

# Laboratory of ecophysiological anatomy

## Research topic A): Plant ecophysiology under impact of environmental factors

studies focused on the role of plants in globally changing environment connected mainly with anthropogenic pollution

## Current research projects:

### 1. Assessment of Mining Related Impacts Based on Utilization of HyMap Airborne Hyperspectral Sensor. **GAČR 205/09/1989 (2009-2013)**

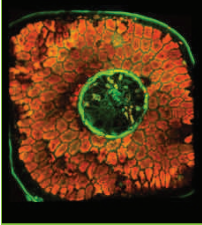
- international project:

**Project PI at the Czech geological survey Mgr. V Kopačková**  
**PI at Charles University – doc. J. Albrechtová**

collaborations:

- **Czech geological survey - Mgr. V Kopačková, Mgr. J. Mišurec**
- **Global Change Research Centre AS CR, v.v.i.– Ing. J. Hanuš**
- **Martin- Luther University, Halle, Germany – prof. C. Glaesser**
- **University of Zurich, Switzerland – Dr. Z. Malenovský**
- **at the Charles University: Department of Applied Geoinformatics and Cartography – Dr. Potůčková, Dr. Kupková**





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## A1-1. Assessment of Mining Related Impacts Based on Utilization of HyMap Airborne Hyperspectral Sensor.

Sokolov – north-western Czech Republic (field research + remote sensing)

Assesment of vegetation physiological status using hyperspectral data.

Sample collection in adjacent Norway spruce forests.



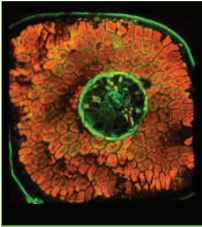
Sample collection at post-mining heap Lítov, which is recultivated with Scots pine and spontaneously regrew by Silver birch.

Substrate with high content of trace elements: As, Pb, Hg.



**GAČR 205/09/1989 (2009-2013)**





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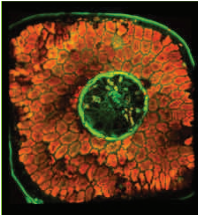
Using laboratory spectroscopy we search for suitable vegetation indices, which are tightly related with contents of important biochemical leaf compounds such as: photosynthetic pigments, phenolics and lignin. These relationships are later used for interpretation of HyMap data.



Our goal is to assess the tree physiological status (Norway spruce, Scots pine and Silver birch) based on relationships between foliage chemistry and reflectance.

**GAČR 205/09/1989 (2009-2013)**





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## A1-1. Assessment of Mining Related Impacts Based on Utilization of HyMap Airborne Hyperspectral Sensor.

Sokolov – north-western Czech Republic (field research + remote sensing)

### Publications and outputs from last 5 years:

Malenovský Z, Albrechtová J, Lhotáková Z, Zurita-Milla R, Clevers JGPW, Schaepman ME, Cudlín P (2006): Applicability of the PROSPECT model for Norway spruce needles. *INTERNATIONAL JOURNAL OF REMOTE SENSING* 27: 5315-5340.

Malenovský Z, Ufer C, Lhotáková Z, Clevers JGPW, Schaepman ME, Albrechtová J, Cudlín P (2006) A new hyperspectral index for chlorophyll estimation of a forest canopy: Area under curve normalised to maximal band depth between 650-725 nm. *EARSeL (European Association of Remote Sensing Laboratories)* 5(2): 161-172.

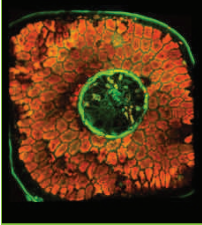
Albrechtová, Jana; Seidl, Zdeněk; Aitkenhead-Peterson, Jacqueline; Lhotáková, Zuzana; Rock, Barrett N.; Alexander, Jess E.; Malenovský, Zbyněk; McDowell, William H. (2008): Spectral analysis of coniferous foliage and possible links to soil chemistry: Are spectral chlorophyll indices related to forest floor dissolved organic C and N? *Science of The Total Environment*, 404: 424-432, ISSN 0048-9697.

**Veronika Kopačková (1), Jana Albrechtová(2), Zuzana Lhotáková (2), Jan Hanuš(3), Zbyněk Malenovský(4), Andras Jung(5), Cornelia Glasser(5), Stephane Chevrel(6), Anna Burginon(6), Christoph Salbach(5)** Hypso: a multidisciplinary hyperspectral project assessing mining related impacts by means of image spectroscopy. 17-19. 3. 2010, ESA Hyperspectral workshop, Rome, Italy

**Lucie Kupková, Markéta Potůčková, Kateřina Zachová<sup>1</sup>, Zuzana Lhotáková<sup>1</sup>, Veronika Kopačková<sup>2</sup>, Jana Albrechtová:** Chlorophyll determination in silver Birch and Scots Pine foliage from hyperspectral data. *Remote Sensing and Geoinformation not only for Scientific Cooperation EARSeL*, 2011 <http://www.conferences.earsel.org/abstract/show/2394>

**Jan Mišurec, Veronika Kopačková, Zuzana Lhotáková, Jan Hanuš, Joerg Weyermann, Petya Entcheva-Campbell, Jana Albrechtová:** Utilization of hyperspectral image optical indices to assess the Norway spruce forest health status (manuscript under preparation)





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**Research topic A): Plant ecophysiology under impact of environmental factors**

## A1. Assessment of environmental impacts on trees

### Current research projects:

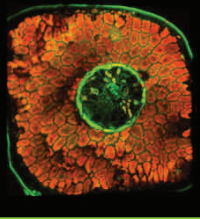
2. Impact of CO<sub>2</sub> enrichment and irradiance on structure and performance of forest tree photosynthetic apparatus at different hierarchical levels. **GACR P501/10/0340 (2010-2014)**

**PI: J. Albrechtová**

#### Collaborations:

- **Institute of Physiology, AS CR, v.v.i. – Dr. L. Kubínová, Dr. J. Janáček**
- **Global Change Research Centre AS CR, v.v.i. – Dr. Šprtová, Dr. Urban, prof. Marek**
- **University of Zurich, Switzerland – Dr. Z. Malenovský(GAČR), Dr. Joerg Weyermann**
- **University of New Hampshire, USA – prof. BN. Rock, prof. S. Ollinger**
- **University of Maryland, NASA Goddard Space Flight Center, USA**  
– Dr. P.Entcheva-Campbell



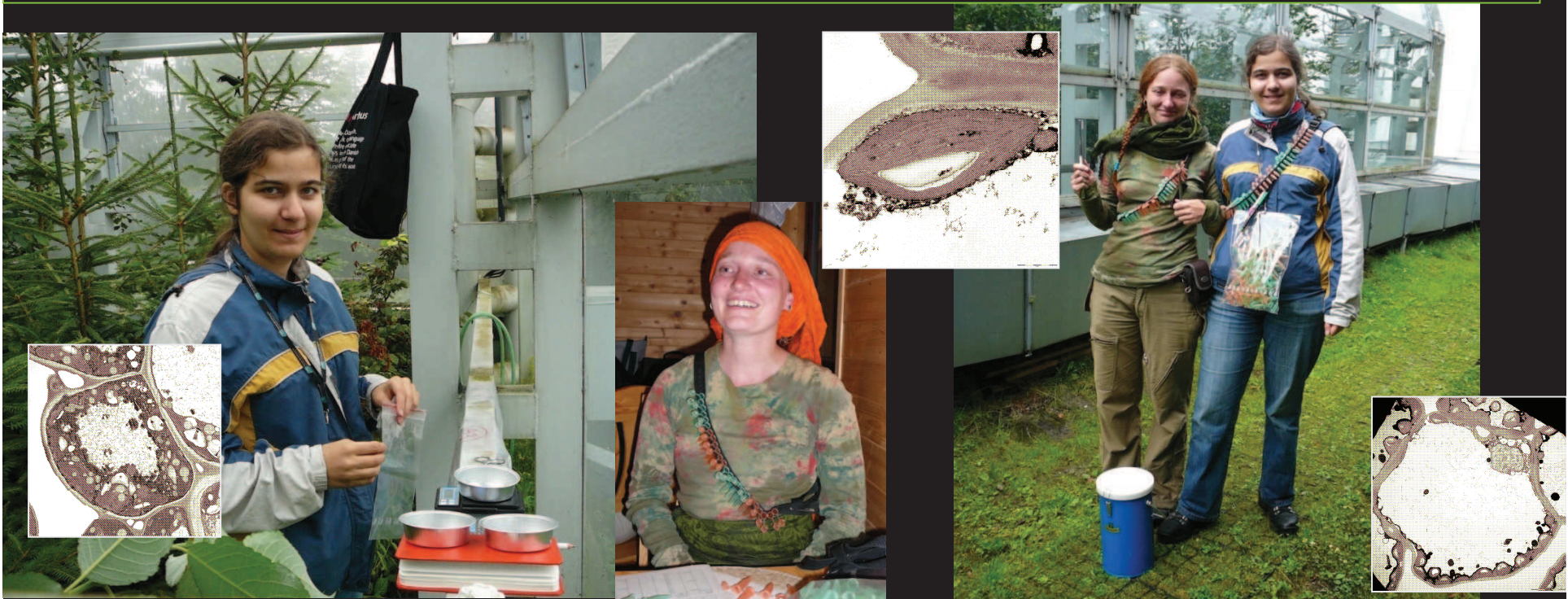


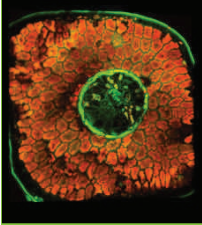
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## A1. Assessment of environmental impacts on trees

**A1-2. Impact of CO<sub>2</sub> enrichment and irradiance on structure and performance of forest tree photosynthetic apparatus at different hierarchical levels.**





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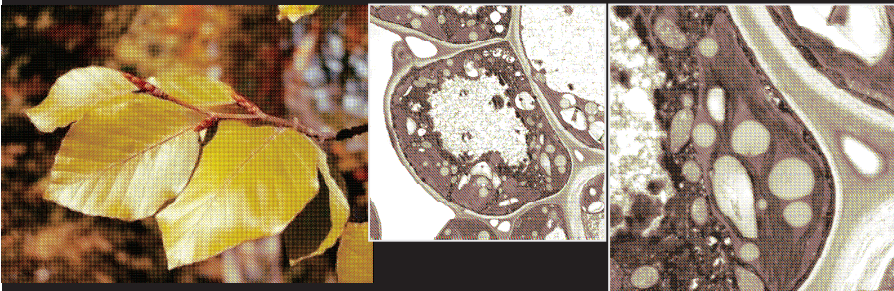
**Research topic A): Plant ecophysiology under impact of environmental factors**

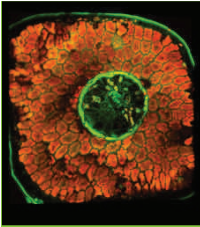
## A1. Assessment of environmental impacts on trees

### A1-2. Impact of CO<sub>2</sub> enrichment and irradiance on structure and performance of forest tree photosynthetic apparatus at different hierarchical levels.

Elevated CO<sub>2</sub> concentration enhances photosynthetic rates in both – Norway spruce and European beech. At the level of mesophyll we did not find any anatomical changes in spruce needles.

- What is the cause of enhanced photosynthetic rates? Changes at chloroplast ultrastructure, activity of electron transport rates in PS I and PS II or Rubisco activity?
- Are there any changes in content and proportion of nonstructural saccharides?





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## A1. Assessment of environmental impacts on trees

### A1-2. Impact of CO<sub>2</sub> enrichment and irradiance on structure and performance of forest tree photosynthetic apparatus at different hierarchical levels.

#### Publications and outputs from last 5 years :

Albrechtová J, Janacek J, Lhotakova Z, Radochova B, Kubinova L (2007): Novel efficient methods for measuring mesophyll anatomical characteristics from fresh thick sections using stereology and confocal microscopy: application on acid rain treated Norway spruce needles. JOURNAL OF EXPERIMENTAL BOTANY 58 (6):1451-1461.

<http://jxb.oxfordjournals.org/cgi/reprint/erm007?ijkey=VvGB5dkAsoLNPLK&keytype=ref>

Lhotáková, Z; Albrechtová, J; Janáček, J; Kubínová, L (2008): Advantages and pitfalls of using free-hand sections of frozen needles for three-dimensional analysis of mesophyll by stereology and confocal microscopy. Journal of Microscopy-Oxford, 232: 56-63, ISSN 0022-2720.

Lhotáková Z, Urban O, Dubánková M, Cvikrová M., Tomášková I, Kubínová L., Zvára K, Marek MV, Albrechtová J (submitted): The impact of long-term CO<sub>2</sub> enrichment on sun and shade needles of Norway spruce (*Picea abies*) photosynthetic performance, needle anatomy and phenolics accumulation

Holá, D, Kočová, M, Rothová, O, Hlízová, E, Fridrichová, L, Lhotáková, Z, Albrechtová, J (submitted) A universal method for the isolation of photochemical from conifer needles and its possible application in photosynthetic studies. Photosynthetica

