

Estimating and Addressing America's Food Losses

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The U.S. food supply is the most varied and abundant in the world. Americans spend a smaller share of their disposable income on food than citizens of any other country and choose from an average of 50,000 different food products on a typical outing to the supermarket. In 1994, the food supply provided an estimated 3,800 calories per person per day, enough to supply every American with more than one and a half times their average daily energy needs. Given this abundance, few of the Nation's resources have traditionally been devoted to measuring or reducing food waste.

In recent years, growing concern about hunger, resource conservation, and the environmental and economic costs associated with food waste have raised public awareness of food loss. This in turn has accelerated public and private efforts to make better use of available food supplies by recovering safe and nutritious food that would otherwise be wasted.

Of course, not all food that is lost is suitable for consumption (fig. 1). Some losses—like the condemnation

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Food Losses Occur Throughout the Food System

Some food losses occur at the farm and farm-to-retail level...

Farm and post-harvest

- Preharvest losses due to severe weather, disease, and predation.
- Harvest losses attributed to mechanization, production practices, and decisions.
- Storage losses due to insects, mold, deterioration, shrinkage, and spoilage.

Processing and wholesaling

- Removal of inedible portions—bones, blood, peels, pits, etc.
- Discard of substandard products (bruised fruit, etc.)
- Shrinkage in storage
- Poor handling or package failure
- Transportation losses

ERS estimates only losses by retailers, consumers, and foodservice¹...

Retail

- 5.4 billion pounds of food were lost at the retail level in 1995.
- Retail losses were less than 2 percent of edible food supplies.
- Dairy products and fresh fruits and vegetables accounted for half of retail losses.

Consumer and foodservice

- 91 billion pounds of food were lost by consumers and foodservice in 1995.
- Foodservice and consumer losses accounted for 26 percent of edible food supplies.
- Fresh fruits and vegetables accounted for nearly 20 percent of consumer and foodservice losses.

Note: ¹Foodservice and consumer losses include storage, preparation, and plate waste at the household and foodservice levels. Source: Economic Research Service, U.S. Department of Agriculture.

of diseased animals at the slaughtering house, or the discard of moldy fruit from the produce shelf at the supermarket—are necessary to ensure the safety and wholesomeness of the U.S. food supply. Such foods are not recoverable for human use.

Likewise, plate scraps are appropriately discarded at eating establishments out of health considerations. In addition, not all food that is lost is economically recoverable. Food recovery efforts are often limited by financial and logistical constraints that make it difficult to match recovered food with potential recipients.

Nevertheless, large quantities of wholesome, edible food, are lost at every stage of the marketing system. Examples of such losses include meats, bread, and other foods prepared by a restaurant or caterer but never served and the discard of blemished or over-ripe produce, which may be unmarketable for cosmetic reasons, but are otherwise nutritious and safe.

Even a modest increase in the recovery of such wholesome foods could reduce hunger by supplementing existing food-assistance efforts; provide tax savings to farmers, supermarkets, and foodservice establishments that donate food; and lessen the environmental impacts of waste disposal. Understanding where and how much food is lost is an important step in reducing waste and increasing the efficiency of food recovery efforts.

USDA's Economic Research Service (ERS) recently undertook a review of the current data on food waste and built on this knowledge to generate new estimates of food loss by food retailers (supermarkets, convenience stores, and other retail outlets), and consumers and foodservice establishments (storage, preparation, and plate waste in households and foodservice establishments). These losses were estimated by applying known waste

Figure 1

While Some Food Is Recoverable, Some Is Not

Not recoverable for human consumption

- Livestock condemned at slaughter because of disease.
- Diseased or otherwise unsafe produce.
- Spoiled perishable food, including meat, dairy, and prepared items.
- Plate waste from foodservice establishments.
- Losses of edible portions associated with processing, such as skin and fat from meat and poultry, and peels from produce.

factors, gathered from published studies and discussions with commodity experts, to the amount of edible food available for human consumption in the United States. However, losses of nonedible food parts such as bones, pits, seeds, and peels, were excluded (see box about measuring food loss).

According to the new ERS estimates, about 96 billion pounds of food, or 27 percent of the 356 billion pounds of the edible food available for human consumption in the United States, were lost to human use at these three marketing stages in 1995 (fig. 2). Fresh fruits and vegetables, fluid milk, grain products, and sweeteners (mostly sugar and high-fructose corn syrup) accounted for two-thirds of these losses (fig. 3).

ERS does not know the share of these losses that are recoverable. However, we can get an idea of the significance of loss by calculating the potential benefit of recovery. On average, each American consumes about 3 pounds of food each day. If even 5 percent of the 96 billion pounds were recovered, that quan-

Recoverable for human consumption

- Edible crops remaining in farmers' fields after harvest.
- Produce rejected because of market "cosmetics" (blemishes, misshapen, etc.)
- Unsold fresh produce from wholesalers and farmers' markets.
- Surplus perishable food from restaurants, cafeterias, caterers, grocery stores, and other foodservice establishments.
- Packaged foods from grocery stores, including overstocked items, dented cans, and seasonal items.

tity would represent the equivalent of a day's food for each of 4 million people. Recovery rates of 10 percent and 25 percent would provide enough food for the equivalent of 8 million and 20 million people, respectively.

The loss estimates presented here are tentative and are intended to serve as a starting point for additional research. Many of the studies on which these estimates are based date from the mid-1970's or before. Dramatic changes have occurred in the food marketing system since then, including innovations in food processing technology and unprecedented growth in the foodservice sector. While we made crude adjustments for these changes in our analysis, additional research—especially updated data on foodservice, processing, and household food losses—is needed to add precision to these estimates and to provide a more complete picture of food loss across the entire marketing system.

Food Losses Begin on the Farm...

Food losses begin on the farm even before a commodity moves into the marketing system. Although ERS was not able to quantify food losses that occur on the farm or between the farm and retail levels, anecdotal evidence suggests that such losses can be significant for some commodities.

Periodic preharvest losses occur, for example, because of severe weather, such as droughts and floods, or pest infestations. For example, each year an average 7 percent of U.S. planted acreage was not harvested during 1994-96. Freezes that periodically damage Florida's citrus crop and natural disasters like Hurricane Fran, which destroyed agricultural crops in North Carolina in the fall of 1996, are examples of causes of such losses. Most of these commodities are not recoverable for human use.

On the other hand, many harvesting losses, especially losses of com-

modities like fruits and vegetables, are often well-suited for recovery efforts. Economic factors, which affect producers' willingness to bring their product to market, are the most common source of such losses.

For example, minimum quality standards for fresh produce set by State and Federal marketing orders, bumper crops that reduce commodity prices, and consumer demand for blemish-free produce often result in the removal of safe and edible produce from the food marketing system. With such requirements in mind, fruit and vegetable producers often harvest selectively, leaving small, misshapen, or otherwise blemished produce in the field, since these commodities would likely be discarded in the packing shed or processing plant.

Harvesting losses can also be attributed to technological factors, such as increased mechanization, equipment malfunction, and new management practices. Commodities can be lost because mechanized

harvesters cannot retrieve the entire item or because the machines are unable to discriminate between immature and ripe products. However, these losses are often viewed as an acceptable tradeoff between field efficiency (lower production costs and faster operation) and increased yields.

Many farmers mitigate harvesting losses by using leftover crops as fertilizer or animal feed. Harvesting losses are also reduced through gleaning efforts, in which volunteers collect leftover crops from farmers' fields where it is not economically profitable to harvest a crop or after a field has been mechanically harvested.

...And Continue Into Processing and Marketing

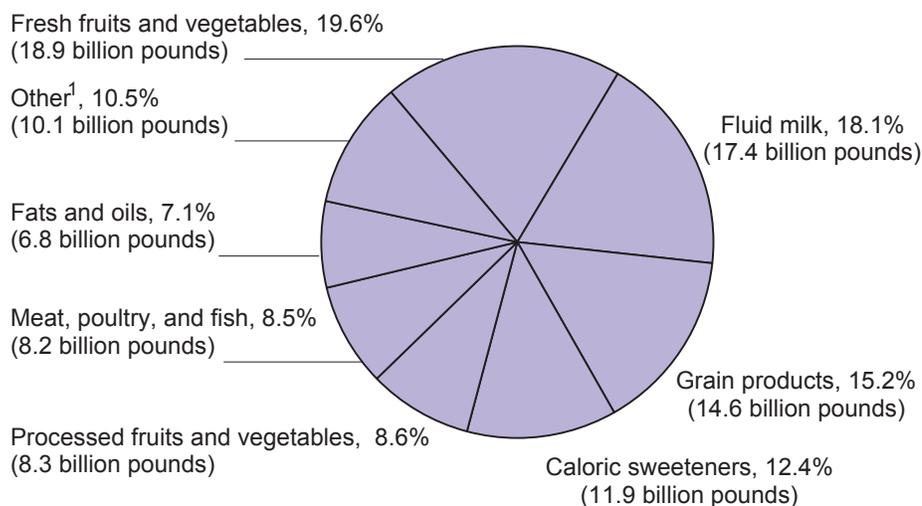
Food is subject to additional loss as it leaves the farm and enters the food marketing system.

Some loss occurs in storage, due to insect infestations or mold, deterioration, or improper transportation and handling. Produce, dairy, meat, and other fresh items are subject to shrinkage (loss in weight or volume) due to inadequate packaging or simply the passage of time. Also, fresh foods stored or transported at improper temperatures can deteriorate, wilt, or suffer bacterial degradation or microbial growth.

Frequent handling by food processors, brokers, and wholesalers can lead to additional losses. According to published studies, a typical food product is handled an average of 33 times before it is ever touched by a consumer in the supermarket.

Food-safety regulations also divert some product from the human food chain. According to USDA's Food Safety and Inspection Service (FSIS), 0.2 percent of hogs, 1.7 percent of calves, and 0.4 percent of chickens and turkeys were "condemned" or otherwise rejected at slaughter in 1993 and could not be used for human food. After

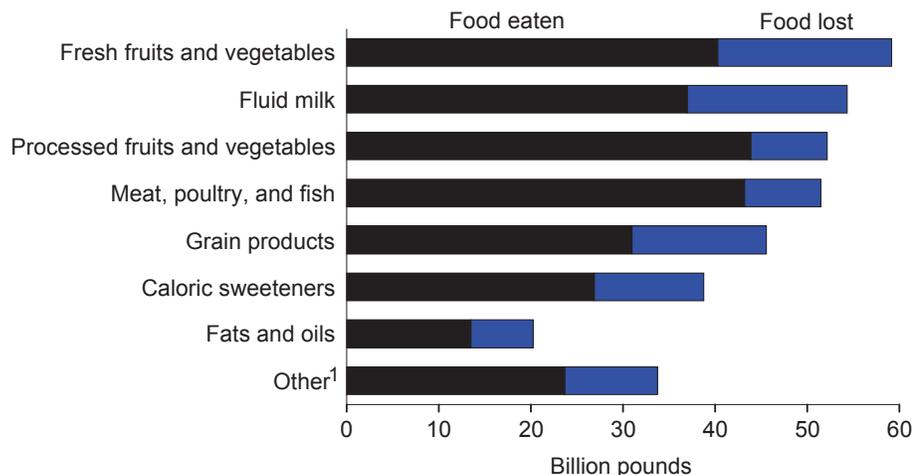
Figure 2
More Than 96 Billion Pounds of Edible Food Was Lost by Retailers, Foodservice, and Consumers in 1995



Note: ¹ Includes eggs, peanuts, tree nuts, dry beans, peas, and lentils, and dairy products other than fluid milk. Source: Economic Research Service, U.S. Department of Agriculture.

Figure 3

Food Losses Vary by Commodity—Largest Losses Were in the Fresh Fruits and Vegetables, Fluid Milk, and Grain Products Sectors in 1995



Note: ¹Other includes eggs, peanuts, tree nuts, dry beans, peas, and lentils, and dairy products other than fluid milk. Source: Economic Research Service, U.S. Department of Agriculture.

slaughter, some meat is trimmed away because of bruises and other defects. In addition, some viscera, especially livers, are condemned due to safety concerns. Although some of these losses may be preventable through improved farm management and marketing practices, once food becomes spoiled, it is no longer available for human use.

Food losses also occur when raw agricultural commodities are made into final food products. Some of these losses, like removing edible skins from fresh produce, are a normal and necessary part of food processing. For example, about 20 percent of the weight of a fresh apple is lost when it is processed into applesauce. Other processing losses, such as the removal of skin and trimming of fat from meat and poultry, are due to consumer demand for more healthful food choices. Still others, like the increased trimming associated with precut produce, are the result of increased demand for convenience foods from consumers and the foodservice industry.

Although such losses are usually not suitable for direct human consumption, they are often diverted for use in animal feed or as ingredients in other food products. For instance, fresh potatoes lose about half of their weight when they are processed into frozen french fries. Although this appears to represent a “loss” of edible fresh potatoes, most of the “loss” is actually recovered and used by processors for other potato products, such as dehydrated potato flakes and potato starch; and potato skins are often sold to renderers for animal feed.

Dairy Products and Fresh Produce Account for Largest Share of Retail Food Losses

An estimated 5.4 billion pounds of food, less than 2 percent of edible food supplies, was discarded at the retail level in 1995 (table 1). Nearly half of these retail losses came from fluid milk and other dairy products and fresh fruits and vegetables.

These findings are consistent with published studies on supermarket discard, which show that fresh produce, dairy products, and other perishable items make up the largest share of retail food losses. Overstocking, overtrimming, improper stock rotation, and post-holiday discard of seasonal items like Halloween cookies are the main reasons that retailers discard food.

Another important component of food loss is stock removed from retail shelves because it has reached its “sell-by” date. Such losses chiefly apply to fresh perishable items such as dairy and bakery products. A rise in the number of instore bakeries and freshly prepared specialty and deli items may mean that supermarkets are managing larger quantities of highly perishable food products with shelf lives as short as a few days. Some of these items, such as day-old bread and expired dairy products, are safe to eat for a short time and are potentially recoverable.

Canned fruits and vegetables, breakfast cereals, pasta, and other nonperishable food products get discarded because of crushed, dented, or otherwise damaged packaging, and expired shelf dates. For example, losses of processed fruit and vegetables, including fruit juices (on a fresh-fruit equivalent basis), were estimated at 521 million pounds, or almost 10 percent of total retail food losses in 1995. Most of these losses occur in inventory control, storage, and handling.

High failure rates for new food products may have increased retail food losses in recent years as the number of new product introductions has risen. More than 16,000 new food products—including new sizes, packaging, flavors, and brands of existing products—were placed on U.S. grocery store shelves in 1995, more than double the fewer than 8,000 introduced in 1988. Although ERS does not know the

success rate for such products, industry experts estimate that more than 90 percent of new food products are removed from the market.

Food recovery programs, which collect such damaged or unmarketable products from food retailers and distribute them to charitable food organizations, can convert these safe but otherwise “unsaleable” items into consumable food

and provide a tax benefit to food retailers who donate their products.

Plate Waste Contributes to Large Losses

From foods forgotten and spoiled in the refrigerator to the uneaten vegetables tossed in the garbage, consumer and foodservice food waste is the single largest source of

food loss in the marketing chain. Estimated at 91 billion pounds, this food loss accounted for 26 percent of the edible food available for human consumption in 1995. Fresh fruits and vegetables accounted for 19 percent of consumer and foodservice food losses, with an estimated 18 billion pounds discarded annually. An additional 16 billion pounds of fluid milk—the equivalent of one-

Measuring Food Loss: About the Estimates and the Data

Food is lost at every stage of the U.S. marketing system. However, due to the enormous size and diversity of the American food industry, few studies estimate aggregate marketing losses across the entire food sector. Typically, researchers report food losses as a percentage of food servings, household food stocks, or retail inventories at specific points in the marketing system, such as fresh fruit and vegetable losses in supermarket produce departments, household plate waste, or preparation and storage losses in foodservice operations.

In this study, food loss was estimated by applying these loss factors, gleaned from published studies and discussions with commodity experts, to the amount of food available for human consumption in the United States in 1995. Losses at the retail, foodservice, and consumer level were estimated for 260 individual foods, which were aggregated into the food groups listed in table 1. However, preharvest, on-the-farm, and farm-to-retail losses were not measured.

The amount of food available for human consumption was obtained from national food supply and utilization data, collected and published annually by USDA’s Economic Research Service (ERS). These data measure flows from production to end uses of several hundred commodities. ERS commodity specialists construct supply and utilization data sets from a wide variety of sources within the Government and food industry. Food available for consumption is calculated as the difference between available commodity supplies (the sum of production, beginning stocks, and imports) and other uses (seed, feed, and industrial consumption, and exports). These components are either directly measurable or estimated by Government agencies using sampling and statistical techniques.

In this study, the amount of food available for consumption was estimated by adjusting these food supply estimates for the removal of nonedible food parts—

peels, skins, bones, pits, and seeds. These adjustments were based on ERS conversion factors that account for processing, trimming, and other weight reductions that occur as raw agricultural commodities are made into semiprocessed and final food products available for consumption at the retail, household, and foodservice levels. These reductions ranged from 5 percent for fresh fruit to more than 30 percent for meat, poultry, and processed vegetables.

Limitations inherent in the food supply data suggest that the loss estimates for the consumer, retail, and foodservice sectors presented in table 1 understate total losses for most agricultural commodities. For example, the food supply data for dairy products measure the consumption of manufactured foods, such as ice cream, skim milk, and mozzarella cheese. As a result, the loss estimate for this group includes only the share of processed dairy foods lost to human use. It does not include the loss of raw milk that occurs earlier in the marketing system as the milk is shipped from the farm to the processing plant and used in manufacturing.

Also, estimates of retail, foodservice, and consumer food losses are likely understated due to limitations in the published studies on which these estimates were based. Food loss, particularly at the consumer level, is by nature difficult to measure accurately. Participants in household surveys on food waste, for example, tend to be highly “reactive”—changing their behavior during the survey period out of reluctance to acknowledge how much food they typically discard. Also, archeological examinations of household garbage may underestimate losses due to some food being fed to pets or being discarded in drains and garbage disposals. In addition, only a very limited number of studies, most of them conducted in school and university cafeterias, have successfully measured plate waste at the institutional and foodservice levels.

third of an 8-ounce glass per person per day—and 14 billion pounds of grain products were also lost. Together these foods accounted for more than half of total estimated consumer and foodservice food losses in 1995, partially reflecting their relative importance in the diet when consumption is measured by the weight of food.

Common sources of foodservice food losses include overpreparation

of menu items, expanded menu choices (which can make management of food inventories more difficult), and unexpected fluctuations in food sales due to sudden changes in the weather or other factors beyond the control of foodservice operators. In addition, consumer plate loss may be on the rise at restaurants and other eating places due to a growing trend toward the “upsizing” of food portions.

Unless consumers take home uneaten portions for later consumption, restaurants must discard such plate leftovers for health considerations, meaning that increasing amounts of food may be going to waste.

Household food losses occur because of overpreparation, preparation discard, plate waste, cooking losses, spoiled leftovers, and breakage, spillage, and package failure,

Table 1
Large Food Losses Occurred at the Retail, Foodservice, and Consumer Levels in 1995

Commodity	Edible food supply ¹	Losses from edible food supply					
		Retail food loss		Foodservice and consumer food loss		Total retail, foodservice, and consumer food loss	
	Million pounds	Million pounds	Percent	Million pounds	Percent	Million pounds	Percent
Grain products	45,606	912	2	13,682	30	14,594	32
Fruit	48,338	707	2	10,609	23	11,316	23
Fresh	22,389	448	2	6,717	30	7,165	32
Processed	25,949	259	1	3,892	15	4,152	16
Vegetables	63,077	999	2	14,947	24	15,946	25
Fresh	36,830	737	2	11,049	30	11,786	32
Processed	26,247	262	1	3,898	15	4,160	16
Dairy products	76,276	1,525	2	22,883	30	24,408	32
Fluid milk	54,474	1,089	2	16,342	30	17,431	32
Other dairy products	21,802	436	2	6,541	30	6,977	32
Meat, poultry, and fish	51,466	515	1	7,720	15	8,235	16
Red meat	30,350	303	1	4,552	15	4,856	16
Poultry	17,108	171	1	2,566	15	2,737	16
Fish and seafood	4,008	40	1	601	15	641	16
Eggs	7,918	158	2	2,328	29	2,486	31
Dry beans, peas, and lentils	2,263	23	1	336	15	359	16
Tree nuts and peanuts	1,861	19	1	276	15	295	16
Caloric sweeteners	38,827	388	1	11,473	30	11,861	31
Fats and oils	20,250	203	1	6,564	32	6,767	33
Total ²	355,883	5,449	2	90,818	26	96,266	27

Notes: ¹Excludes nonedible food parts such as bones, hides, peels, skins, pits, cores, and seeds. ²Totals may not add due to rounding. Source: Economic Research Service, U.S. Department of Agriculture.

either in the home or en route from the point of purchase. A variety of factors, including household size, income, and food-safety concerns, influence the type and quantity of foods lost at this level.

Archeological examinations of household garbage by researchers at the University of Arizona's Garbage Project revealed that household waste is generally lower for frequently purchased staple items like bread, milk, and cereal than for less frequently used specialty products such as sour cream, hot dog buns, or items bought on impulse. They also concluded that large quantities of single food items, entire heads of lettuce, half-eaten boxes of crackers, and sprouted potatoes—rather than plate scraps—account for the largest share of household food loss.

A 1987 study by the University of Oregon, which examined the reasons that households discard food, suggests that consumer education may play an important role in reducing consumer food loss. In the case of perishable food, knowledge of, or misconceptions about, food safety were the single most important determinants of household food discard. The study indicated that many main meal planners confused quality defects with edibility and were unable to accurately assess whether a food was safe to eat. Such assessments were particularly difficult for consumers under the age of 35. All households had difficulty interpreting package dating information, such as “sell-by” dates or expiration codes.

Looking for Solutions: Food Recovery, Recycling, and Education

Many public and private assistance groups, food retailers, food manufacturers, policymakers, and consumers have looked for ways to prevent food losses, recover lost food, and reduce solid waste. These

efforts reach into every corner of the food marketing system. They include food recovery projects to feed the hungry, recycling projects to conserve resources and reduce waste disposal costs, and educational campaigns and economic incentives to prevent food loss.

Food Recovery Efforts Feed the Hungry

Despite the abundance of food in the United States, hunger is a reality for some Americans with limited financial resources. In 1995, 36.4 million people in this country were living in poverty (annual income of less than \$15,569 for a family of four). According to USDA food consumption data for the early 1990's, almost 12 percent of U.S. households with annual incomes below the poverty line reported that they sometimes or often did not get enough to eat. USDA spent almost \$38 billion providing food assistance to an estimated 45 million people—about 1 in every 6 Americans—at some time during 1996. In addition, an estimated 150,000 nonprofit organizations, including food banks and neighborhood charity outlets, provided more than 10 percent of the U.S. population with a portion of their nutritional needs. However, even with the extensive network of Federal and private food-assistance programs, almost 20 percent of requests for emergency food assistance went unmet in 1995, according to the U.S. Conference of Mayors.

Thus, other sources of food must be utilized.

The term food “recovery” refers to the collection, or recovery, of wholesome food from farmers' fields, retail stores, or foodservice establishments for distribution to the poor and hungry. Food recovery programs operate across the United States and target many different levels of the food marketing system (see box on food recovery efforts). A few are large operations with offices

in many States, but most are small local programs that depend largely on the efforts of volunteers from the surrounding community.

A Citizen's Guide to Food Recovery, recently published by USDA, classifies these efforts into four major types:

- **Field gleaning**—the collection of crops from farmers' fields that have already been mechanically harvested or on fields where it is not economically profitable to harvest;
- **Perishable food rescue or salvage**—the collection of perishable produce from wholesale and retail sources such as supermarkets;
- **Food rescue**—the collection of prepared foods from the foodservice industry, including restaurants, hotels, and caterers; and
- **Nonperishable food collection**—the collection of processed foods with longer shelf lives.

Once surplus food has been “recovered” or prevented from going to waste, volunteers pick up and deliver the food to groups that serve the needy, either directly through neighborhood charitable organizations, such as food pantries and soup kitchens, or indirectly through food banks. In addition to providing additional quantities of food to hungry people, food recovery efforts can also provide food banks with the ability to offer clients more variety and nutrients in their diets by adding fiber-rich fresh fruits and vegetables and grain products to the typical offerings of nonperishable canned and boxed goods.

Food recovery also has benefits that extend beyond providing food to the needy. For example, the additional food supplied by recovery programs allows agencies that serve the disadvantaged to reallocate money to other needed services, money that they would have otherwise spent on food.

These efforts also provide clean fields and tax savings for farmers who donate unharvested crops and reduce waste-removal fees for supermarkets and foodservice establishments. For example, if 5 percent of retail, foodservice, and consumer food losses in 1995 were recovered rather than discarded as solid waste, about \$50 million dollars annually could be saved in solid waste disposal costs for landfills alone. If 10 percent of food losses were recovered, savings for landfill disposal costs would be about \$90 million. These savings would increase to \$200 million with a 25-percent recovery rate.

In addition, large amounts of labor, energy, and other inputs are dedicated to producing food. For example, ERS estimated total U.S. farm production expenses—including seed, fertilizer, and other inputs, and labor, machinery, and other operating expenditures—to be \$180 billion in 1995. Food recovery and other loss reduction programs can make more efficient use of these resources by reducing the amount of food that goes to waste.

Food recovery, however, is not without cost. Recovery operations face a number of logistical and financial obstacles in the course of turning “lost” food into food suitable for consumption. At times, these obstacles are quite formidable. They include locating food donors and making them aware of organizations that channel donated food to the needy; obtaining financial resources for transporting, storing, and packaging donated foods; securing labor, whether paid or volunteer; and training those workers in safe food handling and preparation methods. Second Harvest, the Nation’s largest domestic charitable hunger relief organization, spends more than \$5 million annually transporting food from fields, restaurants, and supermarkets to local food banks that serve the needy.

Until recently, many potential food donors were reluctant to participate in food recovery efforts because they feared legal liability if someone were to become ill from eating their donated foods. The Bill Emerson Good Samaritan Food Donation Act, passed by Congress and signed into law by President Clinton in 1996, promotes food recovery by limiting the liability of food donors to instances of gross negligence or intentional misconduct. It also establishes basic nationwide uniform definitions pertaining to the donation and distribution of nutritious foods, which will ensure that donated foods meet all quality and labeling standards of Federal, State, and local laws and regulations.

Food Waste Recycling and Byproduct Use

Technological advances in food processing and food byproduct development can reduce food loss. For example, many food parts that would have been discarded by food processors 10 years ago are finding new value in industrial raw materials or in other food products. These products include livestock feeds, biodiesel (a fuel made from vegetable oils and animal fats), adhesives and solvents derived from citrus oils, pharmaceutical products made from cow’s and goat’s milk, and juice products and vinegar made from apple peels.

The large volume of shells from raw eggs processed into liquid egg products, for instance, can be used as a source of calcium in poultry feed or as fertilizer. Eggs taken out of their shells by processing machines may also mean lower rates of processing loss, since up to 30 percent of the egg white can stay with the shell when shells from raw eggs are removed manually. Similarly, the introduction of frozen concentrated orange juice has reduced marketing losses for fresh

fruit by enabling processors to use bruised or blemished fruit for juice and the nonjuice portions for cattle feed.

Current research on alternative uses for recycled food waste is focusing on animal feed and compost. For example, research is being conducted on the efficient extraction of food waste materials, known as wash water solids, from dairy processing plants. Extraction of these solids reduces waste disposal fees and results in additional income for dairy processors who sell the recovered material for animal feed.

Food waste can also be blended with other organic compounds, such as newspaper, and composted. The resulting organic material could be developed into a soil-conditioning product. Research is also being conducted on converting food waste into a biodegradable film similar to that used for plastic trash bags. The goal is to develop an organic film that would decompose rapidly and could be used in lawn waste composting operations.

Consumer Education and Economic Incentives

While food recovery and recycling technologies may help to utilize food that would otherwise be discarded, programs designed to prevent food loss in the first place may be particularly useful in reducing consumer and foodservice food losses. A number of programs are currently being implemented.

According to *The Wall Street Journal*, economic incentives are largely behind the Boston Market restaurant chain’s recent adoption of a computer program that monitors food inventories. As menu items are sold and entered into the cash register, the program converts these items, such as cole slaw or mashed potatoes, into raw ingredients. At the end of each day, food inventories that remain in the kitchen are

weighed and entered into the computer where they are compared with estimated food uses based on product sales. The difference between used and remaining inventories provides an instant estimate of preparation and storage losses. Since initiating the program, the chain's self-reported food loss has declined from 5 percent to 1 percent of food inventories.

Some local communities are successfully reducing food and other waste by requiring households and businesses to pay for solid waste disposal based on the amount of trash that they generate, usually by charging higher fees for each additional trash container used. According to the U.S. Environmental Protection Agency (EPA), there are currently more than 2,000 such pro-

grams in place nationwide, with average reductions in household solid waste of 25 to 45 percent. A 1994 study conducted for the EPA reported that food accounted for about 8.5 percent of municipal solid waste collected from households and businesses.

Education programs that help consumers change their food discard behavior may also be effective in

Food Recovery Efforts Reach Across Marketing System

A Citizen's Guide to Food Recovery—USDA has recently published *A Citizen's Guide to Food Recovery*, a resource guide on food recovery programs for businesses, community-based organizations, private citizens, and local governments. The Guide is designed to support food recovery by showing communities, individuals, and businesses how to support existing food recovery efforts or to begin new programs in their communities. The *Citizen's Guide* and other sources of information about gleaning and food rescue efforts, including most of those listed below, are available free of charge by calling toll-free 1-800-GLEAN-IT or through the Internet at <http://www.usda.gov/fcs/glean.htm>.

In addition to creating the *Citizen's Guide*, USDA has taken a wide variety of steps to promote citizen service related to food recovery and gleaning:

Food Recovery Roundtables—Secretary of Agriculture Dan Glickman has convened "round tables" around the country to bring together interested nonprofit groups, corporate leaders, social service agencies, and Government officials for collaborative action on food recovery.

AmeriCorps Summer of Gleaning—In the Summer of 1996,

as one part of its AmeriCorps program, USDA sponsored a special AmeriCorps "Summer of Gleaning" program that implemented 22 food recovery projects in 20 States. The program was based on the so-called "volunteer generator" model, in which a handful of compensated AmeriCorps members recruit volunteers to help implement large-scale tasks. The 88 AmeriCorps members in the summer program recruited over 1,600 volunteers who helped pick, sort, deliver, and prepare recovered foods.

USDA National Hunger Clearinghouse—USDA has contracted with World Hunger Year, a national nonprofit organization, to develop the USDA National Hunger Clearinghouse. The Clearinghouse established a communications network and comprehensive database identifying all known organizations providing hunger- and poverty-related services, particularly organizations supporting food recovery efforts.

Food Safety Training for Food Recovery—USDA's Cooperative State Research, Education and Extension Service (CSREES), in conjunction with the Cooperative Extension System, is helping local hunger groups recover food safely. Nationwide outreach programs like Purdue University's Safe Food

for the Hungry and S.T.R.E.T.C.H. (Safety, Training, Resources, and Education to Combat Hunger) teach food-assistance workers how to transport, store, and prepare food safely. They also show groups dedicated to feeding the hungry how to create nutritious meals from the most commonly donated foodstuffs and bulk supplies.

USDA's Food Safety and Inspection Service (FSIS) is working with the Chef and Child Foundation, the philanthropic arm of the American Culinary Federation, to expand food-safety training for people serving food to the needy at nonprofit feeding program sites, including soup kitchens and shelters.

National Collaboration of Youth (NCY)—USDA signed a Memorandum of Understanding with NCY, an umbrella group for such youth organizations as the Boy and Girl Scouts, Big Brothers/Big Sisters, YMCA of America, and the Boys and Girls Clubs. The agreement specifies how the over 40 million members of NCY organizations will be encouraged to volunteer to recover food.

Federal Cafeterias, Schools, and Farmers' Markets—In conjunction with USDA efforts, the Washington cafeterias of the Department of Justice, the Department of Energy, and the Office of Personnel

preventing food loss. For instance, educational programs that help meal planners determine appropriate portion sizes and distinguish between spoiled and safe food can help consumers reduce plate waste and better utilize leftovers. Improved meal planning and purchasing skills—including information that helps consumers understand the meaning of manufacturers' expiration codes,

and "use-by" and "sell-by" dates—can reduce the discard of food items.

Government-sponsored initiatives, such as USDA's publication of *A Citizen's Guide to Food Recovery*, along with local efforts to train food recovery volunteers in the safe handling and preparation of rescued food, can increase the safety and efficiency of food recovery efforts. Recent legislation that reduces the

liability of food donors has increased the amount of food recovered to feed the needy. Educational programs that increase the awareness of food loss by manufacturers, retailers, and consumers may reduce the amount of food loss and in turn the environmental and economic costs of waste disposal.

Over the long run, the reduction and recovery of uneaten food in the

Management are donating excess food to the DC Central Kitchen in Washington, DC. The DC Central Kitchen plans and distributes 3,000 meals per day, 7 days a week, to 95 charity outlets across the Washington metropolitan area. The Kitchen is in part staffed by homeless workers—48 per year—who receive 3 months of on-the-job training in food preparation and management from professional chefs who volunteer their skills.

USDA is also helping school districts in both the Washington, DC, and Wichita, KS, areas to involve students in community service activities related to fighting hunger and recovering food. USDA is also working with the nonprofit groups Rock & Wrap It Up! and FoodChain to help students recover food from the School Lunch Program, restaurants, and concerts.

In addition, USDA is helping to promote food recovery from farmers' markets nationwide, including markets held at Federal agencies.

Public Service Announcements—USDA worked with the Fox Television Network to air a plot-related public service announcement on the television show *Party of Five* that promoted food recovery and provided viewers with the 1-800-GLEAN-IT telephone number to obtain the *Citizen's Guide* and other informa-

tion about gleaning and food rescue.

National Summit on Food Recovery—USDA, the Congressional Hunger Center, and the nonprofit groups Second Harvest and FoodChain will co-sponsor a National Summit on Food Recovery, which will be modeled on President Clinton's Summit on America's Future. The Summit will bring together leaders from State, county, and city governments, Indian tribes, nonprofit organizations, religious groups, large corporations, and small businesses. All attendees will be asked to make specific commitments to increase food recovery prior to the event.

National Week of Food Recovery—President Clinton will declare a National Week of Food Recovery, during which food recovery volunteer projects will occur nationally.

The Federal Government is not alone in its food recovery efforts. Foodservice operators, retailers, nonprofit organizations, and individual citizens are also involved.

FoodChain—FoodChain is the Nation's largest network of prepared and perishable food rescue programs. It opened its doors in 1992 with a staff of one. Today, 116 member programs and 22 associate programs participate in FoodChain, distributing nearly 100 million

pounds of food to some 7,000 social service agencies each year.

Foodservice—Hundreds of nationwide and regional restaurant chains of various sizes, along with individual foodservice outlets, are channeling unsold food to local food recovery programs.

Second Harvest—Second Harvest, the largest domestic hunger relief organization, rescued 811.3 million pounds of food in 1995 from going to waste by soliciting donations of food and grocery products from the Nation's food industry.

Society of Saint Andrew (SoSA)—The SoSA Gleaning Network has recovered more than 200 million pounds of fresh fruits and vegetables since its founding in 1979, and distributed them to food pantries and soup kitchens across the United States.

"Unsaleable" Food Products—The food industry has developed a Joint Industry Task Force on Unsaleables to develop new strategies and incentives to improve the condition of dented, bruised, or otherwise damaged food products for food banks. These "unsaleables" are channeled through Product Reclamation Centers, which help retailers recover the food for organizations that assist the needy.

United States is a complex undertaking requiring the involvement of public and private institutions, as well as consumers. Efforts to reduce or prevent food loss must be balanced against the cost of conserving and recovering food. However, successful food recovery programs can provide many benefits to society which can offset a portion of these costs. Among other things, food recovery programs can help to reduce hunger; provide tax savings to farmers, food manufacturers, retailers, foodservice operators, and others that donate food; conserve landfill space; and lessen the costs and environmental impact of solid waste disposal. While our estimates of food loss lack precision, they identify an important issue in the food system that deserves closer attention.

References

- Fung, E.E., and W.L Rathje. "How We Waste \$31 Billion in Food a Year," *Yearbook of Agriculture*, U.S. Department of Agriculture, 1982, pp. 352-57.
- Gallo, Anthony E. "Consumer Food Waste in the United States," *National Food Review*, Fall 1980, pp. 13-16.
- Mathews, Ryan. "Is the Damage Done?" *Progressive Grocer*, June 1994, pp. 35-38.
- Sugarman, Carole. "Exploding Portions: America Sizes Up," *The Washington Post*, Food Section, Oct. 11, 1995.
- U.S. Department of Agriculture, Economic Research Service. *Food Marketing Review, 1994-95*. AER-743, Sept. 1996.
- U.S. Department of Agriculture, Food Recovery and Gleaning Initiative. *A Citizen's Guide to Food Recovery, 1996*.
- U.S. Environmental Protection Agency. *Municipal Solid Waste Factbook Version 3.0*. Municipal and Industrial Solid Waste Division, Office of Solid Waste. <http://www.epa.gov/epaoswer/non-hw/muncpl/factbook.htm>, Oct. 8, 1996.
- U.S. Environmental Protection Agency. *Pay-As-You-Throw*. <http://www.epa.gov/epaoswer/non-hw/payt/index.htm>, Dec.11, 1996.
- U.S. General Accounting Office. *Food Waste: An Opportunity to Improve Resource Use*. Report to Congress by the Comptroller General of the United States, Sept. 1977.
- Van Garde, Shirley J., and Margy J. Woodburn. "Food Discard Practices of Householders," *Journal of the American Dietetic Association*, Vol. 87, No.1, March 1987, pp. 322-29.
- Zachary, Pascal G. "Restaurant Computers Speed Up Soup to Nuts," *The Wall Street Journal*, Oct. 25, 1995, p. B6. ■