**MONITORING BIO-ENGINEERING STABILIZATION OF LANDSLIDES IN Lazio Region (ITALY)**

*F. Prelli (a), C. Miliarese (b), P. Guibellino (c), S. De Bartoli (a), G. Fabio (a)*

(a) Università della Tuscia - GEMINI - Centro Regionale Lazio, via Francesco Risso, 01010 Viterbo (VT), Italy
(b) Università di Roma “La Sapienza”, via della Ricerca Scientifica, 00133 Roma, Italy
(c) Università di Roma “La Sapienza”, via della Ricerca Scientifica, 00133 Roma, Italy

**OBJECTIVES OF Lazio Region’s Territorial Policy**
- To orient intervention and soil protection programmes toward criteria that, to a greater extent, respect the natural equilibrium of the territory in question, developing the safeguarding of landscape and of the environment, with particular attention to the renaturalization of areas where, due to risks related to hydraulics or landslides, soil protection works are necessary. A fundamental principle that must always be applied is that any intervention must have the smallest environmental impact.

**ACTIVATED ACTIONS**
- Decree n° 4340, issued in 1996 by the Lazio Region, which defined the project criteria for interventions on soil protection in the Region (concepts and principles that must be adhered to by regional offices dealing in soil protection, as well as by those entities carrying out interventions on behalf of the Lazio Region);
- Conventions for the drafting of studies regarding the application and the monitoring of bio-engineering in various fields of responsibility (hydraulic managements, quarry and dumps recovery, renaturalization of road embankments, protection of coastal sand dunes, and finally the stabilization of slopes);
- Decree of the Lazio Region that defines the project criteria for interventions on soil protection in the Region (concepts and principles that must be adhered to by regional offices dealing in soil protection, as well as by those entities carrying out interventions on behalf of the Lazio Region).

**AIMS OF MONITORING**
- verify the correct execution of bio-engineering interventions, in terms of both technical and landscape insertion;
- verify the effectiveness and the possibility of intervening with bio-engineering techniques in the Mediterranean climate;
- verify which techniques and species have a good adaptability to survive and rooting in the Mediterranean climate;
- identify training needs for contractors and designer of bio-engineering;
- Evidence the necessity to use native plants and inert materials of local origin.

**SITES LOCALIZATION**

**CRITERIA OF SITES SELECTION**
- project
- location
- phytoecological zone
- area (urban, rural, protected)
- typology of landslide
- total cost
- bio-engineering cost
- timeline
- intervention typology
- bio-engineering techniques

**MONITORING FORM**

**GRAPHICS OF RESULTS**

**CONCLUSION**
- The need to further develop research activity aimed at identifying suitable species to be used within the Mediterranean climate area, in the management of slope. Another important factor to be stressed is the need to combine, along with the above-mentioned research and experimentation, local greenhouse enterprises that would be able to furnish the new “construction material”;
- Monitoring serves both to fine tune a methodology for gathering data, for the purpose of acquiring constantly more complete information, as well as to create qualitative standards to be used as reference levels for the efficient planning of future monitoring activities. This is necessary to determine the level of integration of “classic” or “conventional” interventions with bio-engineering interventions;
- The need of a particular certification for contractors that have acquired a specific qualifications in the field of bio-engineering.

From an analysis of monitoring results emerges:

**GRAPHICS OF RESULTS**
- Number of planned and implemented works for each typology in the monitoring sites
- Most frequent errors
- Species used for cuttings
- % total taking of shrubby species
- % root taking of shrubby species
- Work-Slope