Arsenic contamination of Ogosta river:
Linking biogeochemical processes in floodplain
soils with river system dynamics

OUTLINE

- Cooperation

- Project Objectives and Structure

- Report on WP1

- Report on WP3

- Deviations from research plan
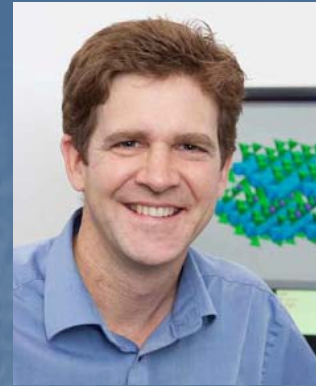
- Publications, presentations, and outreach

PART I

Cooperation

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It started with an e-mail in 2009...

Beginning of cooperation

- Visiting

the Soil Chemistry Group of prof. Ruben Kretzschmar

at IBPD-ETH Zurich in February 2010

Beginning of cooperation

- Field trips to the Ogosta River Valley in 2010 and 2012,
- Seminar at NIGGG-BAS in June 2012

- Visiting ETH Zurich in November 2012 for ASCOR proposal preparations

Beginning of cooperation

Before the start of ASCOR project we already had:

- Knowledge on expertise of both teams

- Mutual trust and respect

Cooperation
during the project

- Meetings via Skype

- Joint field trips in 2013 and 2014

- Sharing data and information stored on a server at   NIGGG-BAS

- Midterm meeting of the whole ASCOR team in May 2014   at NIGGG-BAS

- Integration of project activities and data obtained by both teams

PART II

# Progress of ASCOR project
on behalf of the BG partner

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Institute of Geophysics, Geodesy and Geography - BAS
May 2014

The BG part of the team

- PhD student Velimira Stoyanova – GIS analysis
- PhD student Kremena Boyanova – GIS database
- Dr. Georgi Zhelezov – landscape studies
- Dr. Marian Varbanov – hydrologic analysis
- Dr. Emilia Tcherkezova – LiDAR data processing, geomorphologic analysis
- Dr. Stoyan Nedkov – GIS database, hydrologic modeling
- Prof. Diana Yordanova – soil magnetic susceptibility
- Assist. Prof. Todor Lubenov – flood modeling
- Assist. Prof. Petar Gerginov- modeling As transport in saturated zone
- Dr. Nathali Van Meir – modeling As transport in unsaturated zone
- Dr. Dimitar Antonov– modeling As forms in river water
- Prof. Aleksey Benderev – hydrogeological analysis
- Dr. Tsvetan Kotsev - As distribution in soil, BG project coordinator

# Project objectives and structure

WP3

WP1

WP2
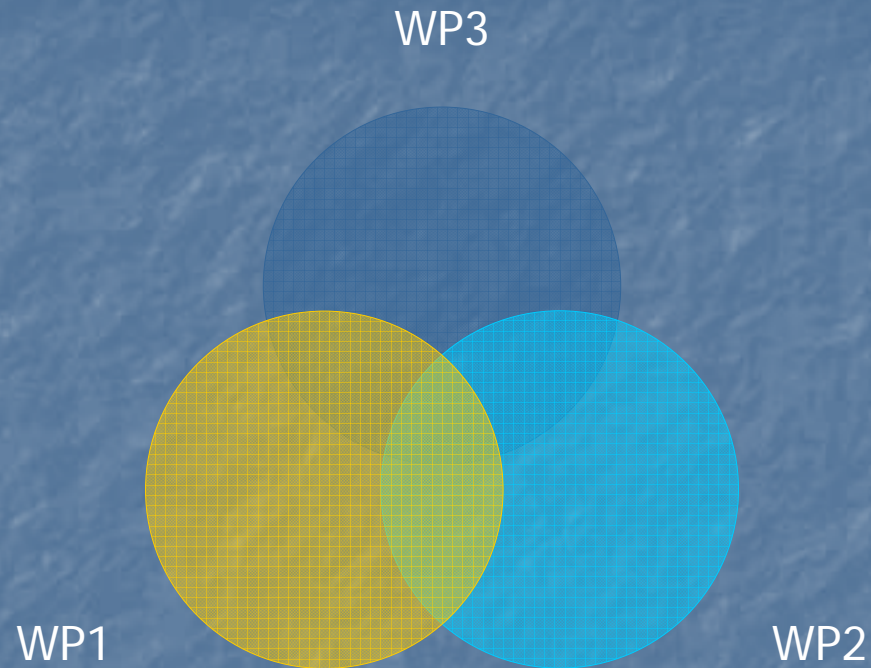
1. Investigate the Spatial extent of As contamination (WP1)

2. Reveal As speciation and mobility in river floodplains (WP2)

3. Assessment of runoff – dependent As mobilization (WP3)

Report on WP1
Spatial extend of As contamination

Task 1-1: Development of ArcGIS database

- General geographic information collected (basin scale)
    - administrative borders, settlements, roads, protected areas
    - geological data – lithology, hydrogeology;
    - hydrological data– rivers, lakes and reservoirs, hydrometric gauges, watersheds;
    - topomaps 1:5000 (valley scale) and 1:25 000
    - digital elevation model (DEM) 90m free available
    - land cover data – CORINE Land Cover 2000 free available
    - orthophoto mosaics provided by the Ministry of Agriculture and Food
    - soil maps
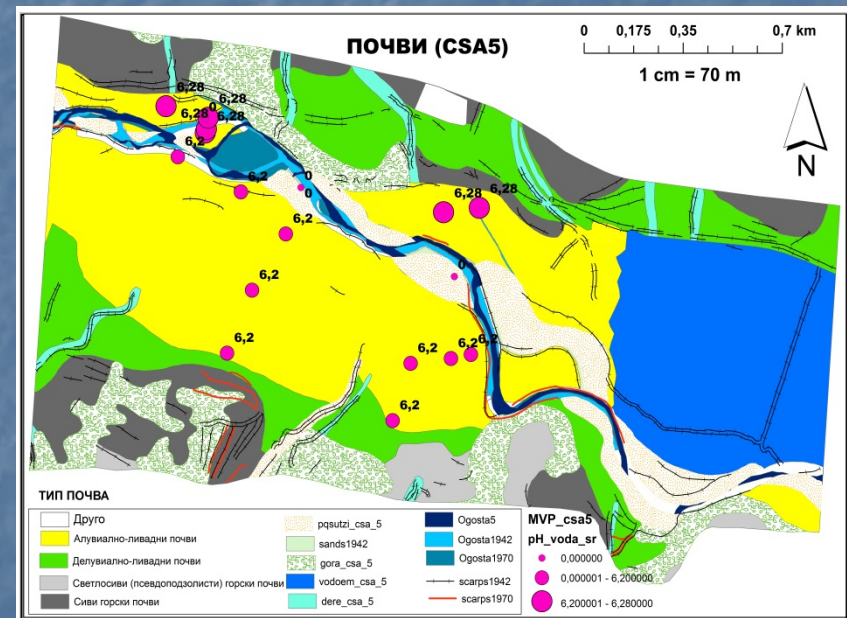
Report on WP1
Spatial extend of As contamination

Task 1-1: Development of ArcGIS database

- Project data integrated in GIS data base (valley scale)

  - Detailed orthophoto mosaics, obtained during the laser scanning

  - Precise DEM generated from the airborne laser scanning of the Ogosta Valley;

  - Maps of floodplain geomorphology

  - Lands under irrigation in the past

  - Magnetic susceptibility of floodplain soil

Report on WP1
Spatial extend of As contamination

Task 1-2: Spatial analysis of river floodplain morphology

- Airborne Laser Scanning survey conducted

- Precise DEM elaborated

- Spatial Analysis of DEM to reveal floodplain geomorphology

- Field trips for validation of the geomorphologic features

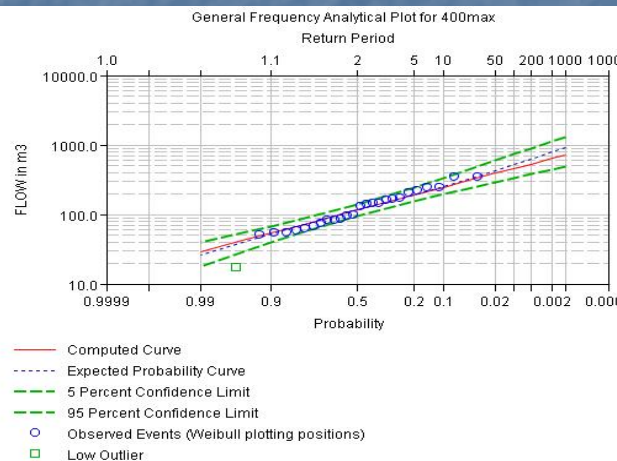- Maps of floodplain geomorphology under preparation
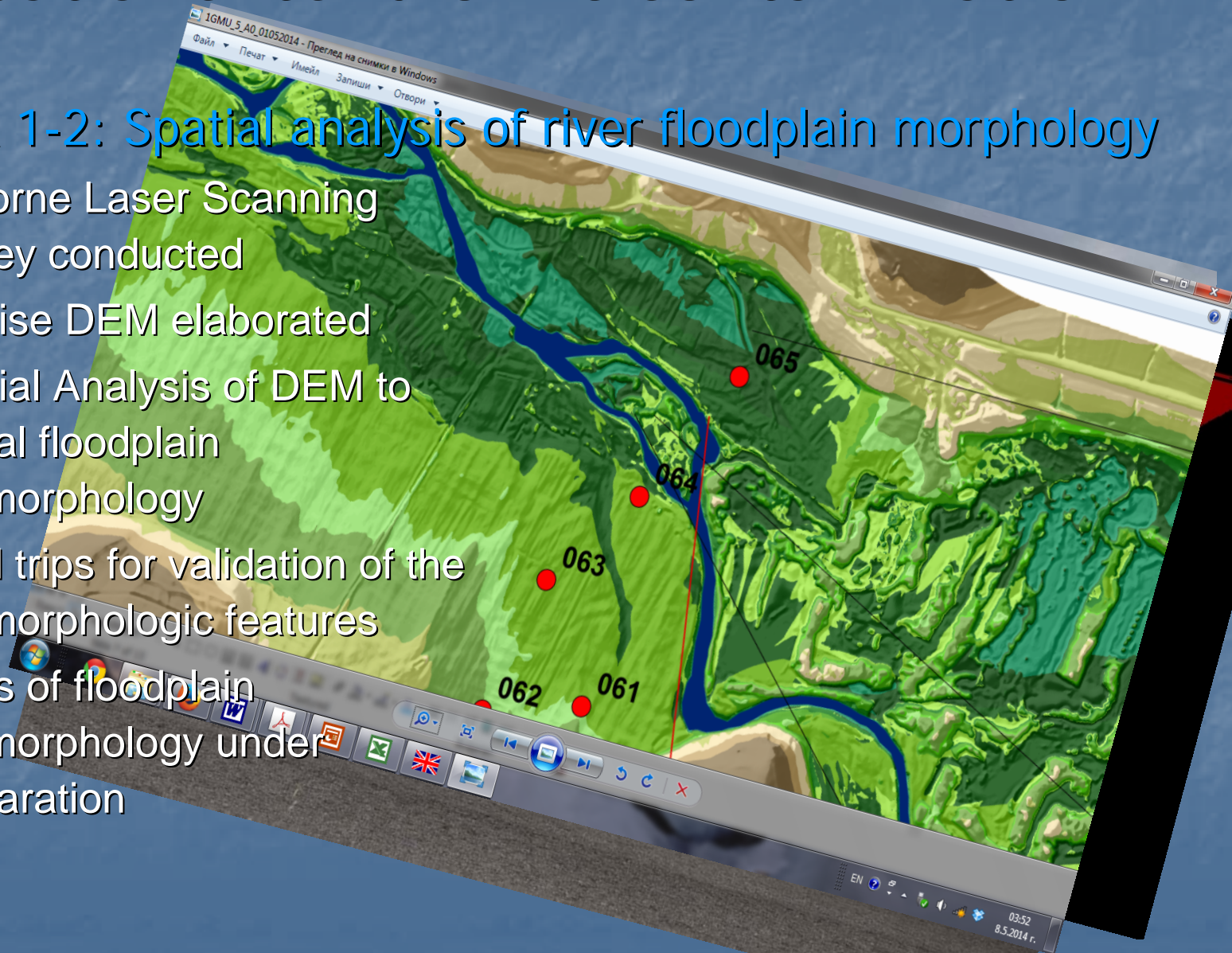
Report on WP1
Spatial extend of As contamination

Task 1-3: Hydrological analysis

- River discharge rates of annual exceedance probability (1%, 5%, 20% and 50%) calculated

- Ogosta R. cross-sections measured

- Regular river monitoring started in December'2013

General Frequency Analytical Plot for 400max

Computed Curve
Expected Probability Curve
5 Percent Confidence Limit
95 Percent Confidence Limit
○ Observed Events (Weibull plotting positions)
□ Low Outlier

Report on WP1
Spatial extend of As contamination

Task 1-4: Flood modeling

- River discharge rates along Ogosta R. are computed using the SWAT hydrologic model

- The HEC-RAS hydraulic model is calibrated and tested for several scenarios of inundation

- Information on the flood extend on 19 April 2014 is collected in the field to improve the calibration of the hydraulic model

Report on WP1
Spatial extend of As contamination

Task 1-5: Investigation of As spatial distribution

- Available data on As soil contamination has been collected
- Magnetic susceptibility of floodplain soil has been measured in more than 250 sites in the Ogosta Valley at certain depths
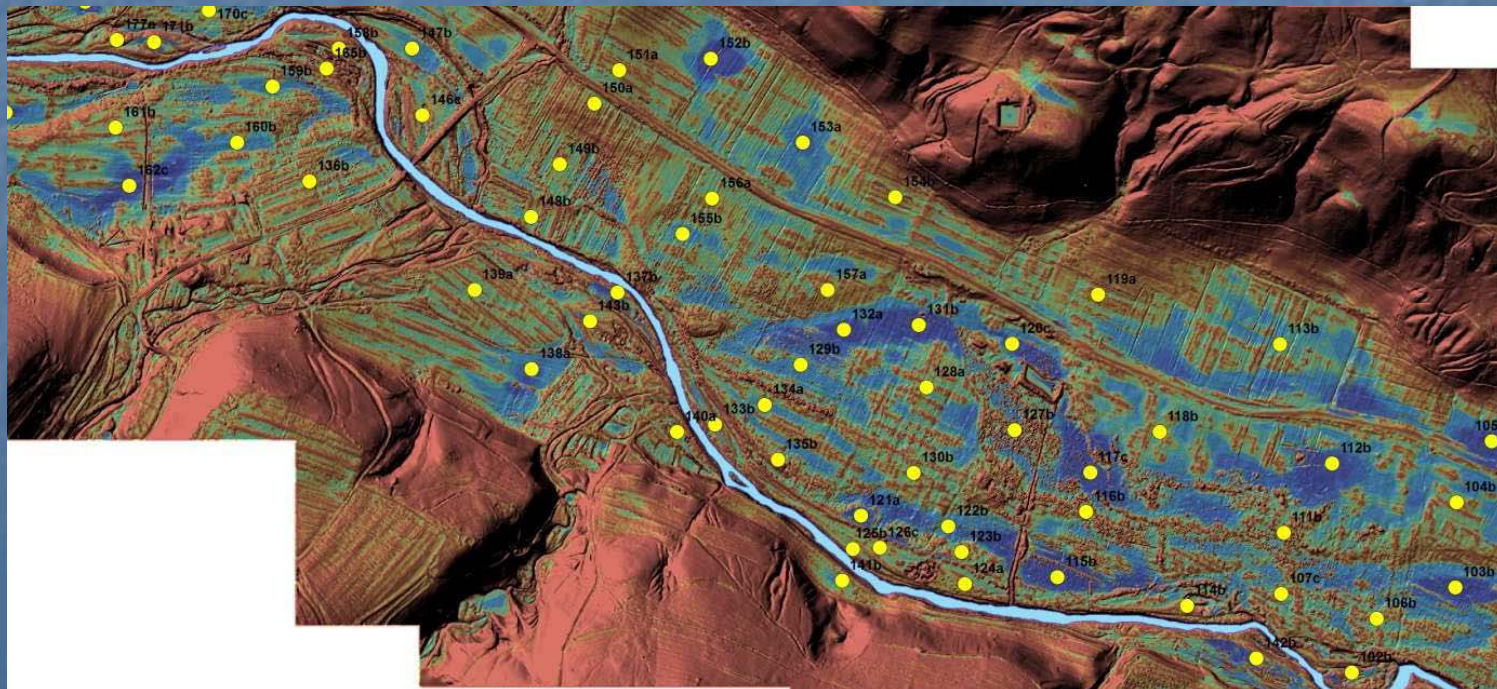
Report on WP3: Runoff - dependent As mobilization

## Task 3-1: Assessment of arsenic fluxes via groundwater

- Information on thickness and structure of floodplain sediment has been obtained in 33 sites by the VES method
- Saturated hydraulic coefficient for floodplain sediment has been measured in the field
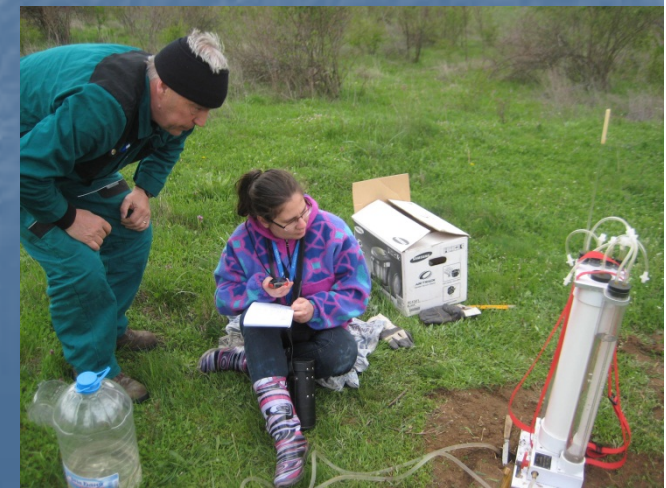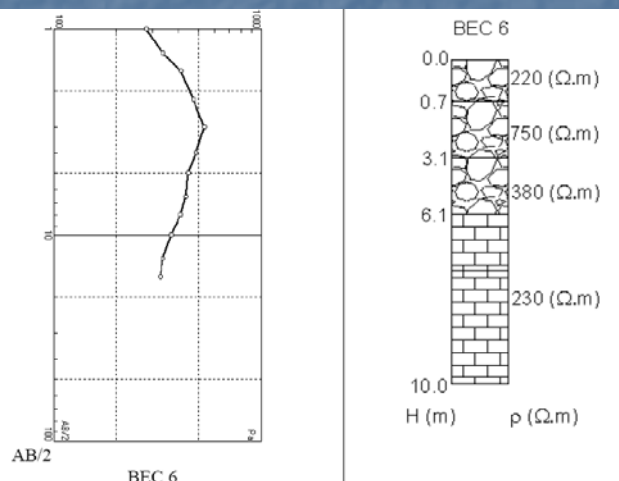
Report on WP3: Runoff - dependent As mobilization

Task 3-2: As fluxes in the Ogosta River

- Automatic meteo-station installed in the Ogosta Valley
- On-line access in the Internet: http://www.vremeto.org/ogosta/station/wxindex.php
- Supports the analysis of Ogosta River discharge regime, hydrologic and groundwater modeling
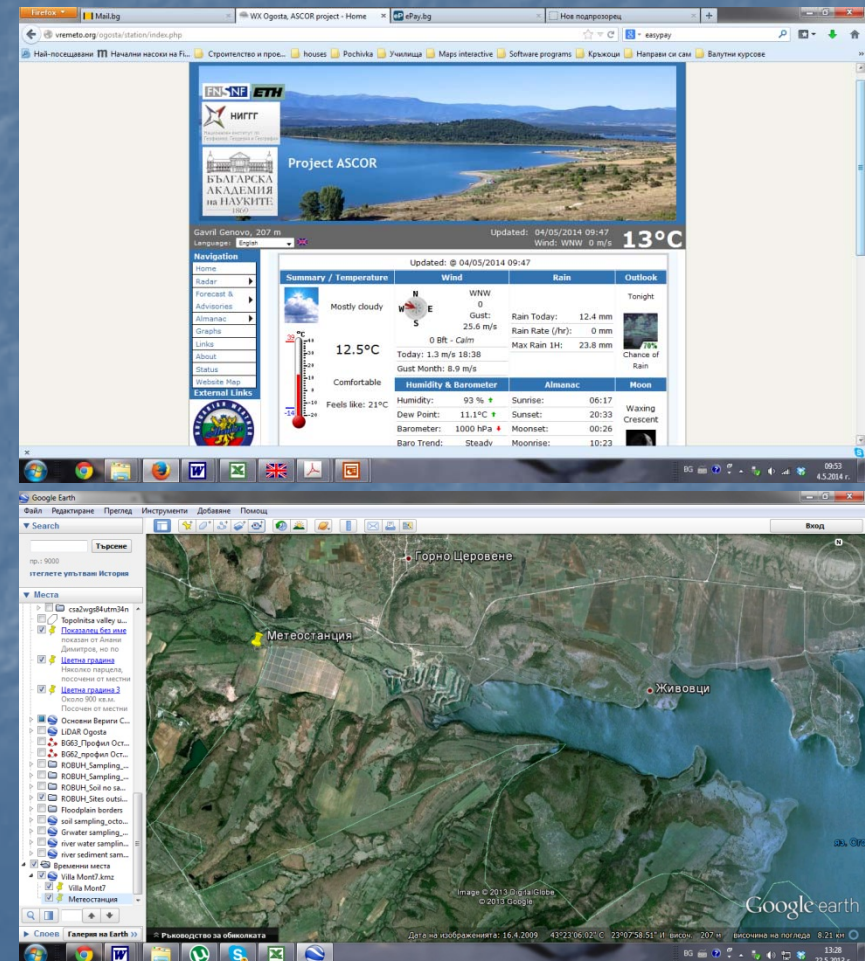
Deviations from research plan

- No significant deviations from the plan are made
- 6 months delay for the LiDAR data delivery from Airborne Technologies due to administrative procedures and bad weather
- 6 months delay for all activities dependant on the LiDAR data:
    - Spatial analysis of river floodplain morphology
    - Flood modeling
    - Arsenic spatial distribution
    - Pilot‐scale groundwater monitoring system

Publications, presentations and outreach

- No data has been published yet

- Chiprovtsi townhall meeting, April 9, 2013 - Presentation of ASCOR project to the local authorities, governmental agencies and NGOs

- Field demonstration for pupils from Chiprovtsi, May, 2013

- Meteo data is put into practice by the EcoTerra biofarming

Lessons learned

- The more detailed planning the better

- Plans always change during the project

- Meetings face to face cannot be replaced by e-mails and Skype

- Administrative support from the base organizations is crucial

Greetings from the Ogosta Valley

Photo Velimira