3.13 Selected Pressures on the Environment: Toxic Emissions, Energy Use, and CO^2

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Report Card

- Most categories of hazardous waste emissions, air and water pollution (especially non-point), toxic releases and waste generating are growing. In aggregate, while not necessarily caused by these factors, pollution and waste are growing at about the rate of Oregon's population and economic growth.
- While difficult to measure or predict, the increased pressures on the environment caused by the continued rise in pollution and waste may affect environmental health, economic sustainability and human health within Oregon's urban and residential areas and their associated ecoregions and watersheds.
- Air quality has improved in monitored compliance areas but is still at risk from vehicles.
- Recycling is increasing, but the rate of waste generation is equal to and may exceed the rate of recovery and recycling.

Indicators

1. Percentage of assessed groundwater that meets current drinking water standards.
2. Frequency that the Air Quality Index exceeds existing standards.
3. The amount of carbon dioxide emitted.
4. Trends in aggregate toxic and hazardous emissions.
5. Trends in waste produced compared to recovery.

Introduction

In other sections of this Report, the conditions and trends of various resources and risks to naturally functioning landscapes and economic sustainability in Oregon have been assessed. In this section we take a different approach by examining the aggregate pressures on the environment generated by Oregonians, as measured by point and non-point pollutants. In specific, we assess trends in air pollution, toxic releases, solid waste, hazardous wastes, energy use and CO^2. Most, but not all, of these environmental pollutants result from activities associated with Oregon urban areas. Some of the impacts of the pollutants are evaluated within other chapters of this Report (such as the water quality section in chapter 3.1). In this chapter, we assess trends in generation and recovery, not environmental impacts *per se*.

We have assessed trends in pollution and waste because physical changes to land use and land cover are not the only sources of impacts to Oregon's environmental or economic sustainability. The introduction of pollutants and waste into the environment can also be significant threats to the health of Oregon's environment and economy. Sometimes the impacts of pollution and waste are direct, such as when soil or water is contaminated. Other times the pollutants intermix in ways that are difficult to measure and generate more significant environmental impacts than any one pollutant alone may create.

This section assesses trends, not impacts. We have taken this approach because while it is possible to measure the environmental effects of some individual emissions and discharges in isolation, it is often difficult to measure their long-term cumulative effects or the effects of combinations of pollutants on the environment or human health. In addition, environmental impacts often result from "leakages" throughout the economy which regulatory monitoring programs don't capture, such as when toxics embedded in products leak into the environment through use or disposal, when toxics are used for home and garden use, or when small spills and leaks occur. Thus, assessing overall trends in pollution and waste may provide a helpful assessment of potential impacts than our existing impact monitoring and measurement tools alone can provide.

We conclude this section by comparing trends in many (though not all) of the pollutants and waste to the growth of Oregon's population and economy. In aggregate, while not necessarily caused by population growth, we found that pollution and waste as defined by most of the parameters assessed here are growing at about the rate of Oregon's population and economic growth.

It is important to note that no single form of pollution or waste provides a complete picture of potential risk to environmental or economic sustainability or human health. Some of the data used in this assessment, such as the Toxic Release Inventory (TRI), are still in the developmental stage and irregular sampling and reporting efforts may mask trends. The TRI data are also skewed towards industrial sources and do not include the many other sources of toxic chemicals present in Oregon. TRI data therefore provides an incomplete, generally low level assessment of all sources of toxic chemicals.

In addition, many factors must be considered to determine the risk levels resulting from the pollutants and waste. For example, the toxicity of the pollutant, the extent of exposure, the life cycles of chemicals involved, the type of release, various delay mechanisms in the cause-and-effect chain, the effects of long-term accumulations, the effects of combinations of toxics in nature, the location of discharges, and the assimilative capacity of the environment must all be assessed to determine risk levels. The information in this section should therefore be used *only* within the context of a set of many other indicators to draw conclusions on potential risk to environmental and economic sustainability or public health.

Assessing trends in pollution and waste is important, however, because the issues are of concern to Oregonians, toxic chemicals, pollution and waste have the potential to harm the environment and human health, and the data analyzed hereare the best available today. As the reasons are complex and relate to producer and user management issues, public policies, and other issues that are beyond the scope of this report, we have not attempted to identify what may be driving the trends identified. Even without understanding the drivers, however, measuring trends in pollution and waste provides an important piece of information an how well Oregonians are doing at managing some of the pressures they place on the environmental. It also provides important insights into the effectiveness of existing pollution and waste management policies.

Mobile, area, and point-source air emissions

Clean air is important to environmental and economic sustainability. Air pollution is created when the type, concentration and duration of pollutants exceed nature's capacity to break down and re-assimilate pollutants into the environment. The effects of air pollution on the environment depend on the type of pollutant, its concentration and toxicity, and the duration of exposure. These effects may include the direct impacts of the pollutant as emitted, such as a gas, the deposition of nitrogen and sulfur leading to acidification of water bodies, ozone impacts on vegetation, visibility impairment in wilderness and scenic areas, and effects to human health.

Air pollutants are broadly categorized into two main classes. The first are the Criteria Pollutants, which include nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10}), carbon monoxide (CO), lead (Pb), and Ozone (O_3). Volatile organic compounds (VOCs) although not a Criteria Pollutant are also subject to controls because together with NO_2 and CO they are a precursor of O_3. For the Criteria Pollutants, EPA has established the National Ambient Air Quality Standards (NAAQS) to protect against adverse public health effects, including the health of sensitive populations, and to protect against adverse effects on the environment. The NAAQS are expressed as a concentration that can be measured by an air quality monitor, or that can be mathematically modeled using source emissions data. In addition, EPA and the Federal Land Managers, such as the National Park Service, have established criteria levels for pollutant impacts in wilderness areas and national parks.

The second major class of air pollutants is comprised of the Hazardous Air Pollutants (HAPs), compounds that either cause short-term acute health effects or long-term chronic effects, such as cancer. Although EPA has suggested some benchmarks for Hazardous Air Pollutants, the establishment of these benchmarks will receive greater attention as EPA and the states increasingly focus their efforts on local HAP impacts.

Sources of air pollution are categorized into three broad classes: point sources, area sources, and mobile sources. Point sources emit pollutants from a single, stationary location, such as a manufacturing plant, and operate under a permit from the Department of Environmental Quality (DEQ). Area sources include relatively small individual sources of pollution spread across a geographical area, which collectively contribute to significant levels of emissions. Examples of area sources include residential wood stoves, open burning, dry cleaners, fuel use and distribution, and road dust. These sources are not issued permits directly, although the activity may be controlled under certain conditions, such as curtailment of open burning during stagnant conditions. Finally, mobile sources include cars, trucks, airplanes, railroads, vessels, and non-road vehicles and equipment, such as graders and backhoes. **Figure 3.13-1** shows the relationship between these source categories and emissions. Note the relatively high mobile source emissions for all pollutants, and the corresponding low contribution from point sources, generally under 10% of total emissions. The high area source emissions are largely from prescribed burning and forest fires.

Air quality in Oregon is evaluated by DEQ using two basic approaches. The first is direct measurement of ambient air using air quality monitoring sites. The second approach uses estimated emission levels from sources, together with numerical modeling of these emissions to predict the ambient concentrations in a given area. The results of the monitoring and modeling can then be compared against air quality standards, such as the NAAQS, or other criteria levels as they are available. Relative change in air quality over time can be evaluated by looking at changes in monitored values, looking at changes in modeled impacts based on emissions estimates, or looking at changes in the emissions estimates directly as a substitute for modeled impacts.

Monitoring

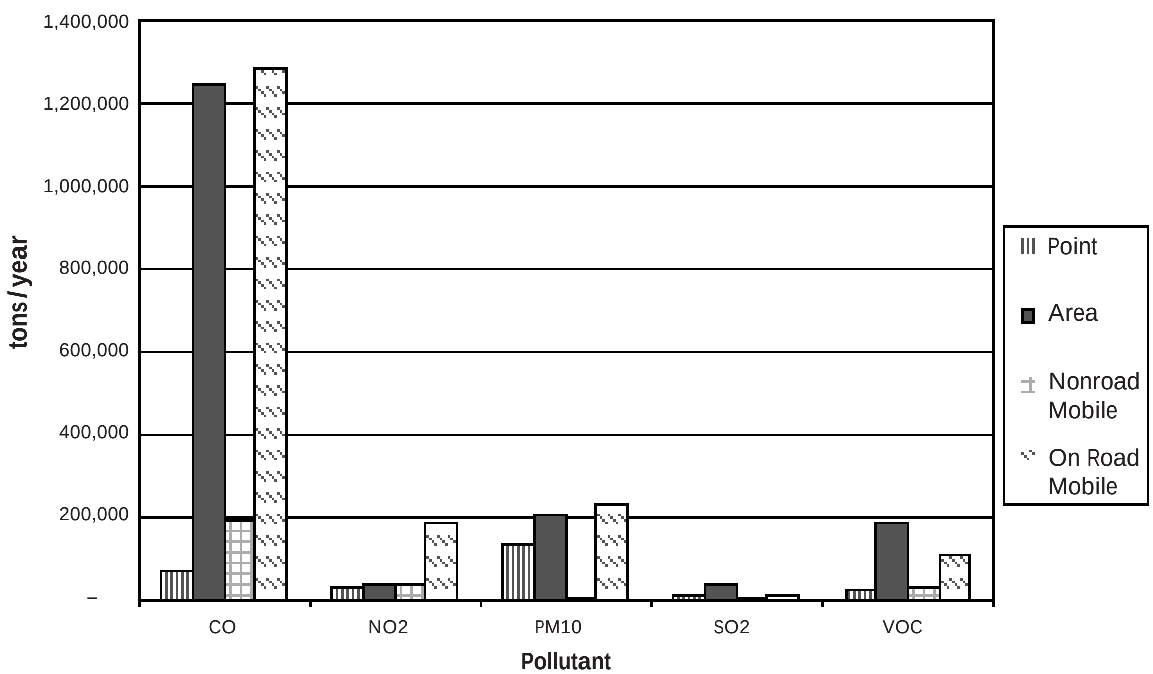
Historically, the focus of the monitoring network has been on the Criteria Pollutants, especially PM_{10}, CO, and O_3 in Oregon. In general, monitored values for all criteria pollutants show a declining trend. Attainment for O_3 is based on multiyear averaging. The variability of the O_3 trend is the result of the high dependence of O_3 on temperature and sunlight.

The apparent trend to lower air pollution levels is in large part the result of cleaner running automobile and truck engines and controls on open burning. However, we may be near a point where a counter trend of population growth and increasing numbers of cars will flatten and reverse these trends in the absence of further reductions in emissions. Thus mobile source emissions may rise.

Monitoring of Hazardous Air Pollutants is more expensive and resource intensive, and monitoring on a consistent and continuing basis has only begun in limited areas in Oregon over the last year. Thus, at present there is no history of monitored HAPs data with which to show trends. DEQ is about to complete a highly detailed HAP inventory for 1996, which could be used for modeling of specific areas of concern. As future inventories are developed, trends of specific Hazardous Air Pollutants emissions and their modeled impacts can be tracked and evaluated, and will be a valuable tool for evaluating trends in air quality in Oregon.Toxic emissions into air

As stated above, DEQ is in the process of characterizing Hazardous Air Pollutants in Oregon. This section uses data from

Figure 3.13-1. 1996 Oregon Criteria Pollutant Emissions



Note: Area source emission totals include wildfire & prescribed burning.

the Toxic Release Inventory (TRI), as generated by the Oregon State Fire Marshall, to show trends in toxic air releases.

Total toxic air releases, a measured by the Toxic Release Inventory, increased by 1,616 tons from 1990 to 1996. Air emissions constituted the highest quantity of TRI listed chemicals released, which remained constant between 1990 and 1996. Examples of the types of chemicals released into the air include ammonia, trichloroethylene, naphthalene, freon 113, and others. **Figure 3.13-2** illustrates the total toxic release by air in 1990 to 1996.

While there are many factors that must be assessed to understand potential risk to the environment and human health, TRI data provide a general depiction of what is probably the lower level amount of toxic chemicals that are directly released into the air. As discussed elsewhere, the TRI is still in the developmental stage and irregular sampling and reporting efforts may mask actual trends. The TRI data are also skewed towards industrial sources and do not include the many other sources of toxic chemicals released into the air in Oregon. A thorough evaluation of all toxics released into Oregon's air will provide a more accurate assessment of potential risk.

Toxic emissions into water

Water quality is an important indicator of aquatic ecosystem health. Poor water quality can impact fish and other forms of terrestrial and aquatic biodiversity. It can also lead to human health problems. Water quality is threatened by a variety of sources, especially "non-point" sources (e.g. urban stormwater and agricultural runoff). A review of data from four Oregon river basins shows approximately 85% of pollution coming from non-point sources. Non-point contributions within urban areas can include pesticides, fertilizers, other chemicals, runoff from roadways and parking lots, and sediment from soil erosion. Non-point within agricultural and forested lands can include pesticides, fertilizers, other chemicals and sediment from soil erosion.

The water resources chapter of the *State of the Environment Report* (Chapter 3.1) assesses the conditions and trends in surface water quality statewide, based largely on Oregon Water Quality Index monitoring. The OWQI provides an ambient measure of pollution in streams. This section assesses point-source toxic releases and transfers into both surface water and potable (drinking) water based on information from the Toxic Release Inventory (TRI). TRI data only includes toxic releases by facilities and manufacturing plants that process more than 25,000 pounds or otherwise use more than 10,000 pounds of any listed chemical during the calendar year. While there are many factors that must be assessed to understand potential risk to the environment and human health, TRI data provide a general depiction of the amount of toxic chemicals that are being directly released into the water statewide.

Sewage overflows remain a problem in Oregon, but may be reduced in coming years by infrastructure improvements recently undertaken in several cities. While wastewater flowing into municipal wastewater treatment plants has tripled since1940 (primarily due to population growth), pollution loads from treatment plants have dropped 60% during this period.

Overall toxic chemical releases into water decreased 12.6 percent, from 1990 to 1996. The greatest reduction occurred in potable water, nearly 7 million pounds. It is important to note that much of the toxic chemicals released into potable water are chlorine, which is used as a disinfectant and is listed as a chemical in the TRI. At the same time, toxic releases into surface water continued to increase. **Figure 3.13-3** illustrates the total release by potable water and surface water from 1990 to 1996.

Figure 3.13-2. Total toxic releases into air, in Oregon, 1990-1996

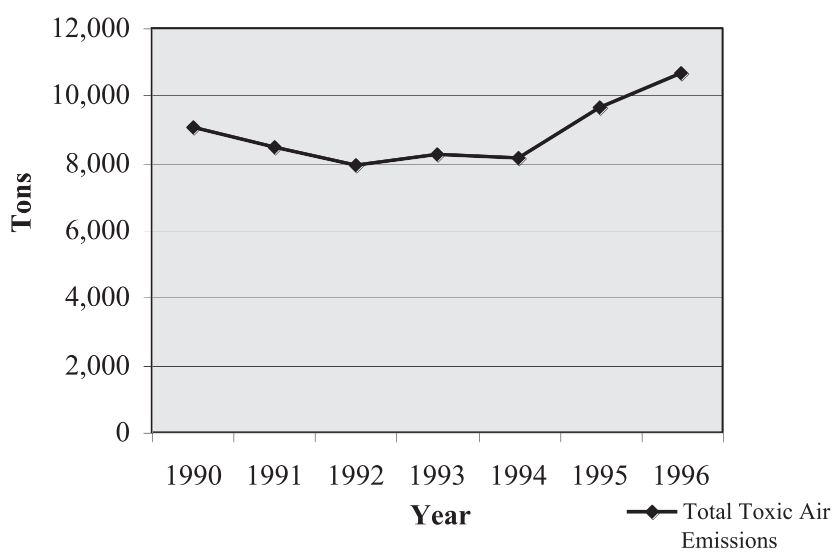


Table 3.13-1. Changes in release 1990-1996

Type	Tons	Percent
Potable Water	-3,499	-82.30%
Water	1,013	24.80%

Source: Office of the Fire Marshal, 1996

There is a substantial gap between the amounts of toxic release in water compared to potable water. On average, 561 tons were released per year into surface water, opposed to the average of 3,317 tons per year released into potable water**.**

Comparing the total releases in 1990 to 1996 indicates that releases in potable water have decreased more than 80% while general water releases have increased by approximately 24 percent (**Table 3.13-1).**

Toxic emissions onto land

Toxic emissions onto land from 1990 to1996 are analyzed here using Toxic Release Inventory data. During this six-year period total toxic chemicals released onto land accounted for lower emissions compared to total toxic releases into air and potable water. Overall, total toxic releases on land have declined from 1990 to 1996. Approximately one thousand tons of toxic releases were reported in 1996, which is less than half of what was reported in 1990 (**Figure 3.13-4**).

On average approximately 1,120 tons per year of toxics were released on land. From 1990 to 1994, there was a steady trend toward decline, but releases increased again in 1995 and 1996. However, total toxic release on land decreased by more than 50 percent, when comparing 1990 and 1996 total releases.

Solid waste generation and recovery

The amount of waste generated and how it is managed can have important consequences for the environment, some of which are just beginning to be understood. For example, waste disposal can affect both soil and water quality due to contamination and leaching at landfills and due to air pollution from incinerating processes. Incineration of solid waste can release toxic substances into the air.

The amount of waste generated can also be a good indicator of the environmental impacts of the overall "throughput" of materials and energy in a local economy. For many wastes, the materials that are disposed represent what is left over after a long series of steps that have environmental consequences, including extraction and processing of raw materials, manufacture of products, transportation of materials and products to markets, use by consumers, and waste management. At virtually every step along this "life cycle," the potential exists for impact ssuch as the production of greenhouse gases. Different wastes and waste management options have different implications for energy consumption, methane emissions, and carbon sequestration. Source reduction and recycling of paper products, for example, reduce energy consumption, decrease combustion and landfill methane emissions, and increase forest carbon sequestration. While knowledge in this area is increasing, the specific relationships between solid waste generation and management in Oregon and the production of greenhouse gases have not been studied. It can be assumed, however, that the larger the throughput of materials and the larger the resulting waste, the greater the possi-

Figure 3.13-3. Total toxic releases into potable water and water, in Oregon, 1990-1996

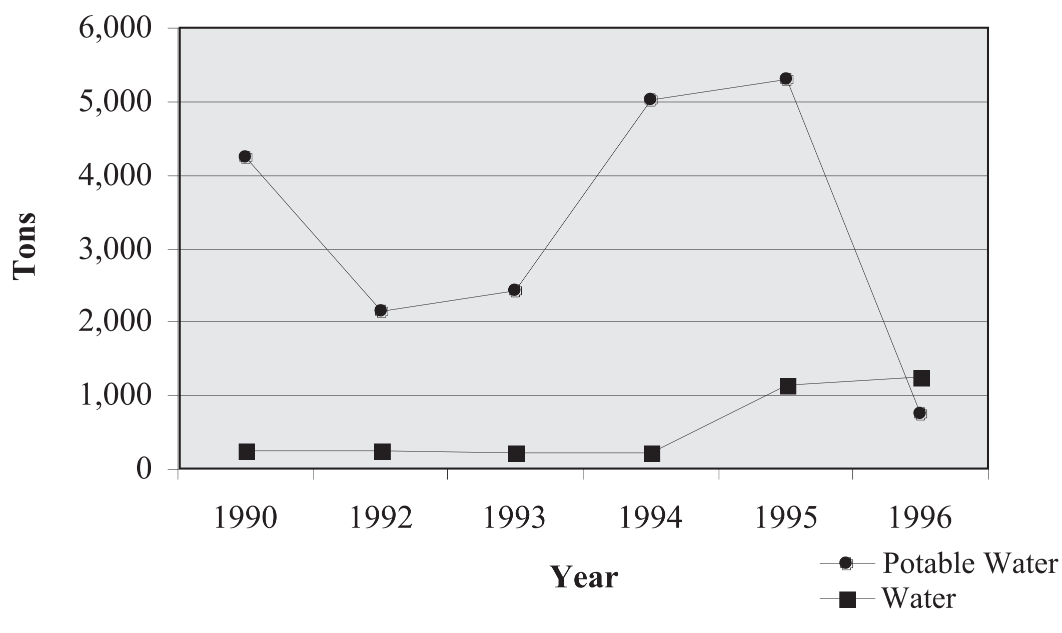
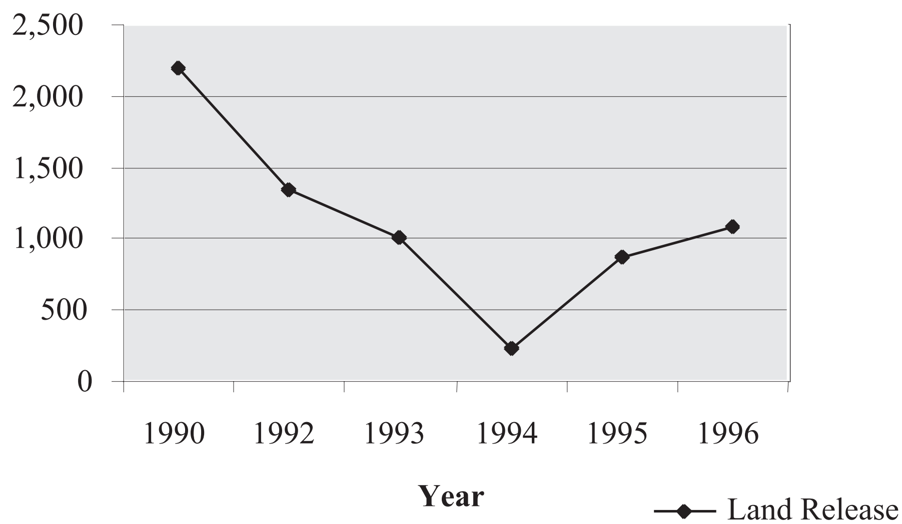


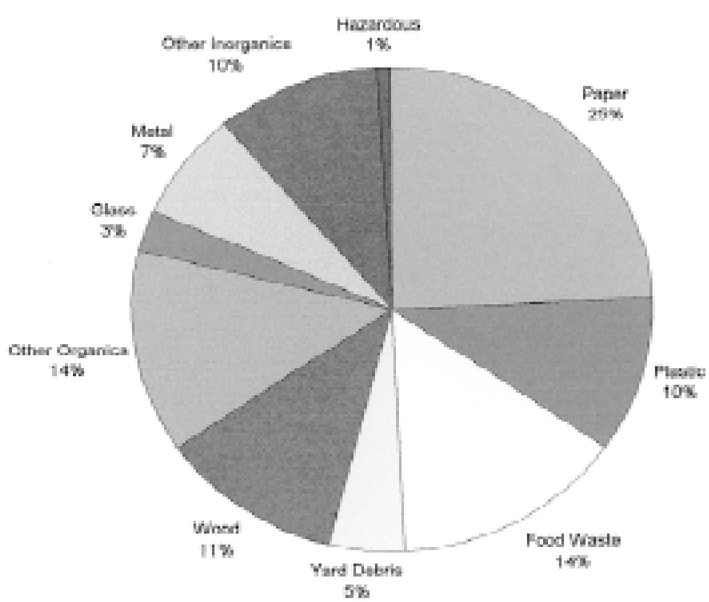
Figure 3.13-4. Total toxic releases onto land, in Oregon, 1990-1996



bility of environmental effects without significant effort to ensure that the materials and energy involved are used efficiency and are reused and recycled as much as possible.

In 1998, 93% of Oregon's municipal solid waste was transported to 48 landfills for disposal; the remaining seven percent was incinerated at Beaver Hill in Coos County or burned for energy recovery at the Brooks Energy Recovery Facility in Marion County. Although modern incinerators and waste-to-energy facilities produce relatively low levels of pollutants, they can emit acid gases, carbon dioxide, and toxic chemicals such as dioxin. In addition, the ash residue must be landfilled for disposal.

Figure 3.13-5. Composition of Oregon municipal waste



Data from the Oregon Department of Environmental Quality show that the total solid waste disposed at municipal and industrial facilities in Oregon has increased from 3,167,000 tons in 1993 to 3,807,000 tons in 1998. During this period of rapid population growth and a strong economy, municipal solid waste generated and disposed in Oregon increased from 2,280,515 tons to 2,695,916 tons. In addition, solid waste from out-of-state disposed of in Oregon facilities increased from 805,539 tons in 1993 to 1,175,205 tons in 1998. However, disposal in Oregon industrial waste facilities decreased from 423,000 tons to 350,000 tons in the same period. Much more is known about Oregon's municipal solid waste than about its industrial waste. This is due to the statutory requirement to calculate a statewide and county-level recovery rates since 1992 and promote the state's goal to recover fifty percent of its municipal solid waste by the year 2000.

The composition of municipal solid waste disposed in Oregon in 1998 is shown in **Figure 3.13-5**. Some materials have very high rates of recovery, including beverage containers collected under the state's Bottle Bill and cardboard and newsprint, while other materials have much lower rates of recovery (see **Figure 3.13-6**). The amount of organics recovered is expected to increase in the future as more composting facilities become more productive and the Cities of Portland and Eugene create food scrap collection and processing programs. If composting becomes more acceptable to Oregon's agricultural community, this increased production could have the additional environmental benefits of increasing the health of agricultural lands while reducing the use of synthetic fertilizers, pesticides, and herbicides. Since both soil erosion and runoff of agricultural chemicals near streams are major sources of water quality problems affecting salmon and other species, increasing the health of agricultural soils should be beneficial to species recovery.