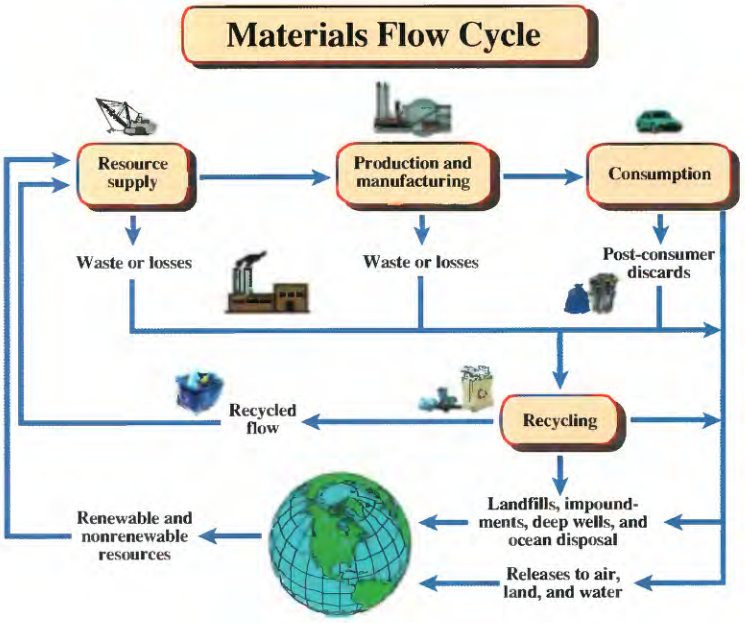
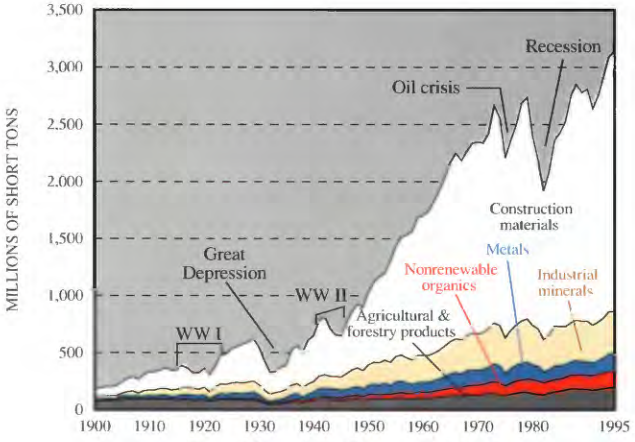
USGS
science for a changing world

Materials Flow and Sustainability

Materials extracted from the Earth are necessary to produce our most fundamental needs – food, clothing, and shelter. Materials are needed to maintain and improve our standard of living. Understanding the whole system of materials flow, from source to ultimate disposition, can help us better manage the use of natural resources and protect the environment.





Raw Materials Consumed in the United States, 1900–1995

Since 1900, use of construction materials such as crushed stone and sand and gravel has increased from about 35 percent to 60 percent of total non-food, non-fuel raw materials consumption in the United States. Consumption of non-food and non-fuel agricultural and forestry products has dropped from about 60 percent to 5 percent of total raw materials consumption during the same period.

Materials Flow

Materials flow, in its most literal sense, is a systems approach to understanding what happens to the materials we use from the time a material is extracted, through its processing and manufacturing, to its ultimate disposition. The U.S. Geological Survey (USGS) investigates how materials affect the economy, society, and the environment. The purpose of this work is to understand how and why we use our resources and to identify policies and practices that make resource use more efficient and more protective of the environment. Some materials-flow studies identify and trace trends that, if they continue, could have worldwide economic and environmental impacts. For example, when considering the total domestic non-food, non-fuel material consumption, a current significant trend is the declining share of renewable resources, such as agricultural and forestry products (i.e., cotton and wood), and the increasing share of nonrenewable resources, especially construction materials. Another type of materials-flow analysis is the commodity mass balance study, which follows and quantifies the flow of a single commodity through its entire cycle. These analyses identify areas where adverse impacts could be minimized through reducing wastes at the source of the materials, improving waste utilization, and enhancing efficiencies. Commodity mass balance studies have been completed on arsenic, boron, cadmium, chromium, cobalt, lead, manganese, mercury, salt, tungsten, vanadium, and zinc.

U.S. Department of the Interior
U.S. Geological Survey

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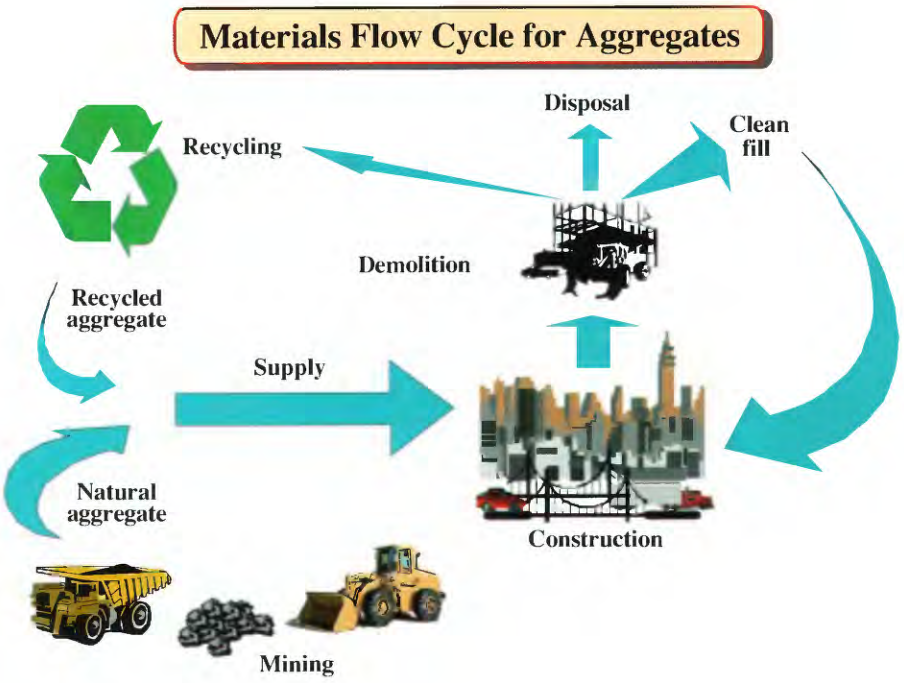
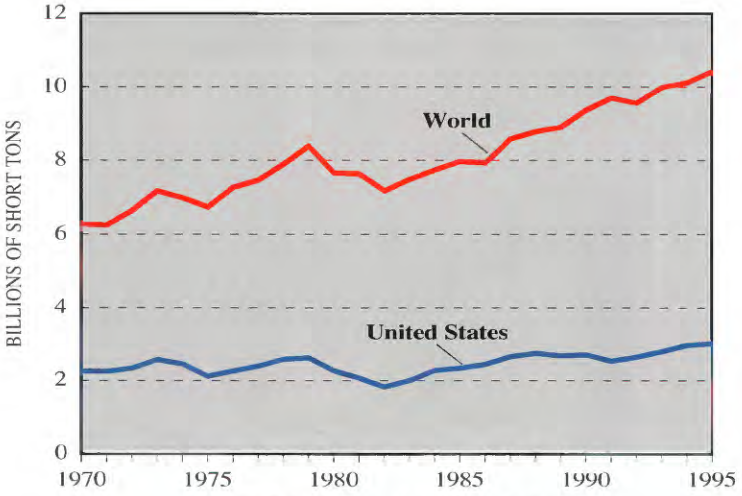
Reports

Current reports include Aggregate from Natural and Recycled Sources; Economic Assessments for Construction Applications; Consumption of Materials in the United States, 1990 to1995; Crushed Cement Concrete Substitution for Construction Aggregates; Energy Consumption for Recycled and Natural Aggregates; Mercury – A Materials Flow Study – An Update; Recycling of Metals; Sulfur – A Materials Flow Study; Total Materials Consumption – An Estimation Methodology and Example Using Lead; and Trends in Minerals Exploration. When completed, selected reports will be posted on the USGS Minerals Information web page at:

http://minerals.er.usgs.gov/minerals





World & U.S. Materials Use, 1970–1995

People worldwide consumed about 10 billion short tons of non-food, non-fuel raw materials in 1995, almost double the materials consumed in 1970. Over this period, the United States has been consuming about one-third of the world's total materials production.

Partnerships/Customers

The USGS works with other Federal, State, and local agencies and private interests to develop an understanding of materials flow and sustainability concepts and to form partnerships to address materials-related sustainability issues. U.S. governmental partners and customers include the President's Council on Environmental Quality, the Environmental Protection Agency, the Interagency Materials Flow and Industrial Ecology Work Group, the President's Council on Sustainable Development, the U.S. Department of Commerce, the U.S. Department of Energy, and the U.S. Department of Agriculture.

For more information contact:

U.S. Geological Survey
(303) 236-8747, Ext. 238
Minerals Information Team

Prepared by John L. Sznopek and William M. Brown