

Quality of the Natural Ecosystem and Environmental Control

P. L. Rampa

ARPA Piemonte Planning, Production, Promotion of Services

The function of European and Italian Environmental Protection Agencies is to support territorial planners and political decision-makers so that each strategic choice considers the necessity to protect and improve environmental conditions.

The Regional Agency for Environmental Protection (ARPA) of Piedmont was established in 1997 with the complete transfer of eight Public Health Laboratories.

The main activities were laboratory analyses or measurement activities carried out separately by Chemists, Biologists, Physicists and Engineers almost exclusively to determine the causes of degradation or poor quality of the environment.

This organization was inconsistent with the new institutional functions which must be carried out in complete interdisciplinary collaboration.

Despite the many difficulties in managing changes of a public organization with 1000 employees in 10 departments throughout the region, the various professional categories (in addition to those mentioned above, Naturalists, Foresters, Agronomists, Environmental Engineers, Geologists, Architects) have overcome their single-profession barriers and now work together in pursuit of the knowledge essential

to defend valuable non-renewable resources like water, soil and air.

The “biological” orientation of the activities of ARPA Piemonte has been very important. Indeed, to understand the environment and contribute to its defence means above all to have knowledge of the mechanisms that regulate the equilibrium of the ecosystem in its various levels of complexity. In this regard, the study of the effects of pollution on the biota is of prime importance. This can be done in the field with biomonitoring networks or in the laboratory with biotoxicological tests.

At a later stage, it is necessary to determine the causes of the environmental damage by means of measurements that reveal the presence of certain pollutants and their concentration. The Agency does not directly conduct research but, through contacts with academic institutions and research institutes, guarantees constant attention to the acquisition of new tools for the correct approach to continuously evolving environmental problems.

ARPA Piemonte’s biological approach to the study of environmental quality is directed toward all levels of complexity.

CATEGORY	ACTIVITY	COMPLEXITY
Evaluation of complex systems	Quality and vulnerability of biotic and abiotic components and ecosystems	Ecosystems
Functional connections	Ecological corridors	Habitats
Synthetic indices	Biological quality of the soil Extended biotic index Lichen biodiversity index Fluvial functionality index Physiognomic and structural analysis of the vegetation	Communities, biocoenoses, taxicoenoses, associations
Biotoxicology	<i>Daphnia magna</i> <i>Selenastrum capricornutum</i> <i>Vibrio fischerii</i> Germination tests	Organisms
Contamination indices	Microbiology – of potable water – of waste and surface waters – of foods – environmental Environmental virology	Cells
Mutagenicity Biomolecular tests	Ames test SOS chromotest Micronuclei test Search for GM sequences in environmental matrices and foods	Subcellular level

Important at the subcellular level are the information about the mutagenicity of atmospheric particulate matter (PM10) and the efforts to monitor the circulation of mutated DNA sequences due to the use of genetically modified organisms in agriculture. Regarding the monitoring of GMOs, ARPA Piemonte is collaborating in European Commission projects for the adaptation and application of community norms to countries where processes of adhesion to the EU (Twinning) are in progress.

Microbiology is a traditional activity of the Agency's laboratories. Important areas include the study of the circulation of viruses in surface waters, verification of the functionality of biological purification plants, the microbiology of confined environments and the study of biopurification of contaminated sites.

All the ARPA laboratories perform biotests of effluent water; a battery of tests employing organisms of different complexity (bacteria, unicellular algae, crustaceans) is used to evaluate the toxic effects of effluents on the recipient water bodies.

Our laboratories have been monitoring surface waters since 1980. Today, the network of around 200 monitoring sites covers 70 rivers and streams. In addition to physico-chemical parameters, the extended biotic index is evaluated twice-monthly as an expression of the health of the fluvial ecosystem in relation to water quality.

The index of fluvial functionality summarizes the vegetational aspects of the river banks, the ecological quality of the river and the use of the surrounding territory.

Monitoring of air quality is conducted with 65 stations that measure physico-chemical and meteorological parameters; almost all the stations are in urban areas. The network to evaluate lichen biodiversity consists of 76 sites arranged in a grid with an 18 Km spacing. It assesses the effects of atmospheric contamination and also allows estimation of contamination far away from the monitoring stations. Mathematical models of dispersion of pollutants in the atmosphere integrate the chemical, meteorological and biological parameters to produce estimates of air quality throughout the region.

The use of georeferencing systems to process data allows the Agency to create maps of environmental quality and ecosystem status. Such maps are important tools for political decision-makers and territorial planners.

ARPA Piemonte's experience with techniques to evaluate the quality of non-renewable environmental components, and thus with concepts like protection, regeneration and re-use, can be useful for a discussion which, in an ideal feedback between earth and space, relates our knowledge of terrestrial macrosystems to the very confined environment of a spaceship in which each molecule of water or oxygen is precious and the concept of recycling is vital.