were made to derive generic relationships between forest structure and biomass and shortwave albedo. The results were applied to predict the effect of changing forests on the albedo throughout the season.

RapidEye object-based image classification and landscape ecology analysis to support the geospatial component of the Brazilian National Forest Inventory. Luz, N. (*Fundação de Amparo à Pesquisa do Estado de Goiás (FAPEG), Brazil; naissa@gmail.com*), Oliveira, Y.M., Rosot, M., Garrastazu, M., Mattos, P., Franciscon, L. (*EMBRAPA, Brazil; yeda.oliveira@embrapa.br; augusta_rosot@hotmail.com; marilice.garrastazu@embrapa.br; patricia.mattos@embrapa.br; luziane.franciscon@embrapa.br*), Freitas, J., Piotto, D., Gomide, G., Souza, G. (*Brazilian Forest Service, Brazil; joberto.freitas@florestal.gov.br; daniel.piotto@florestal.gov.br; guilherme.gomide@florestal.gov.br; gilson.souza@florestal.gov.br*).

In response to the growing demand for reliable information on forest and tree resources as well as for land use/land cover (LULC) maps at larger scales, the Brazilian National Forest Inventory (NFI-BR) is now being conducted. Besides the traditional approaches related to forest assessment, the NFI-BR includes a geospatial component to provide such information at landscape scale. Using a sampling grid of 20 km × 20 km, field registry sample units were established, and 100-km^2 landscape sample units were located on a 40 km × 40 km grid. LULC maps at 1:50000 scale are being prepared for each LSU using RapidEye imagery. The mapping approach uses object-based image classification and newly developed vegetation indices. Attributes from image objects such as spectral characteristics, texture, and context are also involved in process tree classification. A special feature of the LULC map legend is the inclusion of trees outside forests (TOFs), which are isolated trees or small groups of trees not classified as forests. LULC maps are the basis for analyzing landscape-scale forest fragmentation analysis as well as for evaluating compliance of permanent preservation areas under recently approved environmental legislation.

Remote sensing, GIS, and successive inventory for forest resource assessment in the Blue Nile region, Sudan. Mahmoud El-Abbas, M. (*Dresden University of Technology, Germany; mmelabbas@hotmail.com*), A. Elsiddig, E. (*University of Khartoum, Sudan; elnour-elsiddig@yahoo.com*).

Well-designed information systems and management plans are needed as the forest sector in Sudan faces many challenges. One of these challenges is land use/land cover (LULC) changes, particularly deforestation and land degradation. To cope with this issue, the efficiency of successive forest inventory was tested in vast areas of the Blue Nile region. In order to estimate the change, a field mission was conducted in 2005 to revisit the same plots determined within the framework of an AFRICOVER project in 1996. Earth observation data were used to assess the estimates from field inventories. The study showed a high correlation for LULC data obtained by the two methods. Meanwhile, data collected from successive inventory provide detailed information about the vegetation cover. In the area under investigation, results showed the forest land was drastically decreased and degraded. The agrarian structure in conversion of forest into agricultural fields and grassland was considered to be the main cause of deforestation. To conclude, remote sensing and GIS are efficient tools and have been effectively used to estimate large-scale LULC and its dynamics in a timely and cost-effective manner.

Developing modular methods for predicting forest growth responses to environmental change. Mäkelä-Carter, A., Nikinmaa, E., Härkönen, S. Kalliokoski, T., Kolari, P. (*University of Helsinki, Finland; annikki.makela@helsinki.fi; eero.nikinmaa@helsinki.fi; sanna.harkonen@helsinki.fi; tuomo.kalliokoski@helsinki.fi; pais.kolari@helsinki.fi*), Linkosalo, T., Mäkipää, R., Peltoniemi, M. (*Finnish Forest Research Institute (METLA), Finland; tapio.linkosalo@metla.fi; raisa.makipaa@metla.fi; mikko.peltoniemi@metla.fi*), Valsta, L. (*University of Helsinki, Finland; lauri.valsta@helsinki.fi*).

Prediction of forest growth under climate change involves quantification of a multitude of impacts at different spatial and temporal scales. Few ecosystem models incorporate all the essential impacts simultaneously, and single models easily become too complex to parameterise for larger areas or longer time spans. Much information about forest ecosystem functioning is quantified in different models. The Helsinki Integrated Forest Impact Model System (HIFI-MS) approach is to combine models in a modular system for estimating climate change impacts at a regional scale. The method is applied to adaptation of forest management under climate change in southern Finland. Process models were used to predict daily net primary productivity and C and N release from the soil. The results were expressed as parameters of a stand growth model and mapped over the region. A growth model with optimal C:N allocation was applied to derive the climate-sensitive parameters to carbon allocation. These were translated into changes in volume growth and used as input to an empirical growth model to estimate regional forest growth changes. The authors' models predict that despite increasing growth potential with climate change, the initial age distribution of stands will largely determine the total growth in the region for 40–50 years. After this period, climate scenarios and management options start to influence the outcome.

Intra-annual xylem formation of Norway spruce and Scots pine across a latitudinal gradient in Finland. Mäkinen, H., Jyske, T., Kalliokoski, T., Nöjd, P. (*Finnish Forest Research Institute (METLA), Finland; harri.makinen@metla.fi; tuula.jyske@metla.fi; tuomo.kalliokoski@metla.fi; pekka.nojd@metla.fi*).

The expected changes of climate call for better insight into the growth responses of trees to varying environmental conditions over large geographical regions. The authors analysed the intra-annual xylem formation of Norway spruce (*Picea abies* (L.) Karst.) and Scots pine (*Pinus sylvestris* L.) across a latitudinal gradient in Finland (60–68°N). The number of tracheids and the onset, highest rate, and cessation of xylem formation were determined in nine stands during growing seasons of 2001–2009. Tracheid formation initiated earlier and ceased later for Scots pine than for Norway spruce. In northern Finland, xylem formation started later and ceased earlier than in the south. The temperature sum (TS) at growth cessation was lower in the north. In the northernmost stand, the length of the growing season was less than 2 months and the onset of xylem formation required lower TS than elsewhere. The highest tracheid formation rate occurred slightly after the summer solstice, but differences between sites and variation by year were high. The results imply that year-to-year weather variation has a marked impact on the timing of xylem formation. However, the results support the hypothesis that the provenances have adapted genetically and adjust their wood formation to local conditions.