

# New food-ordering formula could lead to less food waste in buffet-style restaurants

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In a 2013 study conducted by the United Nations Food and Agriculture Organization (FAO), researchers estimated one third of all food produced for human consumption in the world is lost or wasted. Although waste occurs in all stages of food production, some of the largest losses occur at all-you-care-to-eat (AYCTE), buffet-style facilities. University of Missouri researchers have calculated the economic and environmental production costs associated with meats and vegetables—such as fuel, transportation and fertilizers—and developed a formula that managers may use to reduce food waste at AYCTE facilities.

"Most research on food waste at the consumption phase has focused on institutions such as schools and hospitals rather than on individual households," said Ronald G. McGarvey, assistant professor of industrial and manufacturing [systems engineering](#) and of public affairs in the MU College of Engineering and Truman School of Public Affairs. "With this new research, we have developed a formula that food-service managers can use when deciding how to store, prepare and serve food. We anticipate that using this new formula could considerably reduce food waste on college campuses and in other AYCTE facilities."

To develop the formula, the researchers investigated the [environmental impact](#) of food waste caused by overproduction in the University of Missouri Campus Dining Services (CDS). The setting, which includes all-you-care-to-eat facilities, is of particular interest to planners as increased chances of discarded leftovers exist.

"In buffet-style restaurants, the tendency is to produce more than is actually consumed or that can be re-used in the buffet lines the next day," McGarvey said.

Working with Esmá Birisci, a doctoral candidate in the Department of Industrial and Manufacturing Systems Engineering, McGarvey and his team analyzed the carbon emissions of three common food items, French fries, chicken sandwiches and beef ravioli. They found that the environmental and monetary costs of throwing away beef ravioli was up to 39 times more than throwing away French fries.

"Farm equipment used to feed and maintain livestock and to plant and harvest crops uses a lot of diesel fuel and other utilities from fossil fuels," McGarvey said. "When people waste food, these fuels, as well as fertilizers, also are wasted."

Based on their estimates, the team developed a production planning formula taking into account the resources used to produce the food. McGarvey said this new formula is more accurate and provides a better picture of food waste. He recommends that food-service managers estimate how much food to cook with an emphasis on producing more vegetables than meat. These calculations will help keep food waste at a minimum while lessening the environmental impact.

"Institutional food-service providers face a common planning problem—how much food to produce in the presence of uncertain demand," McGarvey said. "However, there is growing awareness of the [environmental costs](#) associated with food waste. Employing this new formula we've developed may incentivize AYCTE managers to calculate the environmental costs associated with their production decisions thereby reducing the environmental impact of [food waste](#)."

Future research will aim to develop software tools to aid managers with their production and inventory ordering decisions, McGarvey said.

The study, "Inferring shortfall costs and integrating environmental costs into optimal production levels for an all-you-care-to-eat food service operation," was published in the *International Journal of Production Economics*.

**More information:** Esma Birisci et al, Inferring shortfall costs and integrating environmental costs into optimal production levels for an all-you-care-to-eat food service operation, *International Journal of Production Economics* (2016). [DOI: 10.1016/j.ijpe.2016.08.034](https://doi.org/10.1016/j.ijpe.2016.08.034)

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