Planning Zone Model — an analytical tool for long-term planning

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POLICY BRIEF

The web-based set of models ASBmm (asbmm.uz) was enhanced through incorporation into it of a mathematical model for water management in planning zone (PZM) developed within the PEER Project.

Planning zones (PZs) - the main units of water management zonation in the Amu Darya Basin that (partially or fully) coincide with national provinces. These units are linked with each other through the river network, in upper, middle, and lower reaches of Amu Darya, within the boundaries of the riparian countries of the Amu Darya River Basin. The PZM model considers objects that are characterized by their: crops produced on respective irrigated areas; water resources (local and transboundary rivers – Amu Darya and its tributaries); trends of water use by sectors (drinking water supply, industry, etc.); irrigation system parameters (performance); productivity (crop yield potential); innovation technologies (e.g. drip irrigation, unit reduction of irrigation norm); socio-economic parameters (population growth rates, agricultural product prices).

The planning zone model was created in line with the IDEF family of methods (developed in the U.S.), in particular the function modeling methodology and the information modeling methodology.

The PZM model consists of three large modules, such as "Water balance calculation", "Irrigated agriculture production calculation", and "Socio-economic assessment".

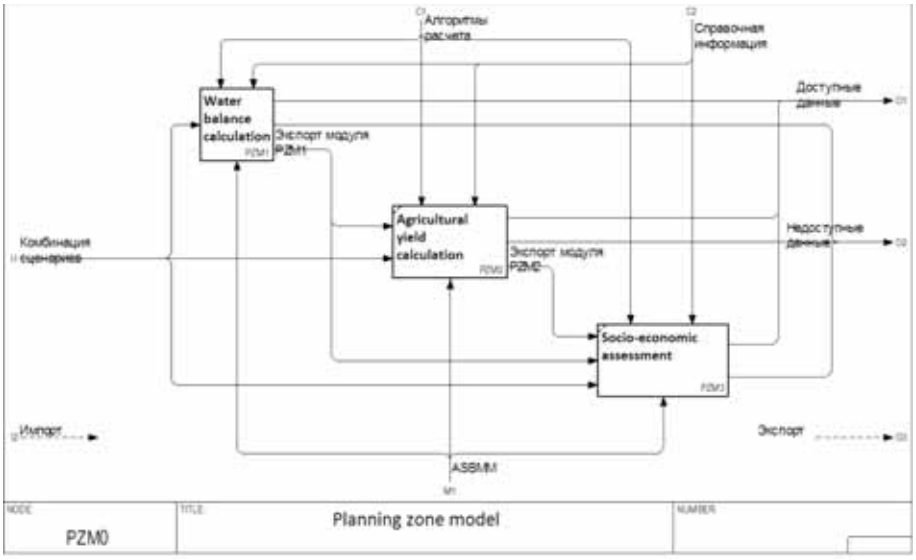
Decomposition of the diagram into smaller fragments (with required detalization) implies division of the "Water balance calculation" module into the following blocks: "Processing of input data", "Calculation of water requirements", "Calculation of available water resources", "Closing a water balance", "Processing and output of calculation results". The input data are grouped into: control actions (user data), information from DB (scenarios, trends, retrospective and reference information), and output data from other models (Cropwat, WAM ASBmm, REMO).

The graph of scenario system and the client interface (cawater-info.net/pzm/basic/web) of the Planning zone model are shown in the Figures below. The Figures show that the user may enable/disable the climate scenario and choose one of the following socio-economic development scenarios: FSD (Food Security and Diet change), ESA (Export-oriented Sustainable Adaptation) or BAU (Business As Usual).

The Figure below shows examples of PZM calculation results (in graphical form) for the Khorezm planning zone – trends of irrigated land productivity.

Project “Transboundary water management adaptation in the Amudarya basin to climate change uncertainties ”

www.cawater-info.net/projects/peer-amudarya/



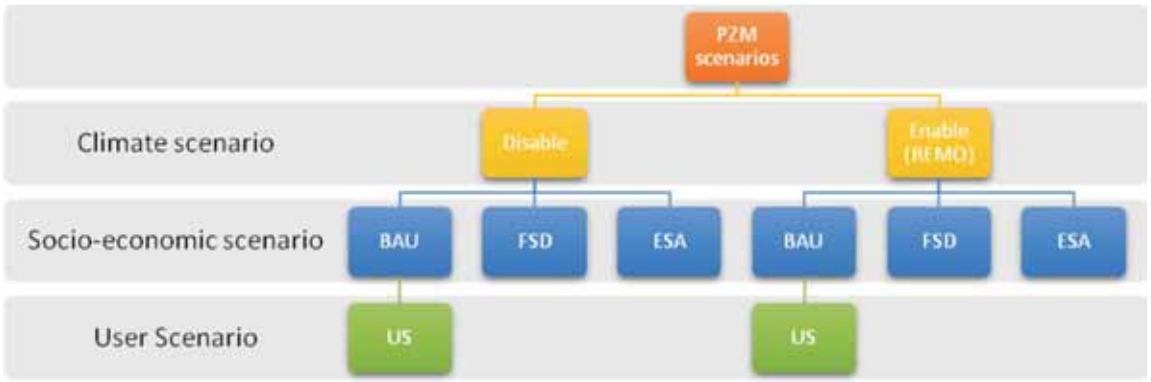
Function model of the Planning zone model

The main parameters of PZM are: required water supply to PZ (under which no water shortage is experienced); water withdrawal from transboundary and local sources; water deficit; potential irrigated agriculture production (in money terms); irrigated agriculture product losses; productivity of irrigated land and irrigation water; production per capita. The average, the maximum, and the frequency of occurrence of the absolute value above the average are calculated for each indicator.

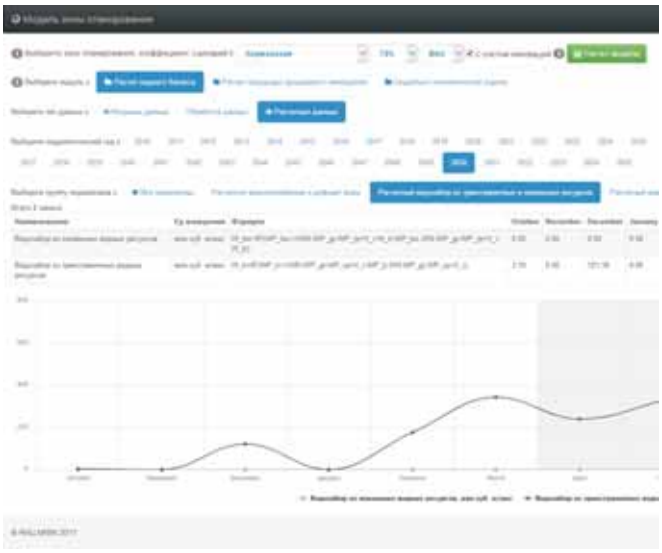
The PZM model is incorporated into the set of models for water resources management in the Aral Sea basin (ASBmm), the last version of which was developed by SIC ICWC together with IHE-UNESCO. ASBmm is comprised of a number of information modules and computer programs, particularly the model of water allocation and flow regulation in Amu Darya Basin rivers by large reservoirs with hydropower. This set of models can be used by the experts in water sector, agriculture, environmental and public agencies who deal with long-term planning and strategic development scenarios.

Optimization of performance of a Planning zone allows improving productivity to 0.8$ per cubic meter of water against the current one of 0.3-0.4$/$m^3$ in this zone, depending on the selected scenario. Climate impact was taken into account in the model when calculating crop water requirements (evapotranspiration, rainfall).

Input and output data of the planning zone model is available in the project database (cawater-info.net/peer/).

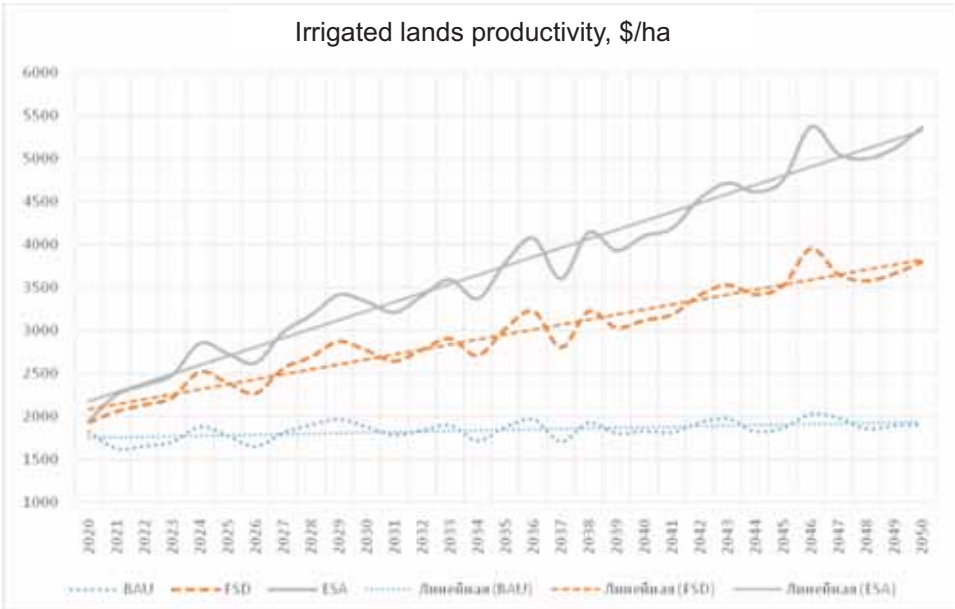


Graph of scenario system



Client interface of the planning zone model

Client interface of the ASBmm model



Results of the PZM model,
example of the Khorezm planning zone

Glossary

Main criteria of forecast calculations:

BAU scenario – business as usual in agriculture,

FSD scenario – achievement of food security,

ESA scenario – export-oriented sustainable agricultural adaptation.

FSD criteria:
• maximum production to achieve food self-sufficiency;
• increased crop and livestock production in line with population growth;
• increased animal heads, contributing to livestock products (meat, milk, eggs) and thus raising self-sufficiency;
• ensured growth of total crop export, revenues from which contribute to other fields of agrarian production (mainly to animal farming);
• intensified application of innovative water- and resource-saving technologies in line with the food security strategy.

ESA criteria:
• maximum food export;
• maintained level of food self-sufficiency at 80%;
• boosted agricultural production, based on currency earnings from export;
• highest possible application of innovative water- and resource-saving technologies at the expense of export revenues.

This Policy Brief is prepared as part of the Project "Transboundary water management adaptation in the Amudarya basin to climate change uncertainties".

The Project objective is studying in a holistic manner transboundary water management issues in the Amudarya basin for the long run under conditions of climatic and other changes along with the national plans on irrigated agriculture and hydropower development.

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