

# **IUFRO Research Group 7.01 “Impacts of Air Pollution and Climate Change on Forest Ecosystems”**

## **Annual Report for 2011**

### **Newsletter No. 1/2012**

In 2011, the **entire RG.7.01** and especially **WP. 7.01.01. Detection, Monitoring and Evaluation** with its Deputy Coordinator, Algirdas Augustaitis and his wife Inga, were busy preparing the 2012 bi-annual meeting of the RG. 7.01 „Biological Reaction of Forests to Climate Change and Air Pollution“ that will be held in Kaunas, Lithuania on May 18-26, 2012. For more information on this meeting please see: <http://www.iufro-at-lzuu.lt/> \*\*\***Remark - registration deadline of this conference has been extended to March 1, 2012.**\*\*\*

Deputy coordinator of RG. 7.01.00, Elena Paoletti with substantial help of other RG members, especially the coordinating team of WP 7.01.02 (Rainer Matyssek, Alessandra Kozovits and Gerhard Wieser), organized the COST Action FP0903 conference entitled “Ozone, climate change and forests” that was held in Prague, Czech Republic in June 2011 < <http://cost-fp0903.ipp.cnr.it/events/conferenceprague.html> >

The conference was attended by 90 participants from 25 countries, including several IUFRO 7.01 officers. A total of 5 keynote, 39 full presentations and 15 poster short talks were given. Eight presentations belong to the session 1A: Ozone fluxes and effects, 5 presentations to the session 1B: Monitoring of ozone effects, 8 presentations to the session 2: Ozone standards for forests, 11 presentations to the session 3: Interaction of ozone effects with climate change, 4 presentations to the session 4: Ozone effects on below-ground part of forest ecosystems and 3 presentations to the session 5: ICP Vegetation: insights from crop science. The conference was very successful in achieving its main objective, i.e. to give a survey of present knowledge on interactions of climate change and ozone impacts on forests and other vegetation. Newest developments of modeling, including both physiological (stomatal flux) and environmental conditions were discussed. The proceedings of the conference will be peer-reviewed and printed in three journals: Environmental Pollution, Journal of Environmental Monitoring and iForest.

Among important scientific issues that IUFRO 7.01 and COST Action FP0903 is an establishment of the Supersites in Europe, i.e. forest sites where integrated soil, atmosphere and plant research and monitoring can be carried out. Planned system of supersites will be based on a small number of highly instrumented supersites and a large number of lower intensity monitoring sites. For integrating information about the research and measured parameters into the main European Research Networks on effects of air pollution, climate change and forests, an Excel metadatabase was developed and made freely available at the Action FP0903 website (<http://cost-fp0903.ipp.cnr.it/Downloads/WG1%20metadatabase.xlsx>).

### **WP 7.01.02. Mechanisms of Action and Indicator Development**

Rainer Matyssek and Gerhard Wieser organized a 5-day Summer School on “*Ecophysiological Field Techniques in Climate Change and Pollution Research*”. The School was held on September 5-9, 2011, at Fondazione Mach, Centro di Ecologia Alpina, Monte Bondone in Trentino, Northern Italy, and was organized in cooperation with the local host Loris Vescovo and his colleagues. The aim of this training course was to provide young researchers with theoretical knowledge and methodological skills needed for better understanding of state and potential of forest mitigation and adaptation to climate change in a polluted environment, and to reconcile process-oriented research, long-term monitoring and applied as well as mechanistic modelling. The Summer School focused on: (1) assessing water potential, leaf-level gas exchange and sap flow in adult forest trees, and up-scaling tree water relations to stand-level water balance; (2) highlighting drought effects on tree ecophysiology employed through experimental manipulation; (3) assessing soil CO<sub>2</sub> efflux; and (4) introducing into theoretical backgrounds about usage of eddy covariance techniques and modelling in Climate Change and Pollution Research.

Nineteen students from 14 countries (Austria, Bulgaria, Denmark, Estonia, France, Germany, Italy, Latvia, Poland, Romania, Serbia, Slovenia, Spain, Turkey, United Kingdom) attended the course <http://cost-fp0903.ipp.cnr.it/training-school/ts2011-italy.html>.



Figure 1. Introduction into eddy covariance methodology (photo credit – Rainer Matyssek).



Figure 2. Getting acquainted with porometers for gas exchange analysis of leaves (photo credit - Rainer Matyssek).

### **WP 7.01.03. Atmospheric Deposition, Soils and Nutrient Cycling**

Mark Fenn, coordinator of WP 7.01.03 was lead author of a new report published by the Ecological Society of America as part of the Issues in Ecology series. This report provides a synthesis on the use of air pollution thresholds to protect and restore ecosystems in the United States. However, the science discussed in this report has applicability to ecosystems in other regions as well. The use of ecological thresholds for acidic deposition, mercury and nitrogen deposition are considered in this report, which is particularly targeted towards the general public and policy makers.

Mark Fenn also contributed to the latest National Acid Precipitation Program (NAPAP) Report to Congress, which provides a national assessment of progress in the United States in reducing the ecological impacts of acid deposition to ecosystems and the environment. Members of the working party also published a review paper in the journal *Ecological Applications* on empirical critical loads for nitrogen in the major ecoregions in the United States. This report includes maps of empirical critical loads and critical load exceedance for the United States.

Members of Division 7.01.03 have recently completed studies of the effects of cruise ship emissions in air quality and epiphytic lichen communities in Southeast Alaska. A preliminary report has been published. Atmospheric concentrations of air pollutants, deposition, and concentration of some elements, including sulfur, lead, zinc, and vanadium, in lichen tissue samples near ship docks were considerably elevated above background levels. In general, as the distance increased from human activity centers, levels of pollutants declined.

Deputy Coordinator of IUFRO-RG 7.01.03, Viktor Bruckman is an active member of the IUFRO TF “Bioenergy”. The prominent research discussion topic was the impact of forest management (silvicultural practices) on aboveground and belowground carbon pools and fluxes (Bruckman et al., 2011). A follow-up paper on nutrient pools (aboveground and belowground, in different compartments) is in preparation and lab work was nearly completed in 2011. Additionally, a TF meeting was held in November 2011 in Vienna during the ESF-COST Research Conference “The Future Role of Bio-energy from Tree Biomass in Europe”. Agenda for the remaining period was discussed and agreement was reached on a need to publish a fact sheet about Forest Bioenergy. Forest Bioenergy is also a major topic in the EGU General Assembly 2012 Session ERE1.8 – Aspects of Biomass utilization from Forests and other Resources. This event will officially start future cooperation between IUFRO and EGU. The session, as well as options for further cooperation were elaborated and prepared in 2011.

#### **WP 7.01.04 Genetic Aspects**

In the study of genetic aspects of air pollution and climate change, particularly the fields of molecular genetics and corresponding investigations on the function of genes supply a variety of applications. Consequently, the identification of stress indicative genes and the integration of genetic markers in the long-term monitoring of the responses of tree populations to various stresses continued to be the focus of the research group 7.01.04 during 2011.

As pointed out at the bi-annual conference of RG. 7.01 in Antalya in 2010, genetic dynamics are essential for understanding the complex processes of adaptation and survival of forest tree populations. An example which illustrates an integrative strategy and the concept “from gene to landscape” very well is the recent book publication “Spruce Forest Decline in the Beskids” (jointly published by Slovakian, Czech and Polish research institutions) which addresses various ecosystem and management related aspects with inclusion of physiological and genetic insights.

## **WP 7.05 Modeling and Risk Assessment**

Activities of the Coordinator of this WP, Salim Belyazid, were:

- Organizing of an international conference on Soil Carbon entitled: Understanding and modeling the effects of nitrogen enrichment on forest soil carbon stocks. The conference was held in Höör, Sweden, and jointly supported by the Centre for Ecosystems and Climate Research, Lund University, and the Nordic Forest Soil Carbon Network
- Participating and contribution to the international conference: Nitrogen and Global Change, Held in Edinburgh, Scotland, on April 11<sup>th</sup> to 14<sup>th</sup>, 2011, and which resulted in the Edinburgh Declaration on Reactive Nitrogen.
- Participation in and contribution to the 10th AcidRain conference in Beijing, China.
- Participation and contribution to the 2011 National Atmospheric Deposition Program meeting, held in Providence, RI, USA.

### **7.01.08 Hydroecology**

The WG Hydroecology was established in 2010 to support studies in the conjunction of ecology and hydrology. Forest and water is one of the high priority areas of IUFRO. The forest-water interaction has been a major concern in both local and global scales due to anthropogenic stressors like climate change and air pollution. Therefore, the management of forests towards water and carbon management and air pollution mitigation becomes a challenging issue and concern to be addressed. The first WG meeting of Hydroecology WG will be organized in Kahramanmaraş-Turkey on September 2-6, 2012.

In 2011, WG 7.01.08 was involved in the following activities:

- Organizing a session at IALE (International Association of Landscape Ecology) 2011 in Beijing on air pollution, climate change and forests. The summary note of the session was published at IUFRO Newsletter,
- Participating in the Climate change action plan of Turkey to suggest actions to combat climate change (Establishment of monitoring systems and support to scientific studies etc.).
- Organizing a national (with international participation) workshop on Adaptation to Climate Change in Antalya in February 2011.
- Supported graduate students for studies abroad (2 Turkish students for Cost Action summer camps and 2 Students for scientific visits to Italy).
- Attended various scientific and technical meetings to emphasize the ecohydrology, air pollution and climate change.



Figure 3. Scientific session organized by IUFRO 7.01.08 WP Hydroecology at the World Congress of the International Association of Landscape Ecology in Beijing, China in August 2011 (Photo credit – Yusuf Serengil).

## Conference Talks:

Ballarin-Denti, A. The impact of climate change, ozone and natural risks on Alpine forests: adaptation versus mitigation policies. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.

Bruckman, Viktor J.; Shuai, Yan; Hochbichler, Eduard; Glatzel, Gerhard (2011) Impact of forest stand management on temporal dynamics of soil carbon and nitrogen. European Geosciences Union (EGU) General Assembly 2011). Geophysical Research Abstracts Vol. 13; Copernicus Publications, Göttingen, Germany.

Shuai, Yan; Bruckman, Viktor J.; Glatzel, Gerhard; Hochbichler, Eduard (2011) A chronosequence approach to study stand age effects on total nitrogen as well as exchangeable K, Ca and Mg in the soils in view of increased energetic utilization of Quercus dominated forests in northeastern Austria. European Geosciences Union (EGU) General Assembly 2011). Geophysical Research Abstracts Vol. 13; Copernicus Publications, Göttingen, Germany.

- Bruckman, Viktor J.; Hochbichler, Eduard; Glatzel, Gerhard (2011) Kohlenstoffhaushalte in eichendominierten Mittelwaldbeständen und hochwaldartigen Beständen im Weinviertel. [Carbon budgets in oak-dominated coppice and pseudo-high forests in the Austrian Weinviertel area]. Proceedings – Central European Biomass Conference 2011, 26th – 29th January, Graz, Austria, p. 139.
- Díaz-de-Quijano, M., Vollenweider, P., Ogaya, R., Peñuelas J., 2011. Ozone concentrations and dieback of *Pinus mugo* subsp. *uncinata* stands in the Catalan Pyrenees. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- de Marco, A. How is tree primary productivity related to climate and atmospheric pollution in Italy? International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- de Vries, W. Modelling past and future impacts of changes in climate, nitrogen deposition, ozone and CO<sub>2</sub> exposure on carbon sequestration in European forests. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Díaz-de-Quijano, M., Vollenweider, P., Ogaya, R., Peñuelas J., 2011. Ozone concentrations and dieback of *Pinus mugo* subsp. *uncinata* stands in the Catalan Pyrenees. International Conference Ozone, Climate Change and Forests, 14-16 June 2011, Prague, Czech Republic. Conference abstract book
- Emberson, L. Understanding climates influence on ozone deposition and implications for human health and ecosystem impacts: a case study for the UK. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Gerosa, G. Assessing ozone hazards to natural forests in the Alpine area. Comparison of a wide scale mapping technique with local passive sampler measurements. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Harmens, H. Species-specific responses of tree saplings to a combination of increasing background ozone and drought . International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Hlásny, T., Sitková, Z. (eds.) 2010: Spruce forests decline in the Beskids. Zvolen: National Forest Centre – Forest Research Institute Zvolen & Czech University of Life Sciences Prague & Forestry and Game Management Research Institute Jíloviště – Strnady: 184 p. ISBN 978-80-8093-127-8
- King, J. S. Responses of forest carbon and water cycling to elevated atmospheric CO<sub>2</sub> and O<sub>3</sub> at Aspen FACE: A summary of ten years of research. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.

- Kivimäenpää, M. Emission of volatile organic compounds (VOCs), expression of VOC-related genes, gas exchange and growth of Norway spruce saplings exposed to elevated ozone and elevated temperature. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Kühn, A., Baumgarten, M., Matyssek, R. The potential of beech (*Fagus sylvatica* L.) for coping with drought and ozone impact as components of climate change. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Lungjame, J. : Challenges of EANET to Promote Regional Cooperation on Atmospheric Environment. Acid rain 2011 conference in Beijing, China on 15-18 June 2011.
- Mankovska, B. Influence of greenhouse gases on epicuticular waxes of *Populus tremuloides* Michx. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Matyssek, R., Wieser, G. Lessons from Kranzberg Forest - Ozone research quo vadis ? International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Pamukcu, P., Erdem, N., Serengil, Y., 2011. Landscape potential assessment in River Basins: Riva Creek Case Study. IALE 2011 World Congress, Beijing-China.
- Serengil, Y., Yurtseven, İ., 2011. Changes in Macroinvertebrate Species Composition between Forest and Urban Watersheds in Istanbul. IALE 2011 World Congress. Beijing-China.
- Serengil, Y., Uygur, B., Yurtseven, İ., 2011. Urban Riparian Ecosystems in Istanbul. IALE 2011 World Congress. Beijing-China.
- Serengil, Y., Uygur, B., Yurtseven, İ., 2011. Degradation of Urban Riparian Ecosystems in Istanbul. IALE 2011 World Congress. Beijing-China.
- Soja, G. Trend analysis of ground-level ozone exposure and ozone uptake of oaks in Eastern Austria for the period 1990-2010. International Conference Ozone, climate change and forests, 14-16 June 2011, Prague, Czech Republic.
- Yan, Shuai; Bruckman, Viktor J.; Glatzel, Gerhard, Hochbichler, Eduard (2011) Nutrient Pools in Oak Forests as a decision support for harvesting intensities (Biomass potential). Abstract, Proceedings – Central European Biomass Conference 2011, 26th – 29th January, Graz, Austria, p. 182.



## Conference Posters:

- Díaz-de-Quijano, M., Peñuelas, J., Menard, T., Vollenweider P., 2011 Visible and microscopical ozone injury in mountain pine (*Pinus mugo* subsp.*uncinata*) foliage from the Catalan Pyrenees. International Conference Ozone, Climate Change and Forests, 14-16 June 2011, Prague, Czech Republic. Conference abstract book (<http://cost-fp0903.ipp.cnr.it/Downloads/Prague/BookAbstracts.pdf> ), 61.
- Moura, B. B., Vollenweider, P., Alves E. S., 2011. Validation of specific ozone symptoms in rain forest trees of southern Brazil. International Conference Ozone, Climate Change and Forests, 14-16 June 2011, Prague, Czech Republic. Conference abstract book (<http://cost-fp0903.ipp.cnr.it/Downloads/Prague/BookAbstracts.pdf> ), 66.

## Selected journal publications:

- Badea, O., Neagu, S., Bytnerowicz, A., Silaghi, D., Barbu, I., Iacoban, C., Popescu, F., Andrei, M., Preda, E., Iacob, C., Dumitru, I., Iuncu, H., Huber, V. (2011) Long-term monitoring of air pollution effects on selected forest ecosystems in the Bucegi-Piatra Craiului and Retezat Mountains, southern Carpathians (Romania). *iForest*, 4, 49-60.
- Belyazid, S., Kurz, D., Braun, S., Sverdrup, H., Rihm, B., Hettelingh, JP., 2011. A dynamic modelling approach for estimating critical loads of nitrogen based on plant community changes under a changing climate. *Environmental pollution*, 159: 789-801.
- Belyazid, S., Sverdrup, H., Kurz, D., Braun, S., 2011. Exploring ground vegetation change for different scenarios and methods for estimating critical loads for biodiversity using the ForSAFE-Veg model in Switzerland and Sweden. *Water, Air and Soil Pollution*, 216:289-317.
- Bruckman, V. J.; Yan, S.; Hochbichler, E.; Glatzel, G. 2011. Carbon pools and temporal dynamics along a rotation period in *Quercus* dominated high forest and coppice with standards stands. *Forest Ecology and Management*, 262, p. 1853-1862.
- Burley, J., Bytnerowicz, A. 2011. Surface ozone in the White Mountains of California. *Atmos. Environ.*, 45, 4591-4602.
- Burns, D.A., Fenn, M.E., and Baron, J.S. 2011. Effects of Acid Deposition on Ecosystems: Advances in the State of the Science. pp. 45-70 In: Burns, D.A., Lynch, J.A., Cosby, B.J., Fenn, M.E., Baron, J.S., US EPA Clean Air Markets Div., *National Acid Precipitation Assessment Program Report to Congress 2011: An Integrated Assessment*. [http://ny.water.usgs.gov/projects/NAPAP/NAPAP\\_2011\\_Report\\_508\\_Compliant.pdf](http://ny.water.usgs.gov/projects/NAPAP/NAPAP_2011_Report_508_Compliant.pdf). National Science and Technology Council, Washington, DC, 114 p.
- Bytnerowicz, A. Bartuska, A. 2011. USDA Forest Service Research and Development – caring



- for the land and serving people. *Folia Forestalia Polonica*, Poland, 53, 68-73
- Dise, N.B., Ashmore, M., Belyazid, S., Bleeker, A., Bobbink, R., de Vries, W., Erisman, J.W., Spranger, T., Stevens, C.J., van den Berg, L., 2011- Nitrogen as a threat to European terrestrial biodiversity. In *The European Nitrogen Assessment, Sources, Effects and Policy Perspectives*. Sutton et al. Eds.
- Fenn, M.E., Lambert, K.F., Blett, T.F., Burns, D.A., Pardo, L.H., Lovett, G.M., Haeuber, R.A., Evers, D.C., Driscoll, C.T. and Jeffries, D.S. 2011. Setting limits: Using air pollution thresholds to protect and restore U.S. ecosystems. *Issues in Ecology*, Report Number 14. J.S. Baron, Editor-in-Chief. Ecological Society of America. Washington, D.C.
- Fischer R, Aas W, De Vries W, Clarke N, Cudlin P, Leaver D, Lundin L, Matteucci G, Matyssek R, Mikkelsen T, Mirtl M, Öztürk Y, Papale D, , Potocic N, Simpson D, Tuovinen J-P, Vesala T, Wieser G, Paoletti E, (2011) Towards a transnational system of supersites for forest monitoring and research in Europe – an overview on present state and future recommendations. *iForest – Biogeosciences and Forestry*, 4: 167-171
- Geiser, L., Schirokauer, D., Bytnerowicz, A., Dillman, K., and Fenn, M. 2011. Effects of Cruise Ship Emissions on Air Quality and Terrestrial Vegetation in Southeast Alaska. *Alaska Park Science* 9: 26-31.
- Grams TEE, Werner H, Kuptz D, Ritter W, Fleischmann F, Andersen C, Matyssek R (2011) A free-air system for long-term stable carbon isotope labeling of adult forest trees. *Trees* 25:187-198
- Grünhage L, Bender J, Jäger H-J, Matyssek R, Weigel H-J (2011) Evaluation of the ozone-related risk for wheat at the local scale. *ICP-Report*: 78-82.
- Grünhage L, Bender J, Jäger H-J, Matyssek R, Weigel H-J (2011) Beurteilungswerte für Ozon zum Schutz der Vegetation. *Gefahrstoffe – Reinhaltung der Luft* 71/ 3:79-89.
- Kuptz D, Matyssek R, Grams TEE (2011) Seasonal dynamics in the stable carbon isotope composition ( $\delta^{13}\text{C}$ ) from non-leafy branch, trunk and coarse root  $\text{CO}_2$  efflux of adult deciduous (*Fagus sylvatica*) and evergreen (*Picea abies*) trees. *Plant, Cell and Environment* 34:363-373.
- Kuptz D, Fleischmann F, Matyssek R, Grams TEE (2011) Seasonal patterns of carbon allocation to respiratory pools in 60-yr-old deciduous (*Fagus sylvatica*) and evergreen (*Picea abies*) trees assessed via whole-tree stable carbon isotope labeling. *New Phytologist* 191:160-172.
- Matyssek R (2011) Erhöhter Ozonstress führt zu erheblicher Einschränkung der Kohlenstoffbindung in Altbuchen. *Gefahrstoffe – Reinhaltung der Luft* 71:103-107.

- Matyssek R, Wieser G, Calfapietra C, de Vries W, Dizengremel P, Ernst D, Jolivet Y, Mikkelsen T.N, Mohren G.M.J, le Thiec D, Tuovinen J-P, Weatherall A, Paoletti E (2012) Forests under climate change and air pollution: Gaps in understanding and future directions for research. *Environmental Pollution* 160:57-65.
- Paoletti, E., Serengil, Y., 2011. Preface to the IUFRO special section: Adaptation of forest ecosystems to air pollution and climate change. *Environmental Pollution* 159, 1023.
- Pardo, L.H., Fenn, M.E., Goodale, C.L., Geiser, L.H., Driscoll, C.T., Allen E.B., Baron, J.S., Bobbink, R., Bowman, W.D., Clark, C.M., Emmett, B., Gilliam, F.S., Greaver, T.L., Hall, S.J., Lilleskov, E.A., Liu, L., Lynch, J.A., Nadelhoffer, K.J., Perakis, S.S., Robin-Abbott, M.J., Stoddard, J.L., Weathers, K.C., and Dennis, R.L. 2011. Effects of nitrogen deposition and empirical nitrogen critical loads for ecoregions of the United States. *Ecol. Applic.* 21: 3049-3082.
- Ritter W, Andersen C.P, Matyssek R, Grams T.E.E. (2011) Carbon flux to woody tissues in a beech/spruce forest during summer and in response to chronic elevated O<sub>3</sub> exposure. *Biogeosciences Discussions* 8:4131-4161.
- Serengil Y, Augustaitis A, Bytnerowicz A, Grulke N, Kozovitz AR, Matyssek R, Müller-Starck G, Schaub M. Wieser G, Coskun AA, Paoletti E (2011) Adaptation of forest ecosystems to air pollution and climate change: a global assessment on research priorities. *iForest* 4:44-48.
- Serengil, Y., Augustaitis, A., Bytnerowicz, A., Grulke, N., Kozovitz, A.R., Matyssek, R., Mueller-Starck, G., Schaub, M., Wieser, G., Coskun, A.A., Paoletti, E., 2011. Adaptation of forest ecosystems to air pollution and climate change: a global assessment on research priorities. *IForest Biogeosciences and Forestry* 4, 44-48.
- Serengil, Y., Swank, W.T., Riedel, M.S., Vose, J.M., 2011. Conversion to Pine: Changes in timing and magnitude of high and low flows. *Scandinavian Journal of Forest Research*. 26, 568-575.