Geophysical Research Abstracts, Vol. 7, 02077, 2005 SRef-ID: 1607-7962/gra/EGU05-A-02077 © European Geosciences Union 2005



Land use as land protection

P.G. Cannata (1), G. Cannata (2)

(1) Istituto Nazionale della Montagna IMONT (INRM), Rome, Italy, (2) Alpha Cygni, Rome, Italy

Introduction

The research project "Land use as land protection" is carried out by an interdisciplinary working team, under the supervision of Prof.Giuliano Cannata, and in close cooperation with the technical staff of the Volturno Basin National Authority.

Started in July 2000 and now near to conclusion, it is focused on the most appropriate land-uses for land protection against floods or landslides.

With priority to agriculture and wooded land, it aims to find the way to encourage those land management practices that are expected to be best effective in the prevention of such "natural" disasters, and discourage those that are not.

In order to provide scientifically sound, as well as relevant to land planners, figures at the basin scale, three Italian case studies, well representative of a variety of land use patterns, environmental concerns and human pressures, are analysed. A simulation model (Topkapi) has been set up to simulate the rainfall-runoff transformation process; a physically-based grid-cell scale modelling of the hydrological processes allows detailed understanding of the influence of land cover changes on streamflow, by depicting alternative land use scenarios.

Existing policy tools, legal and institutional constraints or opportunities, are analysed in depth at both the European and the national levels; special focus is reserved to those Regional Operative Programmes measures, which address EU Structural Funds in "Objective 1" Regions to land protection, forest management and rural development.

In 2004 the project and the research have been revamped with the opening of a new phase supervised again by P.Giuliano Cannata and committed to the branch of INRM

– IMONT located in Stazzema (Toscana) and called CERAFRI. The aim of this new phase of the project is the study and implementation of spread up agricultural rangelands and forestry measures of runoff reduction (land maintenance and land protection). Institutional assistance and financial subsidizing from the PAC (European Unity Agricultural policies) are envisaged.

Applied simplified methods of field hydrological estimates are also foreseen.

The project framework

Assuming the basin scale as the basic unit to both understand the close connection between land use and water management and implement effective land management measures, the addressed major topics are:

- 1. the influence of land use changes on land protection, and the potential role of some vegetation covers in preventing/mitigating floods or landslides;
- 2. the social and economic feasibility of such actions;
- 3. the multifunctional perspectives of rural development in the framework of the EU CAP reform (Agenda 2000).

According to the last EU Communication on "Intermediate CAP Revision" (COM 394/2002 def.), which aims to consolidate the decoupling processes of rural development by applying the cross-compliance principle, rural and wooded areas' multifunctional role is expected to become of increasing importance, in order to meet broader environmental targets.

In this context, land use changes at the basin scale have to be taken into account as a "structural" environmental issue, and considered as a strategic tool of watershed integrated management and planning policies.

It is worth noticing that, in order to pursue this objective, CAP cross-compliance measures shall be re-oriented, in the framework of Agenda 2000 Intermediate Revision, to avoid current subsidies distortions, as well as the expected reform of the Forestry Directive (EC)2158/92 shall integrate the key-concept of land use as land protection.

In risk-prone areas above all, productive needs and revenues coming from both forestry and agriculture have to be evaluated and compared with social benefits raising from risk prevention improvements.

In a preventive, long term approach, the quality of vegetation coverage face to erosion agents plays a crucial role. There is an increasing scientific awareness underlining the

high performance of mixed and multi-layered forests in soil protection and surface runoff control. Even the favourable influence of a permanent vegetation minimal coverage, and of riparian natural areas or parcels scattered among cultivated crops, has been broadly recorded.

Despite of its "limited", or rather, difficult to quantify, role during extreme events, like flash floods or mud flows, land use management should address land protection, as it allows alternative solutions to more complex (and often more expensive) restoration measures. Furthermore, it can reduce the recurrence rate of moderate events, as well as prove beneficial to citizens warning systems, by delaying peakflows occurrence.

Disadvantaged rural areas show a clear economic feasibility for reforestation and setaside programmes implementation. In these areas, a closer engagement of farmers in sustainable practices, specifically oriented to land protection, shall not only reinforce the community's sense of interrelation between upstream and downstream settlements. It can also provide alternative incomes, coming from both the higher environmental value of the landscape, and the higher professional qualifications needed to look after renaturation processes.

In these terms, the EU rural development multifunctional perspective can lead to an innovative approach to social cohesion concerns.

The case studies

In order to consolidate and spread scientific knowledge on land use management as land protection, and demonstrate the socio-economic feasibility of changes in agricultural and forestry patterns, the following case studies have been selected:

- 1. a flood-prone area, the Dora Baltea Basin, located in northern Italy, in Piedmont and Valle d'Aosta Regions;
- 2. the Bussento Basin, located in southern Italy, and included in the Cilento National Park;
- 3. the Vernotico Basin, located a few kilometres North in the same Region of Campania, and affected by landslide phenomena specific to volcanic areas (mud flows).

As mentioned above, the **Dora Baltea** valley is a flood-prone area, its headwaters encompassing the highest Alpine peaks of Italy, and finally flowing into the Po river. In this area, geomorphology, hydraulic and hydro-geology are seriously threatened by both heavy river training works and numerous water abstractions for minor hydropower generation.

In the last decade, two "extreme" flood events occurred, very heavily damaging settlements, crops and infrastructure and causing casualties. Subsequent structural restoration works have invariably proved inadequate to face the next flood.

We call river training all structural engineering works such as levees, weirs, channel straightening and lining, etc.

The alleged purpose is the protection of areas considered as vulnerable due to human activities taking place there. One major frequent drawback is the shifting of risk: where floodplains are withdrawn from the river's overflows, floods will turn more destructive downstream, owing to the increase in water discharge, energy and speed.

The case study is focused on trying to demonstrate that the recent floods can partly be ascribed to river training, which has artificialized a good deal of the channels, bringing about a change in the basin's hydrologic response to rainfall.

To this goal, six major flooding events of the Dora Baltea have been studied relative to contexts both pre- and post- of 1980s river training works.

The analysis of frequency and the exam of the available hydrologic parameters (peak discharge and corresponding rainfall) seem to show that the basin now reacts with a more severe runoff response to precipitation. Some confirmation of these findings has come through the use of a preliminary version of the distributed rainfall/runoff model.

In the framework of a watershed integrated management programme, embankment decommissioning should be better considered, together with re-locating infrastructure and settlements on floodplains, in order to restore river divagation areas wherever feasible.

The **Bussento Basin** is characterised by very low population density (a mean of 40 inhabitants/ square kilometre), as a result of the emigration processes occurred in the last century. Associated with a large extent of permanent set-aside crops, the last period of emigration, dated 1950-1960, has then been followed by a broad spontaneous landscape renaturation. Now, 80% of land is covered by forests either at, or in spontaneous evolution to a natural stage, reaching a high performance in land protection.

In 1994, the area has been included in the Cilento National Park, to protect and improve such an increasing biodiversity. The Cilento Park Plan has specifically recognised forests' land protection functions as one of its major concerns. Residual wine and oil productions must be submitted to sustainable good practices, in line with EU agri-measures (the Cilento olive oil has recently been certified).

Tourism and scientific research plans (a rich endemic entomofauna is present) are now the first income for local population.

The **Vernotico Basin** can represent the opposite of Bussento, as it is subject to heavy urban expansion and intensive agricultural production.

Though featuring a coverage of over 50%, forests appear damaged because of intensive forestry (esp. logging at too short time spans, 12-15 years) and fires. Land protection capabilities are consequently poor. The area is widely affected by landslides, similar to the well-known mudflows of Sarno.

The Vernotico Basin is located at the core of national chestnut and hazelnut production areas: due to its volcanic soils, yields per hectare score ten times the national average value.

In wooded areas, any residual biodiversity is lost. Where current industrial systems of harvesting have taken place, brushes and spontaneous vegetation are continually eradicated. Where traditional harvesting practices are still in use, these are often associated with wood production, which implies abrupt drops in canopy coverage rates. The same occurs with fires: most located in, or close to, productive parcels, they appear very frequently; both phenomena can cause abnormal rises in soil moisture and speed up erosion processes, thus increasing local landslide hazards.

In spite of the national ranking in hazelnut production, the related incomes remain economically marginal for local farmers. A few figures can summarise the economic dimension of the actual conflict between current productive practices and revenues, and risk prevention potential benefits. Farms extend on average about 1.2 hectares each, 80% being less than 1 hectare and only 1% more than 10 hectares. Hazelnut production gives an annual income of about 2,500 Euro per hectare. Local forestry incomes are evaluated about 290 Euro/hectare/year: just the same as set-aside EU subsidies.

None of these practices, which spoil forests and soil profiles face to erosion, is subject to control. Only properties of more than 10 hectares are submitted by the regional Forestry Act to Forestry Assessment Plans. The national legislation does not include hazel trees among forest resources. Local planning tools do not consider specific crops destinations of agricultural areas.

With the support of our project research team, the local Basin Authority, together with the Region of Campania and the Volturno National Basin Authority (based in Naples), are now cooperating to identify the most effective legal, and institutional, framework to improve the conditions of the area, face to landslide hazards.

The aim is to re-orient the Regional Operative Programme financial resources towards risk prevention instead of restoration, and to assess beneficial land use changes on the basis of the existing hazard maps.

At the local level, the so called "Consulta", an experimental Committee on the model of the U.S. Watershed Partnerships, has also been set up. It is formed by stake holders, representatives both of public and private parties, that are potentially interested (inasmuch as they are present on that territory) in being involved in the new wide-scope and integrated approach to land management as promoted by the project.

Lessons learned and recommendations

The following statements have been confirmed through the simulations performed so far with the rainfall-runoff model:

- 1. Forests can play a crucial role in floods and landslides prevention (in the Vernotico, 60% rise in annual peakflow expected in case of the removal of forest coverage scenario).
- 2. Natural and derelict agricultural areas disseminated in productive agricultural land can increase the risk mitigation capacity, especially when appropriate land management schemes are followed (e.g.: buffer strips along watercourses).
- 3. Diffuse non-structural measures such as appropriate land use management should be preferred to point engineering works along river networks or hill-slopes.

Except for protected areas, all case studies show a very poor degree of integration between different existing policy tools, suitable to risk prevention and land protection.

Despite of a national Land Protection Act, dated 1989, which states the integrated management of water and land use at the basin scale, under control of the River Basin Authorities, land protection is still considered a sectoral goal.

There is a lack of integration at the spatial scale, between land use planning tools. There is a lack of coordination with reference to different implemented land uses, and sectoral policies, namely agriculture, forestry and water resources management. There is a lack of data at the basin scale, providing geocoded maps of risk hazards, river networks and land use in order to support decision making. There is finally a broader lack of cooperation between institutional levels. Related policy targets appear often in conflict, and this must be seen as a reason of land protection policies' poor effectiveness, if not failure, facing increasingly frequent "natural" disasters.

Because of their influence on the evolution of national and local legislation, international agreements and EU directives should assume specific land protection targets, and strengthen risk prevention purposes at the basin scale. Watershed integrated management key concept has to be put into practice as an effective interdisciplinary approach, sharing risk prevention and land protection concerns between different policy fields, and encouraging land use changes towards its potential, innovative multifunctional roles.