FOOD AND WATER DEMAND AND SUPPLY IN 2025

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Contents

Summary

Water use projections indicate that in the year 2025 humans will need more than 22% more primary water than in 1995, equivalent to 2820 km^3, to meet all agricultural, domestic, and industrial needs. In addition to using water more effectively, this projection indicates that mankind has to continue to place considerable financial resources into developing water resource infrastructure to store and divert water. Water use is a function of population, diets, domestic, and industrial needs, and how effectively water resources are used. When will human society start to reach the limits of its renewable water resources? What is the potential for reducing future requirements by improvements in managing water resources or changing consumption patterns?

A base case scenario generated by the PODIUM model, representing a likely scenario of water resource use, was used to explore these and related water supply and demand questions. Using PODIUM, it is estimated that in 1995, on a global average, a person requires 470 m^3 of water per year. The base case scenario, using an assumed population growth of 33%, projects that by 2025 average annual water diversions amount to 450 m^3.

Additional scenarios, using the PODIUM base case as a reference, explored sensitivity in water supply to population, diets, efficiency in irrigation, and productivity in irrigated and rain-fed agriculture. It was shown that changing to a less meat-intensive diet could save some water, but it depends heavily on in which countries this change takes place.

Consuming more vegetables may offset gains made in consuming less meat. There are gains to be made in water savings in agriculture, but these are far more limited in magnitude than commonly thought and do not go far beyond the base case scenario. It may not be environmentally prudent to increase efficiency in water use beyond the gains already shown in the PODIUM base case. Productivity gains in both irrigated and rain-fed agriculture certainly hold the most potential for reducing the need for additional water resources. But this will require significant changes in the way agriculture is carried out in developing countries.

1. Introduction

For millennia, humans have diverted water from its natural hydrologic course to meet basic human needs: drinking, bathing, manufacturing, and food production. Except in the most arid areas, a major problem has been to develop more infrastructure for storing and diverting water to meet human needs. When will mankind start to reach the limits of its renewable water resources? How much more infrastructure must be developed to exploit more water resources? What is the potential for improvements in managing water resources? Can humans change their habits to use a limited resource better? With more and more people facing water scarcity in cities and in agriculture, these are critical questions for the twenty-first century.

To explore these questions, the International Water Management Institute (IWMI) developed a Policy Dialogue Model (PODIUM) to help global communities and nations understand key relationships between human water needs, water availability and water use. The model was used extensively to facilitate understanding and promote discussions and consultations meetings leading to the 2000 World Water Forum.

This paper describes key results from the PODIUM modeling exercise. It explores the relationship between global water use and key variables of population, diets, irrigated versus rain-fed agriculture, and productivity of water. In this way the effect of the most important water-related choices needing to be made in the near future can be understood.

2. The PODIUM Model

2.1 Model Description

The most important aspect of PODIUM is that it projects *what can happen* as opposed to *what will happen*. A wide variety of variables can be changed that have a major impact on water use and food production. It allows exploration of various key policy options that will have a major impact in this century. PODIUM is run on a national scale, and then results are compiled on a global scale to obtain a worldwide picture of water use and food production.

Computations are done in four steps (Figure 1). The first estimates food grain requirements based on assumptions concerning population growth, calorie intake, and composition of diets. Second, food production is estimated based on expected yields and cultivated area under both irrigated and rain-fed conditions. The projected production is

then compared to the required production and country-wide surplus and deficit of food grains is estimated. The third module estimates future water requirements by considering domestic, industrial, and agricultural needs. Projected food production by irrigated agriculture is converted into water requirements. Finally, food production is compared to demand, then future water requirements compared to availability of water, to obtain an indication of water scarcity.

Figure 1a. Cereal requirement variables

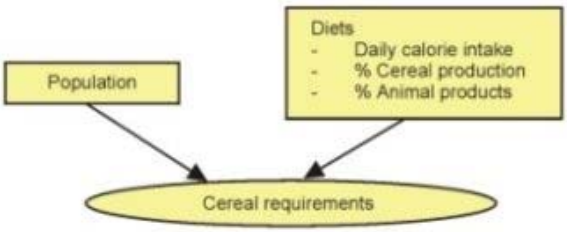

Figure 1b. Cereal production variables

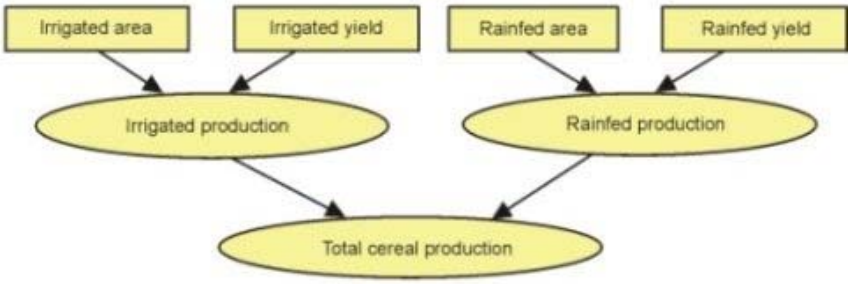

Figure 1c. Water requirement variables

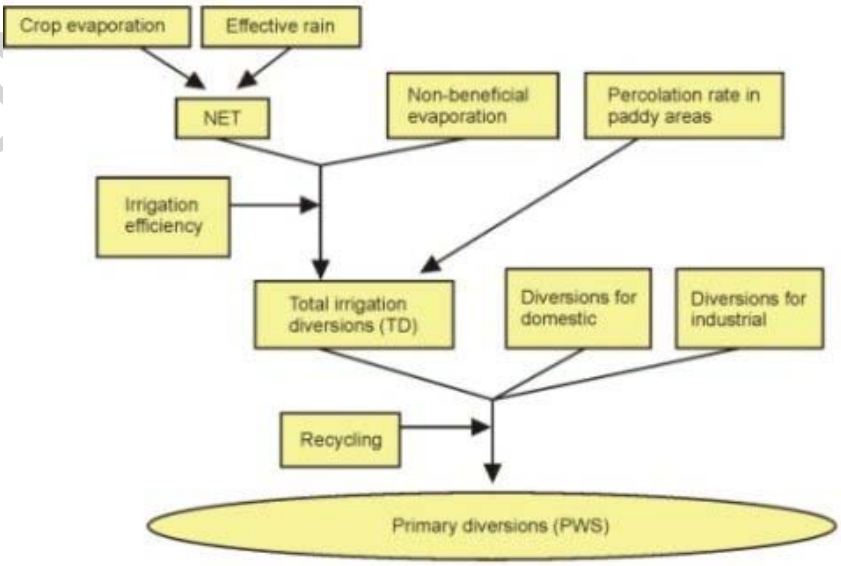

Figure 1. PODIUM Model Variables

It should be emphasized that reliable data on key factors in global water and food supply are lacking. Consequently, assessments of the water use situation and projections for the future involve a large amount of uncertainty. There are large gaps in knowledge about water resources, water use, and irrigated areas. Thus, there is an urgent need for more accurate data. The figures used in the PODIUM model are based on published data sets, supplemented by "best estimates" by IWMI scientists and national collaborators working in the different countries.

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