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NOISE OBSERVATORY INFORMATION SERVICE

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ABSTRACT
This paper describes the NOISE project (Noise Observatory Information Service) i.e. the conceptual outline at the base of the Computerised National acoustics laboratory. The basic structure of this system has been proposed by EEA (European Environmental Agency) expressed through the environmental DPSIR framework; according to this scheme, knowledge on the environment occurs at different levels: the Driver, the Pressure, the State, the Impact, the Response. The NOISE system, by applying DPSIR to noise, has been conceived as a comparative database in which all data and available information on the territory can be stored, analysed and managed. The aim is to create a managing and controlling tool of the territory for noise pollution.

1 - INTRODUCTION

The European Directive n.61 of 24 Sept. 1996 IPPC, on the integrated prevention and control of pollution, stresses the need to establish general homogeneous principles for all environmental fields to make comparisons among environmental data possible; this was deemed necessary since a negative organisation of environmental data was one of the main obstacles in stimulating knowledge towards procedures for managing this type of data [1]. This work analyses the environmental field inherent to noise and presents the NOISE, Noise Observatory Information Service, carried out with regard to a research contract between ANPA and CIRIAF, i.e. a comparative database in which all acoustic data available on territory can be stored and through which future scenarios can be simulated in order to safely sustain a good environmental management on behalf of all suggested entities [2].

2 - NOISE SYSTEM STRUCTURE

DPSIR model represents an efficient means to suitably organise data in various environmental fields, developed through EEA (European Environmental Agency), provides a framework for developing assessments based on causal links between Driving forces (human activities), and Pressures (emissions and resources), that contribute to changes in the State of the environment and cause Impacts on the environment and people health. All this led to societal Responses in the form of the policy action. The system is composed of five modules: *Drivers, Pressures, State, Impact, Responses.* In the case of noise, DPSIR is developed as follows (fig. 1): in the drivers module, all data, which concern economic, productive and social activities able to produce pressure factors regarding noise, are singled out and organised. The pressure module records the effects of the aspects singled out in the drivers module: the pressures in the NOISE system are acoustic emissions. The state module regards gathering data on the acoustic state of the environment investigated and subdivided, on the bases of the current laws in Italy, between internal and external environment. The qualitative and quantitative states of the environment have an impact both on the ecosystem and on the society, determining damage (economical, human health, etc) or benefits according to the trends recorded. The impact module records and verifies the effects due to acoustic emissions; the response module consists of the actions prompted on behalf of governmental representatives and of the preventionary measures regarding the various problems linked

with acoustic pollution. A common platform of the data known about the environment is represented by the *Integration Bases*, a storage of universal data in which it is possible to pick up general information regarding environmental media and factors (water, soil, atmosphere, waste, population, etc). Inside each module, access to the information contained in this supporting file is possible (graphics, information on the industrial activities in the territory, population data, topographic aspects, climatic conditions).

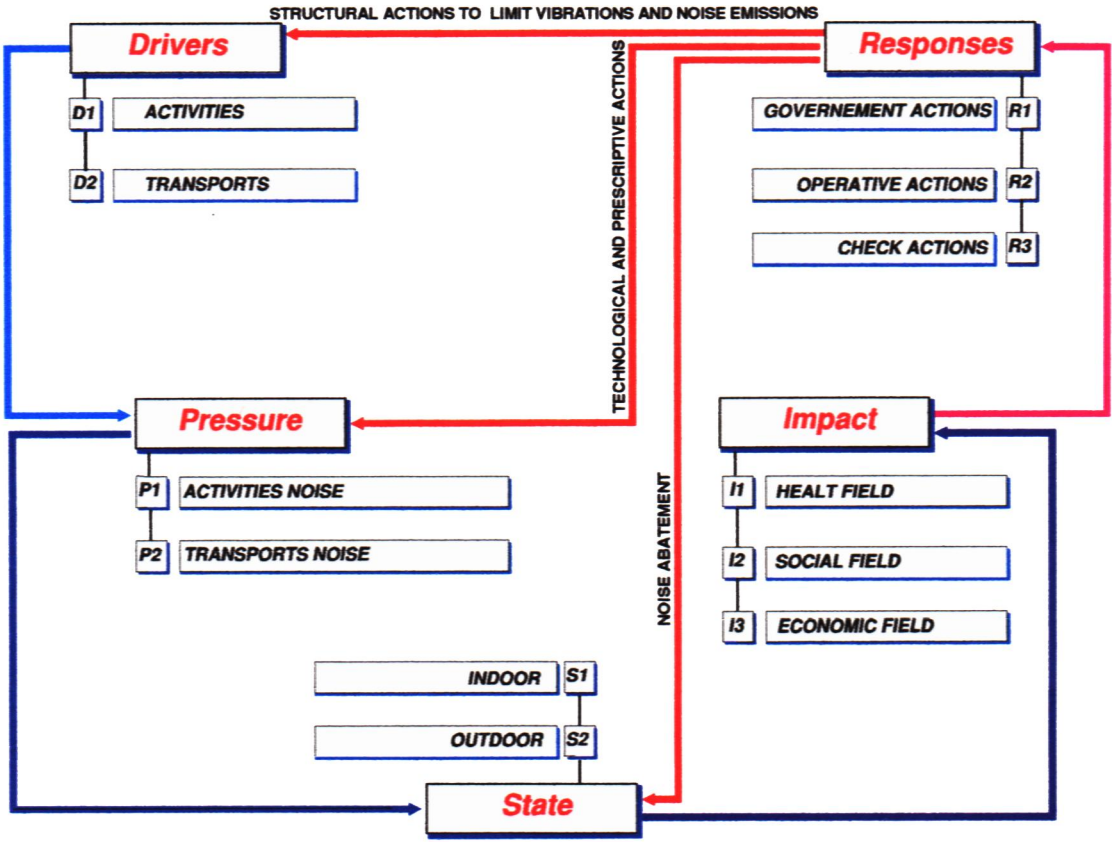

Figure 1: Basic scheme of the NOISE system (Noise Observatory Information Service).

The structure of the NOISE system allows a double function: data storage (which can be downloaded according to the selection opted for), updateable in every section along with the Integration Base to which it is linked, and a programme of simulation and prevention of the environmental condition according to the typologies of the selection made.
The graphic representation of the descriptive schemes explains the computer structure of the main software programmes most commonly used so to make it easier to understand the graphics, the internal links and those with Integration Base. Each descriptive scheme is composed of a main page, the contents of which is: Thematic Scheme for the Drivers, Emission Category Scheme for Pressures, Environmental Scheme for the State, Impact Sphere Scheme for Impacts, Response Typologies Scheme for Responses. In all NOISE modules references to space, time and data source are set in the scheme: space context, time context, detection type and detection source. All the main schemes have a descriptor parameter subscheme in which the relative indicators are listed.

3 - INDICATORS, INDEXES AND FUNCTIONAL LINKS

In order to have a qualitative evaluation of the noise problem, a large section was dedicated to researching, defining, analysing and listing the possible indicators and indexes [3]. Indicators were differentiated according to the information which could give: pressure indicators, state indicators, impact indicators, responses indicators. Pressure indicators describe how anthropic activity can affect the environment. State indicators show the environment condition through the analysis of qualitative and quantitative aspects. The impact indicators show how pressures act upon certain receptors by comparing them with the sensitivity of the others. Finally, response indicators describe how society responds to certain environmental problems, with decrees, laws, reclamation actions, etc. [4].
For instance, some pressure indicators are listed below:

- I_{P1}: average daily number of vehicles NGM (n), differentiated by typology, (trains, automobiles etc...), with reference to the relative infrastructure;
- I_{P2}: electrical supply P (kW), in the case of industrial activities in general;
- I_{P3}: number of clients/employees n, in the case of commercial activities of facilities, with reference to the territorial surface of concern (n/km^2).
  Among the state indicators, some are taken from those cited by the Community's Fifth Environmental Action Programme: Towards Sustainability I_{S1} pondered continuous equivalent level A LeqA (dBA) (noise indicator) [6], or L_{den} as defined in DGENV Draft, concerning the proposal for a Parliament and Council Directive on the approximation of the laws of the Member States, relating to the Assessment and Reduction of Environmental Noise;
- I_{S2} percentage of the population territory exposed to LeqA above 65 dBA at night and to 55 dBA at night (%) [6].

Some of the impact indicators are:

- I_{I1}: Number of endorsements for noise with reference to a particular territory (n/km^2);
- I_{I2}: diffusion of passive protection systems, such as double glass windows (n/km^2);
- I_{I3}: diffusion of health problems linked to noise (n/km ^{2}).

Finally, for response indicators, there were:

- I_{R1}: percentage of the territory PTZ (%) and population PPZ (%) referring to noise zones [7];
- I_{R2}: percentage of territory PTM (%) and of population OTM (%) referring to noise mapping;
- I_{R3}: percentage of territory interested by noise mapping, subjected to noise reduction (%) PTR.

As in DPSIR scheme, even the NOISE system has functional links of cause and effects among the modules; they can be either direct, Drivers-Pressures, Pressure-state, State-Impact, Impact-responses, or indirect, Responses-Drivers, Responses-Pressure, Responses-State. The aspects involved in the system dynamics are so complex that only macroscopic links were defined: this is so both to predict the operability and manageability of the system and also to avoid case studies that, although elaborated, would anyhow appear to be incomplete. In particular, some links between impact and state indicators were described through the definition of relations like Is=f(Ip) in the two main cases with emissions deriving from activities or mobility.
In the case of emissions originating from infrastructures in road transportation, the data stored through the I_{P1} indicator, NMG (average daily number of vehicles), are input data of models to calculate the state indicator I_{S1}, LeqA. In the case of Pressures, some of the indicators thought to be more suitable for the Activity sector are those which assume a functional link between energetic type of quantities, such as electrical supply (I_{P2}) and the level of noise emitted, of the is type $I_{S\,(dBA)} = f\,(P_{(kw)})$; some specific examples are reported in [8] and [9].

4 - CONCLUSIONS

The NOISE system gives a representation of the relations among the elements which take place when analysing the environmental problem of noise. The main objective is to control the state of the environmental resources altered by Pressures (noise emissions) which mostly originate from anthropic activities, Drivers (industry, agricultural, transportation etc). This alteration causes effects, Impacts, on health, on the ecosystem, and also economical damage etc. In order to cope with these impacts, Responses are developed such as laws, plans for new interventions, regulations, etc. By analysing all the functional links among the various modules of the system it is possible to develop informative procedures which can help to understand the causes and dynamics which have brought on these situations. This is important in order to evaluate the effectiveness of the corrective intervention and the need to plan new actions and to establish priority among the interventions inherent to a particular programme or among different programmes.

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