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# Information systems based on space monitoring for solution of some problems of sustainable development

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## Abstract

The problem of creation of scientific and information base of sustainable development in the Aral Sea region and former Semipalatinsk nuclear test site is considered. This problem can be solved with the usage of space satellites, methods of remote sensing, and proper mathematical models. The ecological and economical model of some regions of Central Asia and its informational base has been developed. Suggested GIS and remote sensing data will provide necessary information.

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*Keywords:* Information system; Space monitoring; Sustainable development

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## 1. Introduction

The problem of studying the Earth as a whole natural system can be solved by using space satellites, methods of remote sensing, and proper mathematical models. Remote sensing involves survey of the atmosphere, surface of the Earth and ocean by means of photography, spectrometry, automatic tracking radars, lidars, television systems from spacecrafts, satellites and aircrafts to study state of nature and to conduct appropriate mapping. In order to find solutions to the above-mentioned problems, it is necessary to create an international global monitoring system based both on satellites and ground stations. A considerable success was achieved in fundamental research of pattern recognition and application of space image processing to the study of natural resources and ecology. Satellites with television, spectrometric, photographic equipment are the main means of continuous control of the state of natural systems of our

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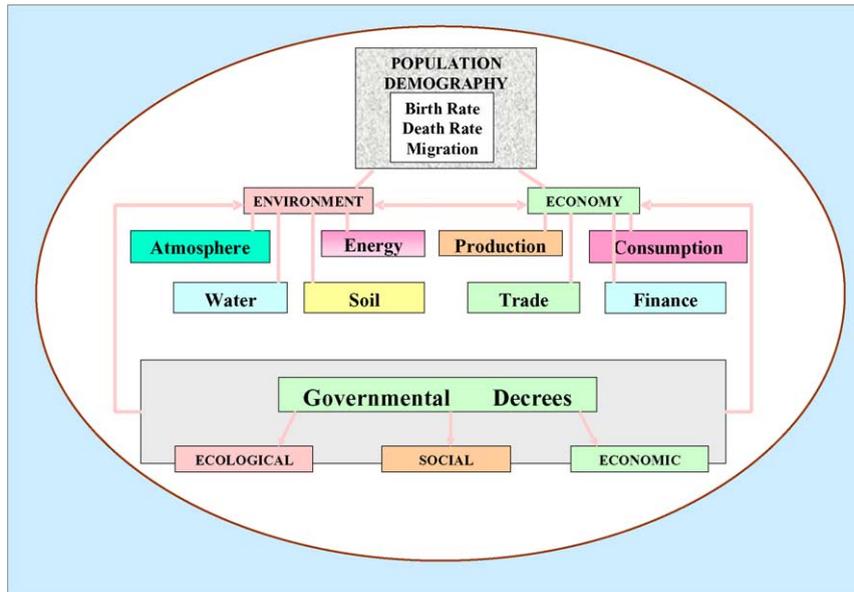


Fig. 1. Sustainable development scheme.

planet: for example, space systems such as “LANDSAT”, “SPOT”, “NOAA”, piloted orbital stations. The American space program “Mission to Planet Earth” studies a wide range of problems from the break down of biochemical circulation to the thermal balance of the Earth.

Today, the problem of revealing universal signs of sustainable development is a matter of great concern. Its solution may be found only on the basis of complex scientific approach. In terms of this approach, the environment, economy and social development should be treated as a unified architectural ensemble with its internal connections (Fig. 1). Interactions between population, economy, and the environment often have non-deterministic character and contain variables that vary at different speeds. It seems that they can be solved only on the basis of system analysis and inter-disciplinary approach. Therefore, they shall be based on the regularities of biosphere development and ecological factors. On the basis of a unified system, it is not difficult to formulate certain target functions of optimal use of natural resources at each level and determine rational indices of sustainable development, which reflect real links. Furthermore, on the basis of unified models there should be identified problems of cleaning atmosphere, water and soil taking into account social economic possibilities of the society [1–3].

At present the following criteria of sustainability is used: gross national product (GNP) per capita should not exceed the same figure expected for future generations and mortality rate for future generations should be less than it is for the present ones. Otherwise, one may speak about unsustainable development. The Aral crisis is one of the examples, which exhibits how ignored interconnections between economic, social, ecological factors have resulted in unsustainable development. Dynamics of water resources allocation in the Aral Sea basin and its connection with GNP and population are shown in Table 1.

How to promote sustainable development in environmental, social and economic terms is a common concern of all countries of the region. For the Central Asia Republics, a key question is also how to balance economic and social objectives with environmental constraints and opportunities. Thereby, we have developed the ecological and economical model of some regions of Central Asia and its informational

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