

## DAMOCLES

DEBRISFALL ASSESSMENT IN MOUNTAIN  
CATCHMENTS FOR LOCAL END-USERS

Contractor: Università degli Studi di Milano - Bicocca

### 6-MONTH REPORT

Reporting period: April – November 2002

#### SUMMARY

During the reporting period the workgroup focused the activity on the following tasks:

1. revision and updating of the landslide inventory of Focus Area B;
2. completion of landslide historical data collection of Focus Area B;
3. preparation of a DEMO presentation;
4. rockfall modelling and rockfall hazard zonation;
5. analysis of empirical relationships for Alpine debris-flows;
6. preliminary statistical model for debris flow hazard assessment;
7. organization of Damocles workshop with end-users, Milano, 21 November 2002;
8. organization of Damocles training course for the Lombardia Region end-user: 10-12-17-19 December 2002.

Referring to the third year project plan, we accomplished all the programmed tasks.

#### DETAILED DESCRIPTION

##### 1. Revision and updating of the landslide inventory of Focus area B (WP2)

The landslide inventory that was produced during the second year of the project has been implemented and updated using new photographs (taken in 2000) and digital ortho-photographs (figure 1). In particular, debris flows have been extensively revised in order to optimise the hazard

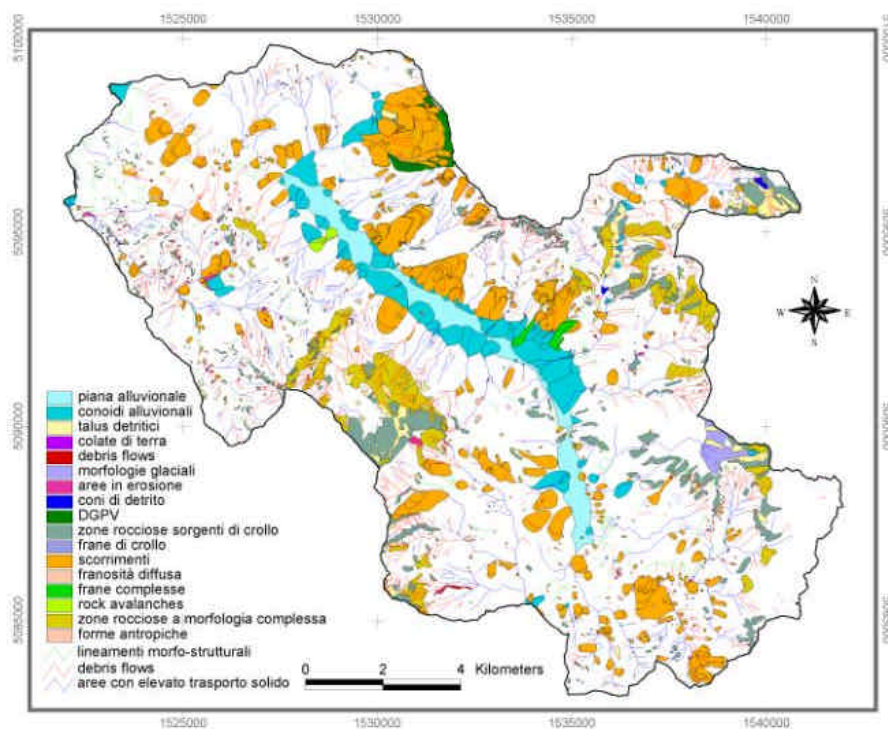


Figure 1. New landslide Inventory of the Focus Area B.

modelling procedure. The new inventory have been transferred to the Newcastle team.

### 2. Completion of landslide historical data collection of Focus Area B (WP2)

A thorough collection of historical records for the study area have been completed through the analysis of several archives (Archivio di Stato di Como, Archivio del Museo Civico di Lecco – Casa di A. Manzoni, Archivio Comunale di Barzio, Archivio dell'Ufficio del CFS di Barzio, Archivio Comunale di Pasturo, Archivio Comunale di Casaro, Archivio Comunale di Primaluna, Archivio Comunale di Margno. Archivio dell'Ufficio del CFS di Margno). Data ranging from the beginning of XIX century to 1990 have been collected, recording 147 landslide events located in 97 different sites. If possible, the sites have been localized and mapped. A detailed report of historical data collection is already available in Italian, and will be translated into English during the next months.

### 3. Preparation of the DEMO presentation (WP5)

In order to explain the integration between regional-scale statistical modelling and basin-scale physically-based modelling of debris flow hazard on alluvial fan a DEMO presentation was produced in collaboration with Padova University team. The DEMO will be available on WEB.

### 4. Rockfall modelling and rockfall hazard zonation (WP2)

A new application of the 3D numerical model for rockfall simulation was performed in the Benasque valley, Spanish Pyrenees. The model was developed using geomorphological and geological data collected and provided by the Saragoza ITGE team. Both rockfall simulation and hazard zonation have been produced for the Benasque area (figure 2). The results were presented during the International EGS Plinius Conference, Mallorca, 2-4 October 2002.

### 5. Analysis of empirical relationships for Alpine debris-flows (WP1)

Empirical and semi-empirical relationships for the computation of flow velocity, discharge and

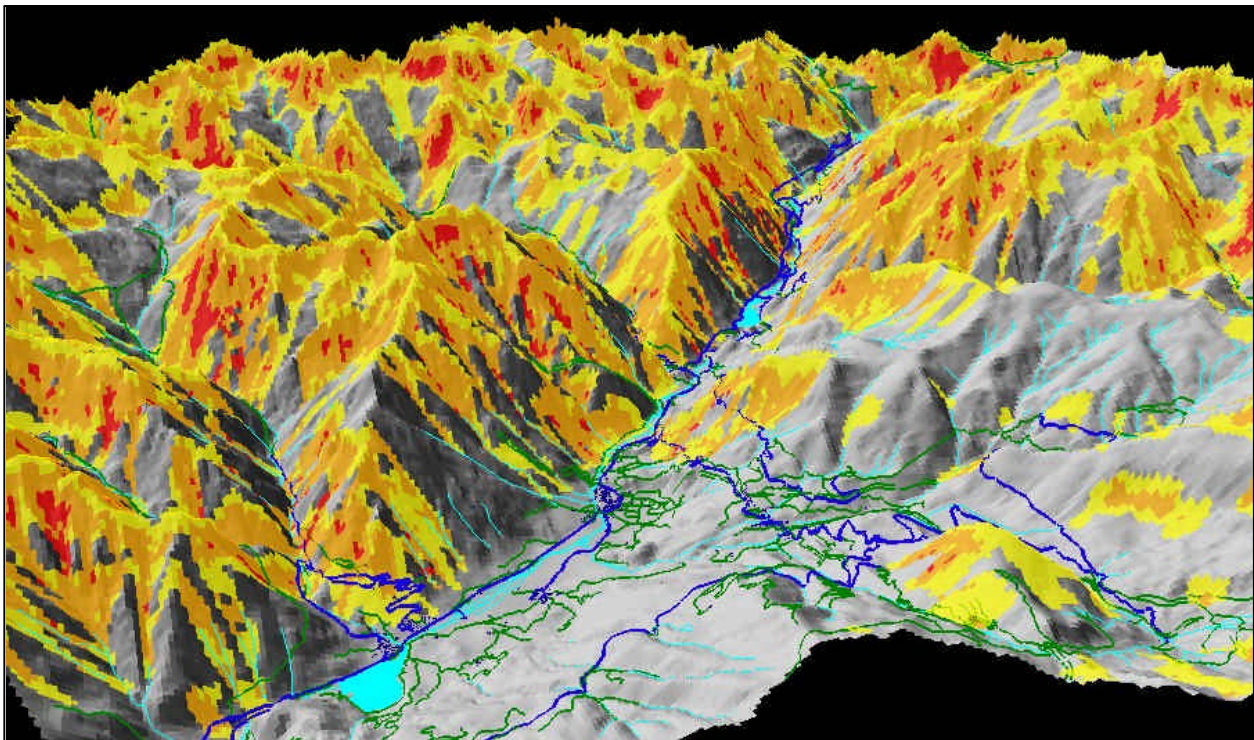


Figure 2: 3D view of rockfall hazard zonation for the Benasque valley, Spanish Pyrenees (legend: yellow areas: low hazard; orange areas: medium hazard; red areas: high hazard; blue lines: road and lifelines; cyan lines: rivers)



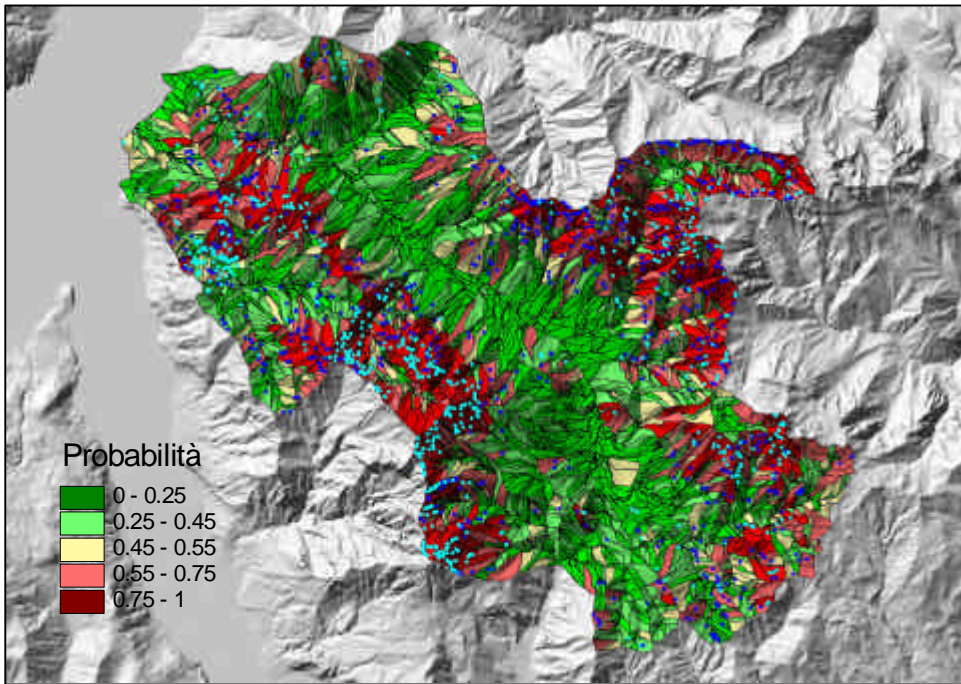


Figure 3: preliminary result of the discriminant analysis

runout behaviour have been applied to granular debris-flows occurring both on talus slopes and in channels in the upper Valtellina (Central Alps, Northern Italy). Then, the relationship between volume and depositional area,  $A=kV^d$ , was used and calibrated with different datasets from the literature. We observed that the empirical coefficient,  $k$ , mainly changes in value as a function of the characteristics of the material involved in the phenomena. The results of these analysis were presented during the International EGS Plinius Conference, Mallorca, 2-4 October 2002.

#### 6. Preliminary statistical model for debris flow hazard assesement (WP2)

A first attempt of statistical modelling was performed during September-October, with a dataset of debris-flows that was successively updated. The application of the updated dataset in November allowed just the production of preliminary results (figure 3) that were presented during the Damocles workshop, Milano, 21 November 2002.

#### 7. Organization of Damocles workshop with end-users, Milano, 21 November 2002 (WP5)

A full-day workshop have been organized at Università Milano Bicocca to present Damocles activities to the end-users. During the workshop, all the Damocles partners presented the results of their activities. More than 50 end-users participated to the workshop, coming from different Italian administrations: Lombardia Region, Piemonte Region, Valle d'Aosta Province, Trento Province, Lecco Province, Italian Geological Survey, and others. During the workshop, a simultaneous translation service have been provided to the end-users.

#### 8. Organization of Damocles training course for the Lombardia Region end-user: 10-12-17-19 December 2002 (WP6)

Four full-day training course have been organized at Università Milano Bicocca. 25 people from Lombardia Region have been trained in the methodologies for debris-flow and rock-fall hazard assesement developed during the Damocles Project.

### PUBBLICATIONS

- Agliardi F., Crosta G.B. (2002). High resolution three-dimensional numerical modelling of rockfalls. Geophysical Research Abstracts, volume 4. Abstract EGS02-A-02514

- Agliardi F., Crosta G.B., Guzzetti F., Marian M. (2002). Methodologies for a physically-based rockfall hazard assessment. Geophysical Research Abstracts, volume 4. Abstract EGS02-A-04594.
- G.B. Crosta , S. Cucchiaro & P. Frattini (in print). Determination of the inundation area for debris flows through semiempirical equations . Proceedings of the 4<sup>th</sup> EGS Plinius Conference, Mallorca, Spain, October 2002, 4 pp.
- Agliardi F., Crosta G.B. (2002). 3D numerical modelling of rockfalls in the Lecco urban area (Lombardia Region, Italy). Proceedings EUROCK 2002, I.S.R.M. International Symposium on Rock Engineering for Mountainous Regions and Workshops on Volcanic Rocks. Madeira, Portugal, 8 pp.
- Acosta E., Agliardi F., Crosta G.B., Rìos S. (2002). Regional rockfall hazard assessment in the Benasque Valley (Central Pyrenees) using a 3D numerical approach. Proceedings of the 4th EGS Plinius Conference, Mallorca, Spain, October 2002, 4 pp.