

Introduction of a System Approach for Environmental Planning of Air Pollution Using Driving force- Pressure- State- Impact-Response (DPSIR) Framework (Case Study: Tehran)

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Extended Abstract

Introduction

Air pollution is one of the major environmental issues in industrial cities such as Tehran, in such a way that in a certain time this city was announced as the second polluted city in the world after New Delhi. Geographical location of this city develops a situation that air pollution does not find a way for dilution. Therefore, air pollution and its reduction to an acceptable level is a very important and complicated issue in Tehran, in which several factors play different roles. Thus, in order to obtain a better identification and management of factors affecting this phenomenon, a holistic and integrated method is needed. Cause- effect models with systemic structures are suitable for studying environmental issues as well as the interactions between different parts of the environmental systems which help the environmental planners and decision makers to get to an appropriate solution. Driving force-Pressure-State-Impact-Response (DPSIR) framework is a system approach for identifying key interactions between human and environment and can be used to relate the environmental issues with political levels. This tool integrates socio- economic and natural factors in one framework and makes a basis for more detail analysis. Its main goal is to introduce policy options and evaluate the efficiency of suggested measures for solving environmental problems. This research is a part of the second State of Environment (SoE) report for city of Tehran (Air pollution section). In this study, using the (DPSIR) framework, different components of air pollution in Tehran are analyzed and then proper responses are suggested.

Materials and Methods

In DPSIR framework used in this research, driving forces are human related factors that cause an environmental issue or problem. These factors are generally related to socio-economic developments that need to use environmental resources and will lead to production of pollution or waste and, therefore, cause a load or pressure on the environment. This pressure can end in a change in environmental parameters state which causes a negative impact on ecosystem and human welfare. Therefore, efficient solutions or responses are needed to address these problems. Responses can go back to every part of the DPSIR chain, but desirable and efficient responses are those that go back to the beginning of the framework, or the driving forces.

In this paper, the DPSIR framework is used to analyze different factors of air parameter in city of Tehran in form of quantitative indices and then using this conceptual model, appropriate responses are presented for each component of the model. Different components of this framework are presented in Figure 1.

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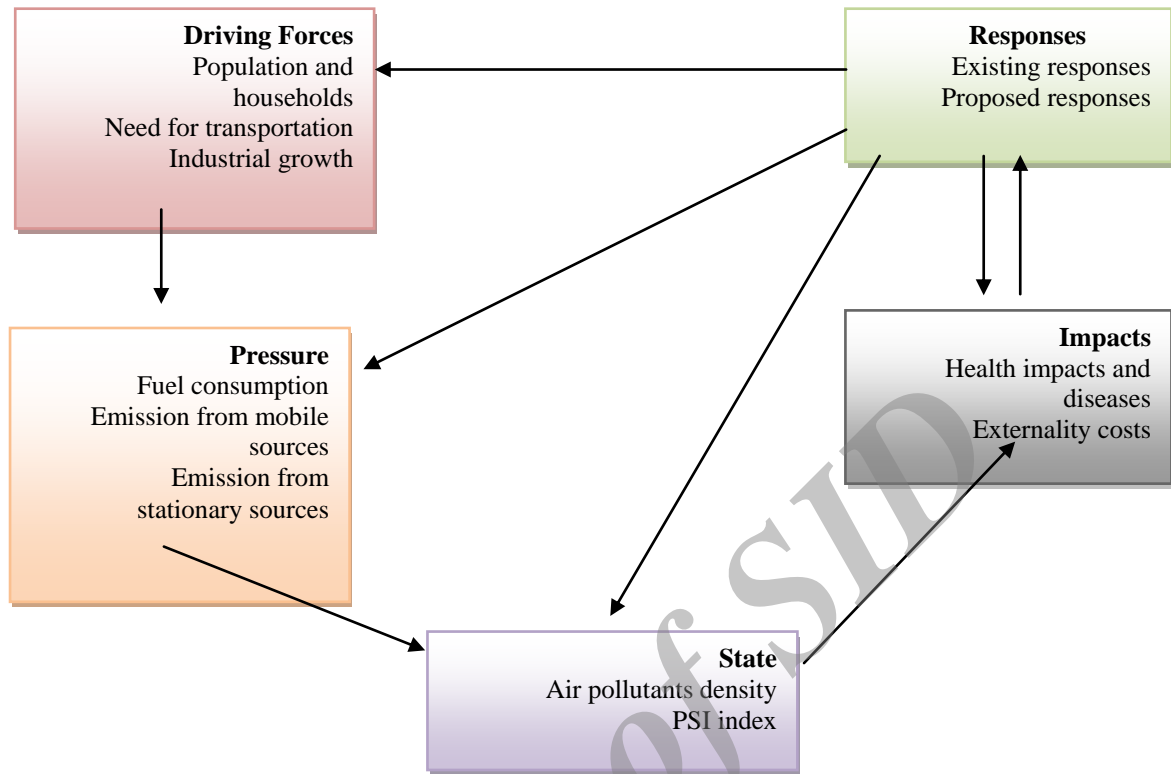


Fig. 1. DPSIR model of air pollution in the city of Tehran

Results and Discussion

According to DPSIR model, population density and intensity and the need for transportation are two main driving forces that cause increase in fossil fuel consumption which shows a considerable rise in the period of investigation. The number of vehicles presented in the city is also one of the main factors affecting the air pollution. Investigation showed that there were a number of 4130044 motor vehicles in city of Tehran in 2010. This means 0.51 motor vehicles for every citizen of Tehran.

In addition to the vehicles used by the residents of Tehran which are possibly driven in the city and creating their share of air pollution, there are other vehicles which are driven to and from Tehran by those passing from the road in other cities. The Karaj freeway with more than 18% of such a traffic load carries the highest number of cars coming and leaving Tehran.

Share of mobile source in Tehran's air pollution, which is classified as a pressure indicator, is increased in the period of investigation.

The high volume of road traffic, and also air transportation in Tehran metropolitan in the period of this investigation has been the major source of air pollutions. Therefore, the major cause of air pollution is still the mobile sources. The percent share of mobile source of pollution has increased from 91.34% in 2008 to 92.73% in 2010. The most important fuel from the aspect of share in mobile source air pollution has also been gas.

In state section, statistics show a decrease in days with healthy air condition, especially in 2010. As it is shown in Figure 2, the highest concentration of air pollutants such as NO_x and particulate matters are found in central and southern parts of city of Tehran.

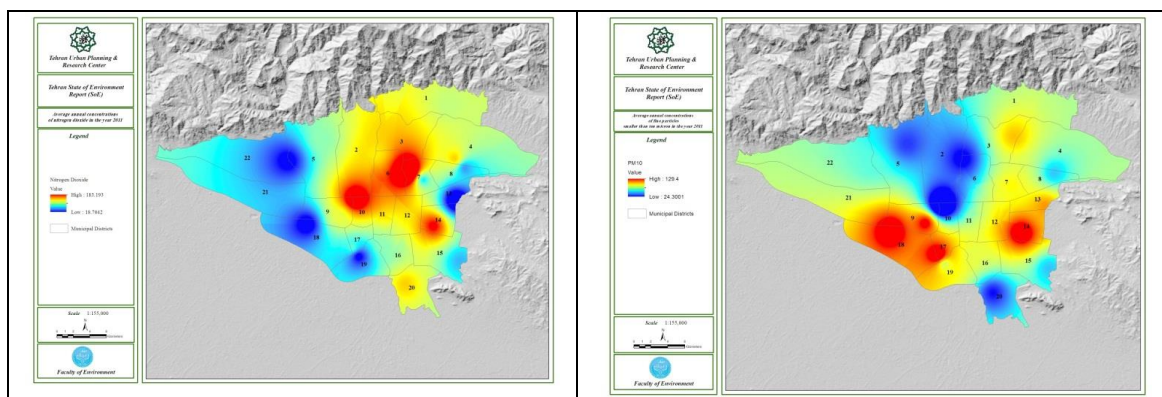


Fig. 2. Maps of NOx and PM10 average concentrations in Tehran in period of investigation

In impact section, it is stated that air pollution has very negative consequences on human health so that 45.5 percent of death in Tehran has been related to heart and respiratory diseases, relevant to air pollution. It also poses a huge external cost on the economy which has been calculated 16111 billion Rials for the year 2010 with an increase of 460 billion Rials in comparison to the beginning year of the investigation.

In response section, at first, actions and responses from different organization in charge of air pollution is assessed and then suggested solutions are proposed. This research showed that not only the state of air pollution in Tehran in time of investigation has become worse, but also the mitigation measures taken were not successful in improving the situation. This is due to the fact that the preventive measures did not address the correct palace in the casual chain of creating air pollution in Tehran, that is decentralization and moving the population gradually from Tehran. Therefore, in response section, using DPSIR framework, suggested mitigation measures were presented for every part of the casual chain, from which decentralization and reducing the population of Tehran and its adjacent areas are the major solutions. Other responses include improving public transportation, improving the green spaces with particular attention to ecological network and green infrastructure and increasing public awareness in order to reduce the use of private vehicles.

Keywords: air pollution, Driving force- Pressure- State- Impact- Response (DPSIR) model, system approach in environmental planning.