taking carbon and albedo optimally into account in forest management requires pricing them according to their social value. Management choices are affected by the assigned prices, as well as the strength of the climatic impacts caused through these channels. The socially optimal price for CO_2 is the Social Cost of Carbon (SCC). Albedo can be priced in two ways: directly, based on the transient warming power of a given surface and the Social Cost of Forcing (SCF), or indirectly, by converting its warming impact into carbon equivalents and then applying the carbon price. Potential inconsistencies between the methods lead to different albedo prices and affect inferences made about optimal forest management. We present a consistent way to calculate carbon equivalents and compare it with a common but inconsistent method. We show that the latter method can (coincidentally) produce roughly correct albedo prices but is sensitive to arbitrary parameter choices and is unable to capture temporal changes in the albedo-to-carbon price ratio. Our results improve the transparency of comparisons between studies in which different albedo pricing methods are applied.