Geoland 2

Progress in Soil Erosion Indicator
Achievements of JRC-AUTh

Christos Karydas, Panos Panagos and Ioannis Gitas
JRC, 24/06/2010
Structure of the project

- Service definition according to end-users requirements
- Review (method compendium)
- Methodology and Processing line
- Demonstration (applications)
- Utility assessment
- Training
- Dissemination
Scope of the soil erosion indicator

- **Users**
  - NAGREF
    - Soil Science Institute
    - Forest Research Institute
  - ETC/LUCI

- **Target**
  - Mapping hot spots of erosion risk under current land uses for allocation of control measures
  - Support of decision making (alternative land use scenarios)
  - Spatial scales:
    - 1:250,000 for pan-European comparison (long term)
    - 1:50,000 for allocation of hot spots (annual)
    - 1:10,000 for identification of anti-erosion measures (event to seasonal)
Submitted/Under review to Environmental Modelling & Software

**Title:** Modelling Soil Erosion by Water - Critical Review from a GIS Perspective

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- Panos Panagos (JRC)
- Ioannis Z. Gitas (AUTh)

Sixty-three (63) soil erosion models identified and classified according to explicit GIS-criteria (spatio-temporal scales, spatial methods, and data types).
Literature review

- Event-based and annual to long-term models equally preferred by model developers.
- Watershed scale slightly more preferred than field scale.
- Pathway approaches slightly more preferred over the spatial co-existence techniques.
- Raster data type predominant over vector.
- Hydrological features and land management the most targeted parameters.
- Major problems today:
  - low spatial data quality
  - need for up-scaling
- Main contribution of the review: informative potential of the classification tables to support decision-makers in selecting appropriate models and types of datasets for mapping erosion hot spots.
Methodology

- **Not a new model** – only interventions (through the processing line, e.g. alternatives according to data availability and expertise)

- **RUSLE**
  - Reasons for selection
    - Simple (no data hungry)
    - Generic
    - Well known
    - Spatially distributed (GIS)
  - $A = R \times K \times L \times C \times P$ (erosion factors)
    - R: dynamic, additive layer
    - C: dynamic layers
    - K, LS, P: (more or less) static layers
  - Processing line
    - Emphasises
      - *Seasonality*
      - *Vegetation cover and density*
    - Makes use of BioPar data (monthly, 300 m cell size)
      - $F_{\text{Soil}}$ (fraction of soil)
      - LAI (vegetation density)
Critical seasons
- Importance of seasonality: dynamic phenomenon
- Depends on:
  - Causing factors
    - Rainfall volume
    - Storm intensity
    - Runoff
  - Protective factor
    - Vegetation’s seasonal and annual phenology

Monthly assessments:
- Critical months
- Hot spots (risky areas)
- Risky land uses

Integration over the year
- Additive? Else? (under consideration); scale vs. sediment delivery ratio
**Study area**

- **Strymon/Struma river basin**
  - Extent=14,500 km²
  - Common data where possible
  - Regional study site (Gr-Bg)
  - Local study site (Gr)

*Legend*
- Shoreline
- Study site
Local scale study area (Gr)

- Extent=150 km²
- Sloppy area
- Large variety of land uses
Pan-European databases

- RAIN
  - MARS data

- SOILS
  - European Soil Database (ESDB)
  - Outputs from LUCAS 2009

- TOPOGRAPHY
  - ASTER DEM

- VEGETATION
  - BioPar data
  - CORINE
  - LPIS

National/Regional/Local databases

- SOIL
  - Soil surveys
  - Physiographic maps
  - Geologic maps

- RAIN
  - Meteo-stations

- TOPOGRAPHY
  - DEM, etc

- VEGETATION
  - Satellite imagery
Use of BioPar data for C factor estimation

- FSoil: fraction of bare soil, i.e. FSoil=1-(FCover+FBrown), range 0-1
- LAI (Leaf Area Index), range: 0-10
- C=f(FSoil,LAI)

Justification:
- Bare soil:
  - totally exposed to erosion
- Vegetated soil:
  - partially exposed to erosion depending on vegetation density
  - LAI: an expression of vegetation density

- Normalisation of resulting C values
- Calibration per month

Challenges
- Comparison with C derived from satellite imagery (e.g. NDVI)
- Comparison with PESERA erosion map
- Comparison with other national/regional/local assessments
Grazie per attenzione!!!
Activities of the Laboratory of Forest Management & Remote Sensing

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Founded in 1926, the Aristotle University of Thessaloniki (AUTH) is the largest university in Greece, consisting of over 40 departments, faculties and schools plus a central administration.

AUTH offers graduate and post-graduate education and carries out both basic and applied research in a wide range of fields, including remote sensing and environmental management.
Up until now, AUTh has been involved in more than 80,000 research projects, most of which have been conducted in close collaboration with European academic and research institutions.

Many projects are financed by the Commission of the European Communities and ESA.
Our Research Team

The Laboratory currently employs 14 people:

3 - Permanent Academic Staff
1 - Secretary
1 - Post-doctoral researcher
4 - PhD candidates and
5 - MSc students
Unit activities

• Research
  ◦ Remote Sensing, Land cover/use – Forest mapping, Forest Fires, Forest Management, Soil erosion, Landscape Ecology

• Education
  ◦ graduate and postgraduate courses

• Dissemination of knowledge to the society
  ◦ operational applications, lectures, seminars, national and international conferences, networks
Research priorities

- Land cover/use mapping
- Landscape ecology
- Soil erosion
- Forest management
- Kyoto protocol (Forest species mapping, biomass estimation)
- Applications in forest fire research
- Environmental degradation assessment
- Ecosystem dynamics
## Research

A selection of granted *international* projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Title</th>
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<tbody>
<tr>
<td>GMES Products and Services</td>
<td>Integrating EO Monitoring Capabilities to Support The Implementation of European Directives and Policies Related to Land cover and Vegetation (GEOLAND)</td>
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<tr>
<td>An Innovative Approach of Integrated Wildland Fire Management</td>
<td>Regulating the Wildfire Problem by the Wise Use of Fire: Solving the Fire Paradox</td>
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<td>Service for the Provision of Advanced Geo-Information on Environmental Pressure and State (SAGE)</td>
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<td>EUFIRELAB - Euro-Mediterranean Wildland Fire Laboratory, a wall-less Laboratory for Wildland Fire Sciences and Technologies in the Euro-Mediterranean Region</td>
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<td>Monitoring forests at the Management unit level for fire prevention and control (FIREGUARD)</td>
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<td>Forest Fire Spread Prevention and Mitigation (SPREAD)</td>
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<td>FOREST FOCUS REVIEW - Review of EU Forest Focus programme (Regulation EC 2152/2003)</td>
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<td>Integrated System for the promotion of Territorial-Environmental Impact Assessment in the frame of spatial development (ISOTEIA)</td>
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Educational activities

The Laboratory offers substantial educational activities covering:

- In undergraduate and postgraduate level. Courses taught are:
  - 1) Aerial Photography
  - 2) Forest Management
  - 3) Environmental Remote Sensing
  - 4) Geographic Information Systems
  - 5) Forest Land Mapping
  - 6) Applied Forest Management

- Special lectures and seminars in cooperation with public and private organizations, institutes, universities and companies
Collaboration with International organisations and Greek end-users

EU JRC
ESA
Greek Secretariat for Research and Technology
National Forest Service
Civil Protection Greece
WWF Hellas
Greek Fire Brigade
Involvement in operational applications of RS and forest fires

National Forest fire danger map (since 2002)

Rapid burned area assessment in the Peloponnese
Recent Publications

Members of the Laboratory have published the results of the research conducted in the Laboratory on many international peer-review journals:
Practical value of our work
Practical value of our work
Other activities

• The unit is a member of EARSeL - chairing the EARSeL Special Interest Group on Forest Fires (EARSeL – FFSIG)

• Members of the group are:
  • editors / guest editors in international journals and conference proceedings
  • in the scientific or organising committee of national and international events

• Members of national committees (Civil protection, Ministry of Rural Development and Food)
Dr. Christos Karydas

• Studies
  ◦ BSC/MSc: Agronomy-Land reclamation
  ◦ MSc: Soil resource management
  ◦ PhD: Multi-scale precision agriculture (Mediterranean agricultural system)

• Expertise
  ◦ Remote sensing of the Environment
  ◦ Geographic Information Science

• Technologies
  ◦ Object-based image analysis (multi-scale approaches)
  ◦ Environmental modelling (landscape, soil erosion, water pollution)

• Teaching (University, CIHEAM-MAICH, American farm school, lectures)
  ◦ Remote sensing
  ◦ Digital image analysis
  ◦ GIS

• Research interests
  ◦ Soil erosion
  ◦ Landscape analysis
  ◦ Precision agriculture
Thank you for your attention !!!