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DISPOSAL OF EDIBLE FOOD BY-PRODUCTS GENERATED FROM RESEARCH AT MICHIGAN AGRICULTURAL EXPERIMENT STATIONS

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DISPOSAL OF EDIBLE FOOD BY-PRODUCTS GENERATED FROM RESEARCH AT MICHIGAN AGRICULTURAL EXPERIMENT STATIONS

By

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ABSTRACT

DISPOSAL OF EDIBLE FOOD BY-PRODUCTS GENERATED FROM RESEARCH AT MICHIGAN AGRICULTURAL EXPERIMENT STATIONS

By

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Research conducted at the Michigan Agricultural Experiment Station (MAES) generates food crops that are by-products of the research process and must be disposed of. The purpose of this research is to identify how this edible food is disposed and to examine the sustainability of these disposal practices. In this work, the term *edible food* is defined as any food crop generated at MAES that is not used for research projects but is 1) edible immediately after harvest without further processing and 2) safe for human consumption.

This research employed a qualitative approach. In-depth interviews and participant observation were used to understand the disposal pathways, process, and decision-making from the perspective of those who do this work. Interviews revealed five main disposal pathways: edible food used as data samples, for human consumption, for animal consumption, tilled into the soil, and "dumped". Using the Environmental Protection Agency (EPA) food scraps hierarchy as a means to identify more sustainable disposal practices, this research suggests that the majority of edible food crops generated at research farms are disposed of in a sustainable manner. However, some farms do better than others, and MAES, in general, could divert more edible food for human consumption and other more sustainable disposal methods.

DEDICATION

For Kimball

ACKNOWLEDGEMENTS

When you make the decision to return to school, you realize there will be a lot of sacrifices, but it is not always clear at the outset how it will affect you and your family. I want to acknowledge the sacrifices my husband Kimball has taken so that I could begin, continue and complete this degree program.

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"The world will not evolve past its current state of crisis by using the same thinking that created the situation."
- Albert Einstein

I. Introduction

"What really matters?" The Office of Sustainability at Michigan State University (MSU) asks the campus community this question to challenge us to reflect on the "connection between our individual choices and the bigger picture" (Office of Campus Sustainability and University Committee for a Sustainable Campus 2003). Sustainability "is a messy, ill-defined concept" creating opportunities for dialogue, misunderstandings and confusion over how to put sustainability theory into practice (Wals and Jickling 2002:230).

In 1987, the World Commission on the Environment and Development (WCED) published their meetings and conversations in the book *Our Common Future*. This book begins to define the concept of sustainable development and shows there is a need to become a more sustainable world. WCED (1987) believes that many of us live beyond the world's ecological capacity. We consume resources faster than the planet can renew or replenish its resources. Industrial countries, like the U.S., consume vast amounts of energy, and this consumption results in both pollution of the biosphere and atmosphere and depletion of scarce fossil fuel supplies. To develop our world, country or university in a sustainable manner requires "meeting needs of [the] present without compromising the ability of future generations to meet their own needs" (The World Commission on the Environment and Development 1987:8).

Universities also consume vast amounts of resources and generate large amounts of waste.[1] Universities have become like little cities and require an army of operational staff. This "army" manages the university's operations. However, operational activities at universities tend to "occur out of sight and mind of both students and faculty" (Orr 1990:213). As universities begin to understand that campus activities have impacts far beyond the institution's borders, sustainability begins to frame their examination of their campus operations, curricula and research topics (Eagan and Orr 1992).

II. What is a Sustainable University?

Sustainability enthusiasts seek to reorient how we view economics, conduct trade, use energy, or practice agriculture (Harwood 1990; Clark 2000; Filho 2000). Common understandings of the term "sustainability" typically include definitions that suggest balancing the economic, ecological and social impacts of our actions as individuals, institutions and communities (van Weenen 2000; Global Reporting Institute 2002).

At Pennsylvania State University, the Penn State Green Destiny Council (PSGDC) developed the following definition for a sustainable university:

> **sustainable university** adj, n. 1. university whose long term prospect for continuing to exist is good; specif. such a university behaves in ways that sustains the integrity and biodiversity of the local and planetary ecosystems upon which all life depends 2. a university whose core values include: respect for the biota and natural processes, mindfulness of place, living within planetary limits, accounting for full costs, and civic responsibility (Penn State Green Destiny Council, 2000:1).

The PSGDC includes an important aspect in their definition. A sustainable university requires a strong core of values. For them, a sustainable university is about understanding the importance of their values in order to practice sustainability.

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[1] The term "university" is used in this document to refer to higher educational institutions generally, including colleges.

Uhl et al. (2002) break the concept of sustainability into five core principles that link the importance of: 1) our environment, 2) our resource consumption, 3) our personal values, 4) the failure of current accounting methods to include long term externalities; and 5) the importance of shared decision-making (Uhl, Anderson et al. 2000). They too place values at center stage. They maintain that values create and support a strong economy and strong communities and protect the environment (Uhl, Anderson et al. 2000).

Wals and Jickling (2002) include cultural, ethical and spiritual domains within their definition of sustainability. They believe that the concept of sustainability "differs over time and space and it can be discussed at different levels of aggregation and viewed through different windows" (Wals and Jickling 2002:227). Wals and Jickling (2002) therefore maintain that it is the responsibility of universities to engage different segments of society or the campus in these discussions.

Cortese (1999) calls for a 'new human perspective' to address environmental catastrophe, political unrest and population growth rate. He argues that the vision of a just and sustainable society is one that "must be informed by the ecological perspective that humans are part of nature and that all social, economic and environmental systems are interdependent" (Cortese 1999:2). He believes we must measure our development in qualitative as well as quantitative means to "seek the virtue of enough rather than more" (Cortese 1999:1).

With differing views and definitions, it becomes a challenge to put these ideas into practice. One common misunderstanding is that sustainability is purely environmentalism. Many universities, responding to the "sustainability call" create

"green initiatives" and other programs that respond to environmental concerns (Creighton 1999). Without fully understanding what sustainability is, putting the concept into practice becomes ever more challenging. Creating a more sustainable campus can be viewed as a daunting task or something that is never attainable if misunderstandings continue.

III. Do Universities have a Responsibility to be More Sustainable?

Uhl et al. (2000) contend that, "the concept of sustainability should become a central organizing idea for higher education"(Uhl, Anderson et al. 2000:152). Cortese (1999) believes colleges and universities have the moral obligation to work to integrate sustainability concepts into curricula. In addition, universities have the responsibility to conduct research to help us understand what sustainability looks like, and to train future leaders to be able to tackle these complex concepts (Uhl, Kulakowski et al. 1996; van Weenen 2000). Finally, researchers should be asking, "What are the ethical, social, and political implications of [my] scholarship?" (Uhl, Kulakowski et al. 1996:1309).

In their ability to influence the thinking of future leaders, universities also "have [the] freedom to act boldly and creatively" allowing them to accept sustainability concepts and apply new technologies out of this movement (Clark 2000:2). Universities have a role to play in gathering these different groups and encouraging dialogue on sustainability issues around different values and different ways of knowing (Wals and Jickling 2002). Universities engaging in sustainability efforts often encourage many different sectors of the campus community to join the dialogue. They come together in an attempt to find a common language in which to discuss sustainability. There is a hope

that this will strengthen the understanding of sustainability as well as create a platform in which this diverse group can work together and put these concepts into practice.

Understanding sustainability involves hearing the differing views held by a variety of stakeholders. To understand the theories of sustainability and to put them into practice are two different things. Taking these theoretical ideas and putting them into practice will require leadership by a broad array of people, cutting across traditional lines of the university.

IV. Challenges to Becoming a Sustainable University

Universities seeking to become sustainable face a number of challenges. Perhaps the greatest challenge is that universities tend to make decisions based on financial costs, rather than economic costs. The true economic costs to an action are captured in full cost accounting, a system that accounts for the full costs and benefits that occur as a result of an action. Full cost accounting, for example, includes the impact that the production of an item has on the economy, the environment and society, over time (Uhl, Anderson et al. 2000; McDonough and Braungart 2002). It recognizes that the total cost to undertake an action (e.g. make a product) is different from the financial costs paid out by the university. Rather, it also includes the costs (and benefits) to society as a whole, including those that affect the environment and society.

Presumably most universities only undertake sustainability projects if they are feasible from a financial perspective. However, Shriberg (2002) maintains that other barriers exist "including [the] lack of funding, lack of time, and organizational resistance to change (Shriberg 2002:290-291). These, he claims, "stem from or are exacerbated by the low priority of environmental issues" (Shriberg 2002:290-291).

When universities examine their own sustainability issues, they are often viewed as only environmental issues. This may be because those working towards sustainability usually are environmentalists or come from the environmental activist perspective (Eagan and Orr 1992; Creighton 1999; Shriberg 2002; Newport, Chesnes et al. 2003). Seeking more "green" or "environmentally friendly" alternatives to existing methods or products is sometimes an easier task than examining all the components of sustainability. An example of this can be found from those who promote sustainable agriculture.

The sustainable agriculture movement focuses mostly on creating more environmentally-friendly production methods (Allen and Sachs 1991). Change may be taking place within the agricultural industry, but typically the change is in *how* food is produced without examining other issues related to sustainability, such as the social dimension.

Berry (1977), however, views a sustainable agriculture as one that supports "both the land and people" (Berry 1977). This definition may be simple, yet it highlights the importance of the social aspects of sustainability and includes the importance of people in the creation of a sustainable agriculture.

Historically, land grant universities sought to provide "intangible benefits that enter into the thought and ideals of the people, leavening the whole lump of civic and social life" (Kerr, Davenport et al. 1931:19). However, today, land grant universities and agriculture scientists tend to exclude the social aspect of sustainability. Walter and Reisner (1994) state that land grants "generally see sustainable agriculture largely in terms of "stewardship", that is, producing food and fiber in ways that minimize environmental degradation but that do not impair farm profits" (Walter and Reisner

1994:119). This stewardship approach typically lacks an understanding of how the agricultural sector impacts the community and different stakeholders.

Others have also decried the lack of attention to the social aspects of sustainability. Allen (1994), for example, identifies "silences" that can be found in the sustainable agriculture literature; issues that are either not addressed or not discussed. These silences include important social issues that are related to the sustainable practice of agriculture, issues such as hunger, migrant labor issues, and the vitality of rural and urban communities. Allen (1994) believes adding the "human face" to sustainable agriculture is the solution. Cortese (1999) shares Allen's beliefs and says that by adding a human perspective we can meet the basic needs of people in the present and future, and "have fair and equitable access to the earth's resources, have a decent quality of life and preserve the biologically diverse ecosystems on which we all depend" (Cortese 1999:1).

As individuals and members of institutions of higher education we need encouragement to reflect on the impact that our decisions and actions have on people. Our individual decisions impact individuals on and off campus; knowing this may help us to create a better understanding of the social dimension of sustainability. Shriberg (2002), in his doctoral dissertation, identified practical examples of how the social aspects may be incorporated to create a more sustainable university. His examples of social sustainability include fair distribution of resources, sharing the decision making, humanization of capital, and sharing of power (Shriberg 2002).

Another challenge universities face is that universities must "tear down walls between academia and campus operations" to offer valuable lessons to all those involved (Mansfield III 1998:24). Those who oversee operations at a university have practical

skills to offer for running the university and in educating students and the university community. Eagan (1992) found that "nonacademic personnel were unexpected beneficiaries" when involved in sustainability projects with students and faculty, with "many wishing that they had more of these kinds of interactions with students." Staff often feel they have a role as well as a responsibility for educating students, but that it is "a role that, regrettably, goes largely untapped" (Eagan 1992:73-74).

A greater challenge to creating a more sustainable campus may be bringing down the barriers between the university campus and the surrounding community. "There is a growing need to educate campus administrators, faculty, staff, students, planners, designers, builders and other stakeholders about these [sustainability] ideas and to formulate common understanding with common definitions" (Wojciechowksi 2003:100). To meet the challenge of creating a sustainable campus, the conversation needs to include a broader network of stakeholders, which includes other campus voices and the surrounding community. New partnerships need to be developed to solve these complex problems.

V. Campus Leadership in Sustainability

Leadership is expected of the university. Society expects universities and colleges to develop new technology, solve societal problems and create future leaders. Leaders are individuals who perform important civic work and are "actively engaged in making a positive difference in society" (Astin and Astin 2000:2).

Creating a more sustainable campus involves working on complex issues with diverse stakeholders that "requires an unprecedented coalition of leaders" (Wojciechowksi 2003:71). "A leader...can be anyone-regardless of formal position-who

serves as an effective social change agent. In this sense, any person, player or actor within the university community is a potential leader— every faculty and staff member, not to mention every student" (Astin and Astin 2000:2).

All university members have the potential to be a leader and be a role model for future leaders. Students often create social change at their institutions – including the development of sustainability initiatives (Creighton 1999; Glasser, Nixon et al. 2002). Student leaders may play the role of activist, but it is the leadership of university staff that institutionalizes these initiatives (Shriberg 2002). Shriberg (2002) believes it is the staff who incorporate values and ethics within their daily work making their work "sustainable".

In his dissertation Shriberg (2002) talks of staff, faculty and student "champions", but top-level support is required to maintain or advance their efforts. Clark (2000) agrees, stating that university presidents, governing boards, and senior administrators have a role in the sustainability movement. Campus sustainability efforts would be stronger if top-level administrators supported current leaders. "While the support of top leaders is important in any campus initiative, this support is especially important when dealing with a complex, trans-boundary issue such as the environment and sustainability" (Shriberg 2002:61).

VI. Becoming a Role Model

Another important aspect of leadership is creating good role models. Astin and Astin (2000) point out that students who have never experienced effective leadership or perhaps viewed leadership in action will have difficulty becoming strong effective leaders. Likewise, the university should lead the community in examining its own

practices and begin to transform itself into a more sustainable university. It is important to practice what is preached. Like the old adage states, "actions speak a thousand words", and students, the university community and the surrounding communities will learn more when they witness sustainability in action. True leadership, says Wojciechowski (2003), is about "individuals stepping up to make a difference" (Wojciechowksi 2003:71).

For students to commit to making changes, the institutions where they live and are trained to be future leaders must also pledge to undertake efforts to change. "Institutions which nurture [students] must be engaged in the work of the society and the community, modeling effective leadership and problem solving skills, demonstrating how to accomplish change for the common good" (Astin and Astin 2000:2).

Public institutions also have the responsibility of being a role model for society in general. Universities and individuals supporting the sustainable campus movement believe "higher education must 'practice what it preaches' and make sustainability an integral part of operations, purchasing and investments" (Cortese 1999:2). The belief is that by modeling sustainable practices, the academic community will be better suited to share its knowledge with communities that are either reacting to or proactively addressing sustainability concerns. Orr (1992) believes that institutions "purporting to induct students into responsible adulthood should themselves act responsibly toward the earth and all of its inhabitants" (Orr 1992:4). However, we need guides, leaders to help us transform the university into a sustainable institution (Wojciechowksi 2003).

Making sustainability a priority for higher education gives universities an opportunity to "confront their core values, their practices...[and] the way they think

about resources and allocate these resources and their relationships with the broader community" (Wals and Jickling 2002:230). The challenges are for the core values to be confronted, and to examine the concepts of sustainability as it relates to the University's curricula, research and operations and the impact decisions have on the community. The lessons for how the world works are there for students, faculty, staff and members of the community, and what is needed is to work together and reach for them.

VII. Land-Grant Colleges and Universities

This research project takes place at a land-grant university. Universities and colleges in general have a role to play in creating a more sustainable society, however land grant colleges and universities were established with service to society. With a land-grant university in every state, there is an opportunity to create positive change nationally.

One of the first land-grant colleges, Michigan State University (formerly Michigan Agricultural College), holds the responsibility of being a land grant university. According to W. J. Kerr, president of Oregon State Agriculture College (president from 1908-1964), the land-grant college or university is "an agency of public progress. Its spirit is determined largely by conditions under which it was created, and is modified by conditions under which it develops" (Kerr, Davenport et al. 1931:7). This spirit is "enlarged and intensified" as American ideals are expanded and reshaped.

Land-Grant colleges and universities were established in 1862 as a result of President Lincoln signing the Morrill Act into law. This was seen as a revolution in American Education. It was referred to as the *New Education*, retaining "the high moral

and ethical ideals of the old" combining with "substantial training in doing the things of every day life" (Kerr, Davenport et al. 1931:10).

The Morrill Act provided public lands to states in the Union to develop a college. During this time, agricultural lands were also becoming less productive, there was a need to educate people in the agricultural and mechanical arts and a sense that the masses of uneducated people needed to have access to an education so they could be of service to the Union. The land-grant success has been due to the efforts of many but it is mostly credited to Justin S. Morrill and Jonathan B. Turner (Land Grant Fact Book 1962).

In 1852, at the Farmer's Convention in State of Illinois, a 'common man's educational bill of rights' was created with assistance from Jonathan B. Turner. The vision was for more than just creating a college in Illinois, it included the creation of a "university for the industrial classes in each of the states" (Kerr, Davenport et al. 1931:10). The objective was that these institutions should not be only to "apply practical pursuits and professions in life" but also "to extend the boundaries of our present knowledge in all possible practical conditions"(Kerr, Davenport et al. 1931:10).

"MSU is frequently referred to as the pioneer land grant institution" because it was created before the land grant system – opening its doors in 1855 (Kevin S. Forsyth, 1992-2004). The Michigan legislature passed Act 130 in 1855. The Act established the Agricultural College, allocated an estimated 14,000 acres of Satl Spring Lands for support and maintenance of the college and $40,000 for the colleges first 2 years of operation (Kevin S. Forsyth, 1992-2004).

Recognizing the need for new information and knowledge, Miles Manly of Michigan Agricultural College and others sought to have research be an important part of

the land-grant college and university system (Blair and Kuhn 1955). In 1887 the Hatch Act created a network of agricultural experiment stations nationwide, including the Michigan Agricultural Research Stations (MAES). "Problems were brought to the experiment stations from farmers seeking information which they could not secure themselves" (Kerr, Davenport et al. 1931:30). It was believed at this time by the legislature and the public that the "results of research would pay the bills with a handsome balance to the good" (Kerr, Davenport et al. 1931:30).

Additional acts would amend the Hatch Act of 1887 including the Adams Act of 1906 and the Purnell Act of 1925. In an effort to consolidate federal laws, which appropriate federal-grant funds for the support of agricultural experiment stations, all amendments were repealed in 1955. In the *Text of Federal Legislation Relating to Land-Grant Colleges and Universities*, it is stated that Congress, through the work of experiment stations, wants "to promote the efficient production, marketing, distribution, and utilization of products of the farm as essential to the health and welfare of our peoples and to promote a sound and prosperous agriculture and rural life as indispensable to the maintenance of maximum employment and national prosperity and security."

VIII. This Thesis

In the spirit of the cited work on the sustainable campus movement, this thesis seeks to investigate "our" disposal practices at Michigan State University's research farms. By examining our own practice, we will better understand our current efforts and "inspire [the public] to be forever alert to improve existing conditions" (Kerr, Davenport et al. 1931:13).

The agricultural experiment stations are, "charged with conducting research and development projects on behalf of farmers (MAES, 2003). Research conducted at MAES generates a by-product, including food crops that are *edible*. For this project, *edible food* is defined as any food grown at MAES that is not used for a research project but is edible immediately after harvest without further processing and safe for human consumption (i.e. fruits, vegetables, nuts and dry beans).

This research examines how edible food by-products generated from agricultural research are disposed of and examines the sustainability of these disposal practices. Managing edible food in a sustainable manner would include recovering edible food for human consumption, providing the food to animals when it is no longer safe for humans, and finally the only value left from the food is as nutrients for the soil.

Two products, a paper and an extension bulletin, were developed from this research and represent two chapters of this thesis. Together these chapters outline how edible food is disposed of at MAES and the factors that affect the decision-making. These chapters tell the story from the perspective of those who are closest to the work at the MAES farms.

This thesis format is intended to embody the spirit of the Department of Resource Development and land-grant colleges and universities by providing outputs that tell the unified story in two formats: one for the scholar, the other for the practitioner. This researcher sought to develop documents to provide multiple perspectives to aid in the creation of a more sustainable campus. The documents attempt to speak the language of the scholar and the practitioner to further the discussion of university sustainability and open the dialogue beyond campus borders. Both seek to inform and inspire change.

Chapter Two

Sustainable Waste Management of Research By-Products: The Fate of Edible Food from Michigan Agricultural Experiment Stations

"We may not waste which is not ours."
- Liberty Hyde Bailey

I. INTRODUCTION

Following the Earth Summit in Rio in 1992, a network of European universities developed a charter outlining their commitment to "the principle and practice of environmental protection and sustainable development within the academic milieu" (COPERNICUS Campus 1993). American universities, mirroring their European counterparts, have also begun to investigate their own practices on how they may become more sustainable institutions. These self-evaluations typically ask how sustainability could, or perhaps, *should be* integrated into various functional areas of the university, including the curriculum, research agenda and facility operations (Eagan and Orr 1992; Orr 1992; Uhl, Kulakowski et al. 1996; van Weenen 2000).

In the area of curriculum, Cortese (1999) suggests that concepts of sustainability should be incorporated into core classes that reach all students, rather than only classes on the environment. He argues that students need to learn about the environment as it relates to ethics and human interdependence. Others argue that learning is enhanced when students work on practical campus sustainability issues in which students can have a voice in developing solutions (Eagan and Orr 1992; Keniry 1995).

Similarly, universities are slowly embracing the challenge of incorporating sustainability into the scope and practice of the research agenda. While many universities have increased the scope of investigations *about* sustainability (Glasser, Nixon et al.

2002), the literature shows little about incorporating sustainable concepts *within* the design of research projects. Furthermore, Uhl et al. (1996) believes that researchers should ask, "What are the ethical, social, and political implications of (my) scholarship?" (Uhl, Kulakowski et al. 1996:1309). For example, some faculty involved in sustainability efforts model what they preach by printing all reports on paper with recycled-content, or using inks with reduced toxicity, or availing of union labor (University of Vermont Environmental Council 1998; Office of Campus Sustainability and University Committee for a Sustainable Campus 2003). Such efforts illustrate a conscious connection between individual decisions at the university and the impact they have on the greater community.

In addition to curriculum and research, a small number of universities also examine campus operations and search for more sustainable alternatives. To understand current practices of university operations, investigations usually begin with understanding the flow of resources used by the university. Campus food systems are one common area of focus. Campus studies that examine food systems ask, "where is our food coming from and how is it getting to us?" (Kloppenburg 1996). However, these projects typically only focus on *consumptive* pathways; they identify the flow of food products into the university through purchase and acquisition, the consumption of food served in dining halls and other campus eateries, and the disposal of food waste and other by-products from these eateries (DeLind 1995; Keniry 1995; Creighton 1999; Penn State Green Destiny Council 2000).

Surprisingly, no one has yet examined the production side of a university food system. Yet many universities, particularly land grant institutions, are also producers of food crops. At these institutions food crops are commonly grown for research projects.

Since they are not grown to generate profits from market sales, it is not clear what happens to these food crops. How are they used or disposed of? And, are these practices handled in a sustainable manner?

In response to this gap, the purpose of this research is to identify the pathways for the use and disposal of the food crops produced at the Michigan Agricultural Experiment Stations (MAES) and to examine the sustainability of these practices. The study focuses on the disposal of *edible food,* food crops grown at MAES that is not used for research projects but is 1) edible immediately after harvest without further processing and 2) safe for human consumption. Examples of edible foods are vegetables, fruits, nuts and dry edible beans that have not been grown with unregistered chemicals.

To assess the sustainability of these practices, the study relies on a framework for the disposal of food waste created by the U.S. Environmental Protection Agency (EPA). Concerned about food waste in the U.S., the EPA has developed a "food scraps hierarchy" that provides guidance on the preferred uses of food waste (EPA 2000). More sustainable approaches include practices that allow food crops to be used at its highest level of use. According to the hierarchy, the preferred use of food scraps is for humans to consume it. Following human consumption, is animal consumption, nutrient cycling through composting, and finally, sending materials to a landfill as the last priority.

Research Objectives

This research sought to address three research questions:

1. How are edible food crops generated on university research farms at MAES used and disposed of after data collection is complete?

2. What factors affect decision-making about the disposal and use of these food crops?
3. What challenges and opportunities exist if MAES were to strive for the most sustainable use of edible food crops, as determined by the EPA/USDA food scraps hierarchy?

Clarification of terms

The terms "by-products" and "edible food" are used interchangeably in this paper. Both refer to the edible food crops generated at the research farms. The term "disposal" in solid waste management often implies the final destination of a particular material. Conventional understanding of the term is that "disposed" materials are sent to a landfill or incinerator, which is not the highest priority (or most sustainable) use for resources (Environmental Protection Agency 1989). The term "disposal" as used by participants in this project, is taken to mean "the act of getting rid of, having to arrange or manage the disposal," "disposing of, as by gift or sale" and having the "power or right to dispose of a thing; control" (Webster 1989).

II. LITERATURE REVIEW

2.1. Food as Resource and Food as Waste

To examine resource flows, solid waste management professionals investigate "waste streams." A waste stream is the path or series of steps a particular resource material takes from one point of the material's life cycle to another. The waste stream could be examined at many different points—for example, from the point of acquisition through to its final disposal or from a point further "upstream" where the material is produced to its final use (Environmental Protection Agency 1989). Following the waste stream is an important means to identify opportunities to conserve resources, examine

viable alternative resources that produce less toxic by-products, develop new management systems to produce fewer by-products, and to reuse or recycle the different resources identified. When products are not used to their fullest potential or intended use, the product is "wasted" (i.e. a new/functional desk is landfilled, unread newspapers are incinerated).

Both the EPA and U.S. Department of Agriculture (USDA) are concerned about the quantity of food that is wasted in the US. According to USDA, food is lost at every stage of the marketing system (Kantor 1997). Food waste in 1995 totaled about 96 billion pounds of food, all of which was unavailable for human consumption (Kantor 1997). Consistent with the priorities of the EPA food scraps hierarchy, Kantor argues that an increase in efforts to use or "recover" this food for human consumption could reduce hunger. "If even 5% of the 96 billion pounds were recovered, that quantity would represent the equivalent of a day's food for each of 4 million people" (Kantor 1997:3).

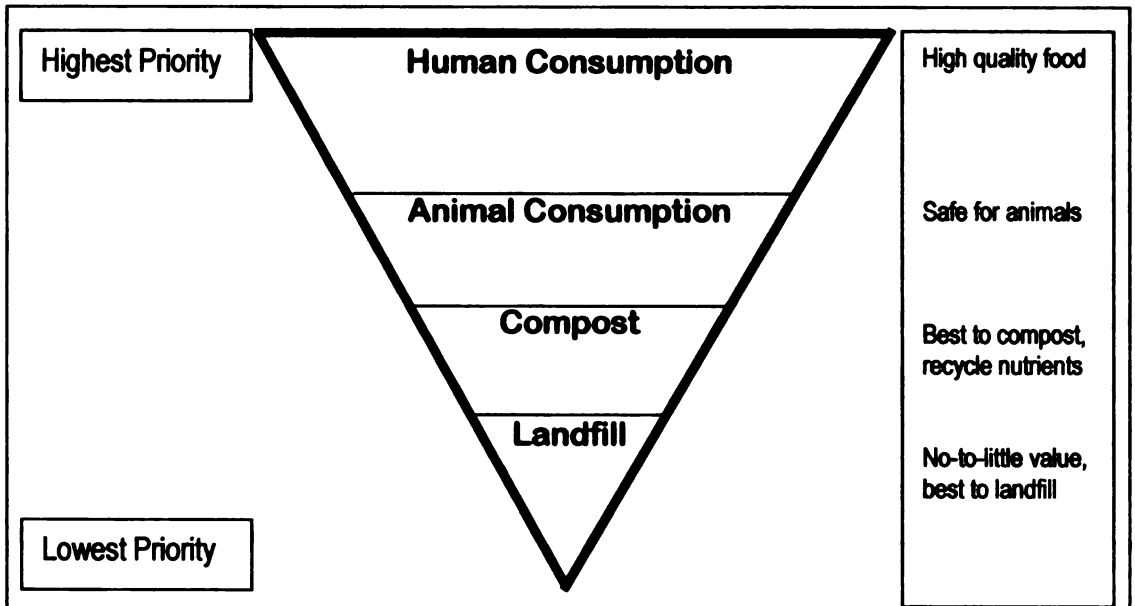

Figure 2.1. Graphic of EPA's Food Scraps Hierarchy (Environmental Protection Agency 2000)

Similarly, the EPA food scraps hierarchy maintains that leftover food should be redistributed or diverted to feed people – specifically those who are needy and can benefit from food donated to emergency food programs including food banks and soup kitchens, homeless shelters and other charitable organizations (Environmental Protection Agency 2000) (see Figure 2.1.). When food is no longer safe for human consumption, the EPA hierarchy states the second priority is to use the food resource to feed animals. When the value of the food has diminished to the point it is inedible, even by animals, the next best option is to compost the organic residuals. When the residuals of food garner no nutritional benefits even for soil microorganisms, the EPA suggests disposing of these materials in a landfill. For this work, the food scraps hierarchy is used to assess the relative sustainability of various disposal practices at the MAES research farms.

2.2. Sustainable Campus Projects

Universities are creating more sustainable or green campuses through a variety of projects. No projects have been found to-date that investigate sustainable disposal of research by-products from university research farms. However, the literature reveals examples of universities examining research by-products from campus laboratories and photographic and art studios (Keniry 1995; Creighton 1999). These investigations examined the quantity and the toxicity of the waste stream from laboratories and studios. As a result, some colleges and universities have reduced the amount of chemicals needed for laboratory courses or have changed to less toxic chemicals (Keniry 1995; Creighton 1999). When less toxic alternatives are difficult to find, hazardous materials are disposed of in a more sustainable manner. While these examples demonstrate a more sustainable

disposal of by-products, in each case the disposal plan has been the responsibility of the institution and not of the individual researchers (Keniry 1995; Creighton 1999).

Universities examining the sustainability of their food system typically investigate how food resources flow into the campus and how food waste flows out (University of Vermont Environmental Council 1998; Penn State Green Destiny Council 2000). Results of these studies have lead to increased purchases of local and/or organic food products and alternative menu options for vegetarians at dining halls (Eagan and Orr 1992; Penn State Green Destiny Council 2000). University food projects have also developed systems to donate perishable leftovers to food emergency programs, recover food scraps for campus composting programs, or link with a local farm who will compost the college's organic waste (Majercak, Bouquillon et al. 1998; Seif 1999; Clark and Derek 2000; SPOON 2002; Office of Campus Sustainability and University Committee for a Sustainable Campus 2003)

However, the literature does not include examples from the production side of campus food systems. The food system projects reported above do not include the production of food crops generated at campus research facilities (Keniry 1995; Creighton 1999). Until now, sustainable campus programs have not investigated universities as food producers or investigated how these by-products from research are disposed of. By not recovering food that is edible, an "opportunity to feed the hungry"(USDA 1977:iii) and to make better use of our resources is being missed.

III. METHODS

Fein (2002) encourages researchers seeking to advance sustainability in higher education to be open to different approaches or research methods to reach their goals.

While many sustainable campus projects seek to quantify consumption of resources or generation of pollution, few sustainable campus projects use qualitative methods (Glasser, Nixon et al. 2002).

Qualitative research methods are appropriate for an area of study when little is known about the topic. A qualitative approach provides the flexibility needed for exploration and the possibility to move in new directions if warranted by the information collected (Maxwell 1996). The strengths of a qualitative approach include understanding the context and its influence on the actions of those being studied (Maxwell 1996) and understanding the meaning of what is being studied from the perspective of those closest to the topic of study (Taylor and Bogdan 1998).

A qualitative approach is highly appropriate for this study as it provides a flexible framework for understanding how edible food is managed and how the context and culture of research and research farms influence options for the disposal of edible food crops. In addition, this approach provides an understanding of edible food disposal from the perspective of the participants. Allowing participants to speak from their own frame of reference enables respondents to describe edible food disposal as they experience it.

3.1. Overview

There were two main phases to this project, each phase consisting of data collection and preliminary analysis with the results of this analysis directing the next phase of the project (see Table 2.1).

Before formal data collection could begin, some preliminary work was necessary to determine the scope of the research. Since 1887, research on experiment stations has been extended beyond agricultural issues such as horticulture, plant pathology and animal

husbandry to include forestry, aquaculture, equine studies and turf management. Preliminary data collection focused on the fifteen MAES field research stations throughout Michigan and a number of research farms adjacent to the main MSU campus. Exploratory interviews were then conducted with farm managers and other personnel at research facilities throughout the state and on campus to identify the types of agricultural products that are grown or raised on each farm. The purpose of these interviews was to understand the focus of each experiment station and to determine whether it belonged in the sample of farms to be further studied.

TABLE 2.1. Overview of Research Design

Phase of Research	Answers Sought	Informant/Participant	Data Collection Method
Preliminary Data Collection	Determine sample. Which MSU research farms generate edible food?	Farm managers, research assistants, research coordinators, research staff, faculty and students.	Telephone calls; questionnaire.
Phase I	How are edible food crops generated on university research farms at MAES used and disposed of?	Key decision makers; harvest events	In-depth interviews; participant observation.
Phase II	How does food disposal occur? How are "links" formed between research stations and outside recipient agencies? How do links survive? Why do links end?	Key decision makers; additional decision makers identified in Phase I; "Linkers" identified in Phase I, "Recipients" identified in Phase I.	In-depth interviews; participant observation.

These preliminary interviews revealed that of the over fifteen research stations and farms, eleven generate edible food crops as a result of agricultural research. Of the eleven facilities identified that generate edible food from research, three stations had less than five acres in edible food crops production. These stations were excluded from the sample as it was assumed that the station's priority would be on managing non-edible

food crops. The final sample includes eight research stations that have more than five acres of research fields in production, which generate edible food.

Once the sample was set, Phase I of the data collection started with in-depth interviews with the farm managers (or defacto farm managers) at each station. The goal of this work was to identify the pathways used to dispose of leftover food crops at each of the research stations producing edible foods. In many cases, further interviews were needed with other farm personnel who were personally responsible for crop disposal. In this study, these individuals, as well as farm managers, are collectively referred to as "decision-makers."

Phase II built on the information gleaned from Phase I to understand the factors affecting the disposal of edible food at each of the research stations. Second interviews were conducted with some of the key decision makers and with new respondents identified in Phase I. Interviews were also held with individuals who did not work for the farm but played a role in the disposal of the food crops.

3.2. Data Collection Methods

3.2.1. In-Depth Interviews

Qualitative methods, such as in-depth interviews, are often chosen when research seeks to explain how events or phenomena happen (Rubin and Rubin 1995; Maxwell 1996). Unstructured interviews with open-ended questions provide a fuller account of the story with rich detail and the depth needed to understand the complexity of the phenomenon studied (Rubin and Rubin 1995). They are a practical tool for researchers to understand "what is going on, why people do what they do, and how they understand their worlds" (Rubin and Rubin 1995:5). Open-ended questions allow respondents to

share their understanding of an event or phenomena without being constrained by terms, questions or frameworks suggested by an interviewer.

In-depth interviews were held first with the key decision makers at each farm. To gain greater understanding of the factors determining the disposal pathways of edible food crops, interviews were also held with individuals who did not work for the farm but played a role in the disposal of the food crops. These interviews focused on how connections were made between the research stations and outside agencies and the impact the connection had on the edible food disposal. Two types of individuals were interviewed. Individuals representing organizations that received the donated food (or "recipients") were interviewed to understand how the relationship was formed with the decision maker and the research station, how the partnership worked, and the mechanisms or strategies that led to long-term and short-term collaborations. Interviews with recipients also helped to identify potential barriers and opportunities to recover more edible food.

Interviews were also held with individuals who helped initiate a link between the research station and an outside agency or organization. These "linkers" are different from recipients as they were not formally associated with the recipient agency. They were, however, important for the connection and hence the food crop donation to be made.

Table 2.2. provides the number of interviews collected by category of respondent. For each of these interviews, an interview guide, a list of questions with possible follow-up probes, was developed to aid the researcher during interviews (Appendices A, B, C). All interviews were audiotape recorded and later transcribed. Field notes were taken

after participant observation and interviews. Field notes were expanded to include additional thoughts from the researcher. Journaling was also practiced to gather additional thoughts of the phenomenon witnessed as well as the feelings that the researcher was experiencing before, during and after data collection.

TABLE 2.2 Respondents Interviewed

Type of Participant	Type of Data Collection	Number of Data Collections
Key decision makers	In-depth Interviews	9
Key Decision makers	Second Interviews	8
Recipients	In-depth Interview	7
Linkers	In-depth interviews	3*
Additional key decision makers	In-depth interviews	2
Recipients	Second Interviews	1
Key decision makers	Follow-up phone interview	5
TOTAL INTERVIEWS		34

* 1 Linker also a Recipient

A "debrief", or what Maxwell (1996) calls "observational notes" or field notes, as typed after interviews to record questions answered, new information learned, additional questions raised and new questions that might want to be asked. A debrief also provided an opportunity for the researcher to share initial impressions including any personal feelings associated with the interview or the information provided. Notes were written during the interview and often added to the written debrief.

3.2.2. Observation

Participant observation was conducted during five harvest events. The purpose of this activity was to 1) gain an understanding of the context of harvesting techniques at agricultural research facilities; 2) gain first-hand experience of harvesting and handling edible food as a research by-product; 3) understand the constraints associated with carrying out multiple research projects at one site; and 4) identify factors affecting whether and how food crops are recovered.

At harvesting events, the researcher worked alongside agricultural researchers, faculty, students, agricultural research staff, seasonal employees and volunteers. These events provided the researcher with first-hand experience in harvesting food crops from a research station and greater insight into relationships between decision makers and other players. The harvesting experience helped the researcher understand the management styles of decision makers. Additional research participants were also identified during these observations.

3.3. Data Analysis

As is described in much of the literature, qualitative analysis begins after the first interview (Weiss 1994; Rubin and Rubin 1995; Crotty 1998). Analyzing qualitative data involves strategy as well as technique. It involves listening to informants, reviewing taped interviews, reading transcriptions, writing down impressions, reviewing initial impressions and writing up new ones. The analysis process provides a feedback loop that informs and shapes future data collection. To analyze is to grasp a basic understanding of what is said, gain a deeper understanding as time goes on, ask new questions as they arise and develop theories from all the data and stories before the researcher.

Journaling, which Maxwell (1996) refers to as memos, also took place beyond the "data focused" activities. Journaling was done throughout the research project to record theories and questions that arose during reflection. These journal entries were later set against the data and/or discussed with another researcher.

Transcriptions and notes were entered into Atlas.ti 5.0 software to help organize the large amount of data collected throughout this project. Data, notes and journal entries were reviewed multiple times to identify different concepts and emerging themes. Transcribed interviews were coded in the Atlas software package. Coding is a process in which a concept is given a label or title and linked with a passage in the data. As new data were collected, new codes were often developed. Codes were also defined to keep the researcher focused on when the code is used and not used and an example of a passage labeled with a particular code. Continued reviews of interviews with the code definitions often resulted in combining two codes or creating new codes.

Concepts and themes brought out through coding were further examined through the use of a "display". This technique sorts the data into broader themes and issues. "Displays constitute an additional analytic strategy; these include matrices or tables, networks or concept maps, and various other forms" (Maxwell 1996:79).

The display helps make the data more visible – providing the researcher an opportunity to see connections or disconnections. Displays help identify what information is known or not known, providing a quick look at what the data answers and what questions need further probing and from whom. It helps flesh out theoretical concepts to see how they pan out across all informants or research stations.

A display was constructed for each research question and organized by research station. Data for each research station often came from a number of sources – including key decision makers, recipients and linkers and observations. Examining all the data by research question for each station showed similarities or differences between stations and where further information might be needed. As new data were collected, they were added to the displays. When data collection was complete a display summary was written, converting from a table format to paragraph form, to bring all the ideas and concepts that emerged from all the displays together.

The primary researcher analyzed coded data and data displays and another researcher familiar with the project reviewed that analysis. Reviews were done during the process of data collection to help validate emerging theories and to support new directions for future data collections. Additional researchers who reviewed data and provided feedback helped support current and provided new interpretation of the data.

3.4. Validity

Validity is related to the credibility of an explanation (Maxwell 1996). For qualitative research "each of the three main types of understanding - description, interpretation, and theory - has distinct threats to its validity" (Maxwell 1996:89). To reduce these threats and maximize validity the design of a project must incorporate controls.

Interviews were all audiotaped and transcribed verbatim. This action ensured the data were complete and could be reviewed by other researchers. By journaling, the researcher was able to record personal reflections and feelings held which could alter interpretation of the data. Having other researchers review transcripts and other collected

data helped the researcher examine their *own* motivations and why they were or were not interpreting the data in a particular way.

Data displays were shared with researchers outside this project to help support current interpretation and/or provide new insight on alternative interpretations. Again, input from other researchers helped the data interpretation "overcome the intrinsic bias that comes from single-methods, single-observer, and single-theory studies" (quoted from Denzin, 1970 in Patton 1990:464).

Second interviews were conducted to provide *member checking*, a system that provides feedback on collected data (Maxwell 1996). During second interviews with decision makers a list of pathways was shared in both written and oral form, and participants were asked to confirm, correct and/or add additional pathways. Member checking provided a third level of testing the validity of the researcher's interpretation.

3.5. Study Limitations

The primary limitation of this study is that it is designed as a case study, which will not result in explicit generalizations. Generalizations, the conclusions or results or lessons learned, will not necessarily be transferable to other universities engaged in agricultural research.

Although not all "lessons learned" may be transferred to other settings, this case study, like case studies in general, "provides a single piece of evidence that can be used to seek general patterns among several studies of the same phenomenon" (Chung 2000:341). These general patterns provide a window into the activities at Michigan Agricultural Experiment Stations, which Agricultural Experiment Stations in other states may find informative and helpful.

IV. RESULTS AND DISCUSSION

4.1. Use and Disposal Pathways for Edible Food

Interviews with the decision makers revealed five main disposal pathways for edible food crops on the MAES farms (see Figure 2.2.). The five main pathways include: edible food used as samples for research projects, for human consumption, for animal consumption, edible food crops tilled into the soil for the purposes of nutrient cycling, and edible food crops that are disposed of in a way that does not recoup any value from the resource. These disposal pathways are consistent with those identified by the EPA; each is discussed below.

4.1.1. Samples Used for Research Projects

The primary goal of the MAES is to conduct and support MSU research. As such, it is not surprising that one of the end uses of edible food crops is for research data.

Agricultural research involves growing crops and collecting data from the plant and/or its surrounding environment (e.g. soil, insects, and water). Although all research projects collect data, not all data collected from the edible food portion of a plant. In instances where leaf tissue of a fruit tree, insects, or soil is collected for the data, none of the edible food crops grown for the research project are used for the research. Ultimately, they are available for other use, such as human or animal consumption.

Another example is when a project examines how long it takes for fruit to drop from a tree. This project will not generate *any* edible food. Once the fruit drops from the tree, it is likely to be inedible – at least for human consumption. Some projects also result in the destruction of the food crop, which takes place during harvesting and/or

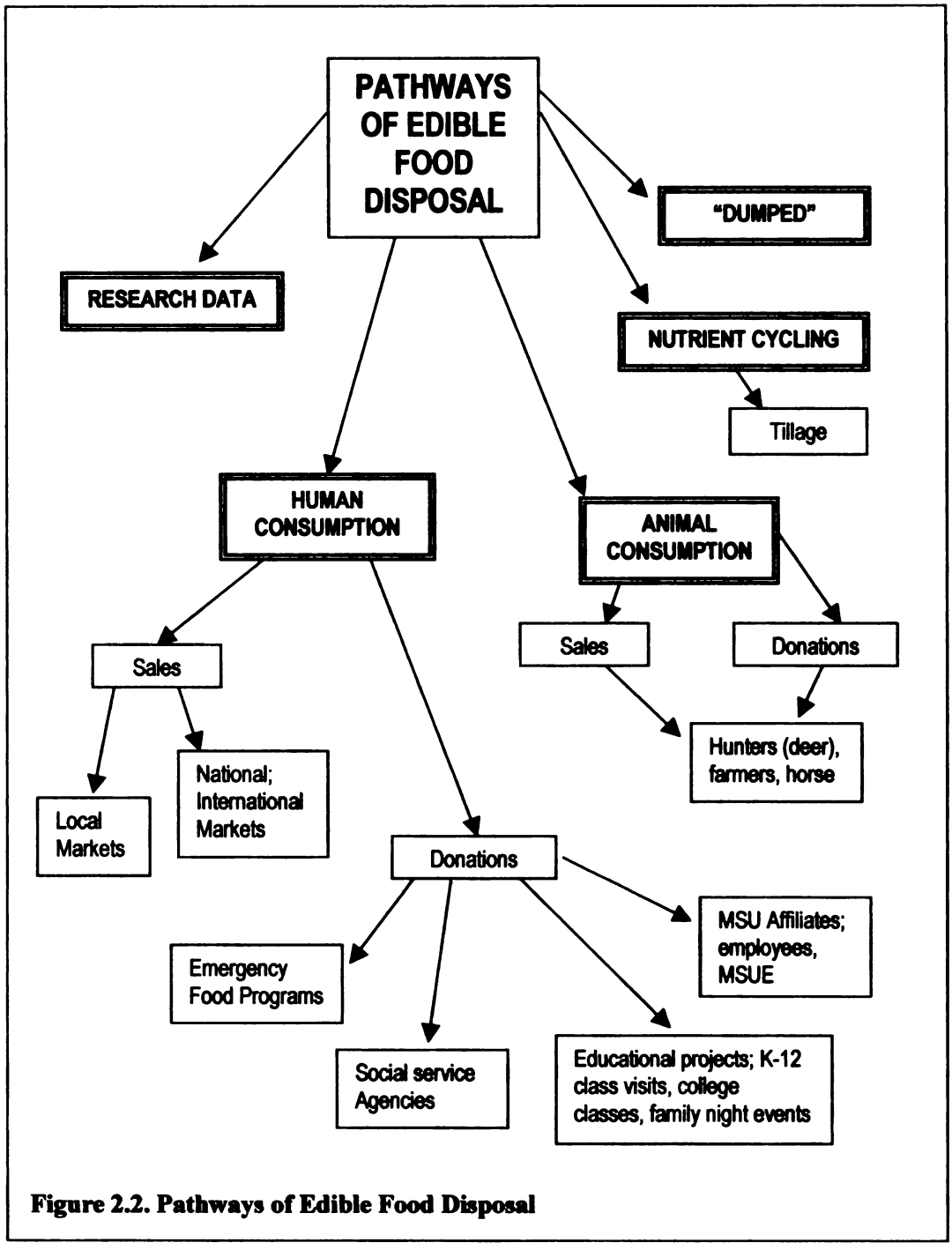

Figure 2.2. Pathways of Edible Food Disposal

processing activities (e.g. chopping, cutting, shredding, fermentation, juicing and canning), which makes the food crops inedible for humans.

Many experimental crops, however, provide the necessary data to scientists and still leave a large portion of edible food. These edible food crops *need* to be disposed and

will continue on one of the other four pathways identified above. These options include human or animal consumption, nutrient cycling by returning the crop to the research plot and plowing it under the soil, or "dumping it" in a way that does not recoup any of the value inherent in the edible food.

4.1.2. Human Consumption

Edible food crops are made available for human consumption mostly through sales and donations, with a small portion consumed by those who work at the research farm. Seven of the eight research stations sell some edible food. This food is sold through direct sales to local markets; other crops will also enter the national and international markets via sales to processors and distributors. MAES' edible food crops therefore enter the food chain locally, nationally and perhaps even globally.

Six of the stations regularly donate edible food to off-site agencies. Edible food donations are made mostly to emergency food programs, but also include social service agencies, children's groups and educational projects, as well as individuals affiliated with MSU. Some stations have a connection with only one outside agency while others work with a number of organizations. One of the remaining stations has donated edible food crops within the last three years, but does not currently donate edible food.

Of the stations that donate food, all have links with emergency food programs including soup kitchens, food banks, church groups and missions. One station donates edible food to social service organizations or children's groups. These agencies make value-added products (e.g. cider, pies) to raise funds at community events for their charitable activities. Three stations have donated to schools or children's groups for educational purposes, and one station donates food crops to neighbors.

Finally, at all the stations, researchers, staff and/or students often take a small portion of edible food for home consumption. These individuals all have an affiliation with MSU, the specific research project, or the research station. In fact, during this project this researcher was often given food samples, anything from a taste of one fruit to a half bushel of edible food for home consumption.

4.1.3. Animal Consumption

When the condition of the food is no longer suitable for human consumption, food crops may be sold or donated for animal feed. Three stations sell food crops to farmers and/or hunters. Three other stations donate their food crops to farmers, hunters and/or MSU affiliates who own horses. Crops sold or donated as animal feed include apples that have dropped to the ground and crops treated with unregistered chemicals. These non-edible food crops are most often used as deer bait by hunters or fed to horses.

4.1.4. Nutrient Cycling

The EPA's food scraps hierarchy includes composting, a form of nutrient cycling, as the third level of priority in the food scraps hierarchy behind the preferred uses of human and animal consumption. Composting is the decomposition of organic materials into a soil-like substance that can be used to enrich soil (Rynk 1992). Currently none of the stations in this study compost edible food crops or their residuals.

However, a number of stations perform tillage, a commonly practiced nutrient cycling activity. Tillage improves nutrient cycling as it pulls crop residuals, stalks, and pieces leftover from the harvest into the soil where it will decompose and return nutrients to the soil (Magdoff 1992). Currently, half of the stations actively engage in tillage as a disposal method for edible food. Of these stations, only one tills in a majority of their edible food crops.

In most cases, research farms plow under crop residuals and some crops, especially border or edge rows. Border rows are rows of crops that are grown on the outer edge of the rows of research plants where data will be collected. Border rows surround the research plots and exist to "protect" the research crops. Border rows are usually the same type of plant as the research crop, but perhaps a different variety, and are usually not harvested for research.

Crops that are not harvested but are tilled into the soil do provide nutrient cycling to the soil. However, nutrient cycling is lower on the EPA's hierarchy than other forms of consumption. Therefore, value is lost when these edible food crops are not being used for human consumption, the highest priority within the EPA hierarchy.

4.1.5. Wasted: Value of Edible Food Lost

Some edible food crops produced by MAES are dumped, "wasted", or ultimately disposed of in a landfill. Individual dumping strategies include throwing edible food crops mixed with culls and plant residuals out in the woods where they are spread, edible food is tossed into piles in the woods, or food crops are dropped into a hole in the ground.

"Wasted" crops are those that are not harvested. These crops will rot on the vine, the tree, or the plant. Some nutrients may be returned to the soil through this process, however, nutrient cycling is not as high as a priority as human consumption. At one research farm, edible food crops are "dumpstered," literally placed in the research station's trash dumpster to be transported to a landfill.

According to the EPA's food scraps hierarchy, this set of strategies represents the least preferred method of managing organic residuals. To let food go to waste or to a landfill to be buried deems it to be of little value (Environmental Protection Agency

1989). Dumping, wasting or sending food crops to a landfill are therefore the least sustainable acts for they do not recoup any of the value of the food crop.

4.1.6. Relative Approximation of Edible Foods Disposed by Each Method

It is difficult to examine how edible food crops are managed without an interest in how much edible food is generated and disposed. This project did not measure precise quantities of edible food as these figures were not available to the researcher. However, farm managers were asked to "estimate" the percent of edible food crops generated at their farm that falls into each disposal pathways identified (see Table 2.3.). These figures are admittedly rough and the intention was not to calculate precise quantities. Rather it is to provide a rough estimate at each farm of how much edible food is disposed through more sustainable means (e.g. that are higher on the food scraps hierarchy such as human consumption).

TABLE 2.3. Estimated percents of edible food (by volume) down different pathways

Site	Data	Sold	Donated	Staff	Tilled in	Un-harvested	Wasted	Total
		HAC	HAC	HAC	NC	NC	W	
Brewster Farm	5	5	10	5	55	30	1	110
Happy Farm			90	1	9			100
Waterbury Farm	15		46	6	35			102
Merida Farm	80	10		5	5		5	105
Nichols Farm		35	59	5		1		100
Kildee Hill Farm	30	65	4	2				101
Chatham Farm	25	43	17	5			9	99
Eastham Farm	2	100		1				103

HAC = Human and Animal Consumption, NC = Nutrient Cycling, W = Wasted
(Note: Sites listed with their aliases)

The results suggest that the majority of edible food at each station is diverted to relatively high use categories on the food scraps hierarchy. More specifically, with the exception of one research farm, the majority of edible food is diverted to either human or animal consumption. By contrast, tilling and "waste" play a large role (over 30% of all

edible food produced) at only two of the eight farms. This suggests that most of the research farms in this study tend to dispose of edible foods in a sustainable manner. However, these estimates suggest there is potential for further diversion of edible foods into more sustainable uses that are higher in the food scraps hierarchy.

4.2. Factors Affecting Edible Food Disposal Decisions

Food crops generated at MAES are an unintended consequence of research. As such, university research farms, unlike private or commercial farms, must seek ways to dispose of their crops. All of the key decision makers indicated that this was a challenge for most edible food crops grown on site.

To understand the constraints and enabling conditions that surround edible food disposal, interviews were held with decision makers at the farms. In addition, interviews were also held with outside partners that participated, either as recipient agencies or as third party facilitators, in the disposal of these foods. These interviews helped to identify the factors that affect decisions made about the disposal of edible food crops. These factors are discussed below.

4.2.1. The No-Competition Rule

When asked about the research station's policies surrounding edible food disposal, decision makers suggested that there was no university-wide policy guiding edible crops disposal. Decision makers at four stations stated that they were not aware of any University policy for the disposal of edible food. Two decision makers said there was a policy for their station that limits staff distribution. Two other decision makers said they have a policy for managing plant material, which includes edible food; one remembers reading a policy over twenty years ago but did not know where to find a copy today; the other had a copy of a policy for disposal of excess plant material and produce,

which outlines marketing and disposal options (see Appendix D). This policy was developed for this specific station by a university department and is periodically updated.

Although it was clear that there was no uniform policy for edible food disposal, all agreed on one unwritten rule - that disposing of products grown at the experiment station should not compete with local growers. Interviews with decision makers, however, revealed that this unwritten rule is interpreted differently by each station and by each decision maker. More specifically, interviews at each of the stations indicate that interpretation of what constitutes "competition" varies widely. In addition, the "no competition rule" often determines whether the station sells edible food crops and the conditions under which a sale might take place. Six of the stations sell some or most of their product and most of them believe they are not selling enough material to negatively impact local markets.

> "The amount of [edible food crops] that we have is so insignificant compared to the whole crop. So, where we were concerned that we would be competing with growers in the past is not the concern that it was when we were established."

Some suggested that it is the way they are selling it that makes the difference. Wholesale transactions appeared to be allowable to some, while retail was not.

> "As long as it's wholesale, as long as you're not involved in this retail deal [you can sell edible food crops]."

> "Competition would mean that if we set up a stand out front and sold it, that would be taking business away from growers in the area."

Another decision maker shared they are not allowed to advertise while another says they can only sell if it is well advertised. Interestingly, only one station believes that *any* edible food sale competes with local farmers.

> "I've never been in favor of selling any crop from the university because then we are unfairly against the people that are making a living on it because we're doing it with dollars they've given us, we're doing it with land that's tax free, we're doing things that add to their surplus and I don't like to do that."

Donating crops, on the other hand, is universally not seen as competing with local growers. One decision maker shared two reasons why donating food is not competing with local producers.

> "We [are] not in competition with producers because our stuff [is] not grade A number one stuff and...the people that get this food...wouldn't and couldn't buy it anyway."

Some decision makers suggested that there was no need for a universal policy. One commented how a policy would only add another layer of bureaucracy.

> "Adding another level of policy on this wouldn't help...Every individual situation isn't going to be able to follow [one] policy very well."

However, one decision maker admitted that he did not know if the choices he has made are the best ones, stating,

> "What is the policy?...some of these questions do come back and then start haunting us...did we do it right? Didn't we do it? Is the University going to be upset?...So in the end, it would be [helpful to have more clarity]."

4.2.2. Weighing Costs and Benefits of Disposal Options

The lack of a university-wide policy allows decision makers at each station to make highly individualized disposal decisions. When asked how they decide to dispose of a crop, most decision makers revealed a very deliberate, although informal and largely mental, cost-benefit analysis associated with each decision. Disposal decisions result from mentally weighing the costs and benefits associated with many factors, including

the station's need for revenue, the availability of labor, the need to accomplish other related tasks on the farm, the nature of the crop and whether it requires any special handling, an individual decision maker's views on "wasting" edible food, and the connection individual decision makers have to community partners and the surrounding community.

The Benefit of Sales Weighed Against Increased Labor Costs

Whatever action is taken, the disposal method typically maximizes the perceived benefits to the farm and minimizes the perceived costs. Sales, for example, provide a clear benefit to the farm in the form of revenue. Selling the produce provides income for the farm to cover expenses when budgets run tight.

> "Anything consumable, if I have a market for it, I will generally try to recoup some funds back from that to put in the operating budget."
>
> "If there is something that's available to be sold, we try and market it because as money is turned back around [it can] supplement what we do here. Either through hiring staff to help operate things or help with research or purchase equipment."

Of the six farms that currently sell edible food, decision makers from three of those farms shared that incentives to make these sales is strong. All three have come to depend on revenue from sales to cover both special purchases and basic operational costs,

> "I'll say 25% to 30% of our budget comes from the sale[s]...of these edible crops. ...this should be extra money so if we want to buy equipment...[now it's] going towards salaries, pesticides, fertilizers."

Another station looks at funds from sales as a bonus – or unexpected money.

> "It has been a philosophy I had since I started here...we would not rely on sales to make our budget. We use [money from sales] to supplement our budget."

While sales do bring in revenue, there are also costs associated with selling edible food crops. It costs money to pay labor to harvest crops that have not been already harvested for the research. It also takes time to market crops. When stations grow multiple crops, decision makers work with a number of markets and individuals, including brokers, processors, wholesale operations, hunters, and the general public to dispose of the crops through sales. Each transaction takes time away from other work on the farm. Decision makers clearly conduct a mental cost-benefit analysis to determine whether it is worth their trouble to even sell a crop:

> "Sometimes it just isn't worth your time to make the effort. If I can't pay my wages to get [the crop to market], it just isn't...The fertilizer value of the crop is worth more than what time it takes me to take it off. You still have to count for your time because somebody is paying for that."

Stations that need income feel the pressure to spend time on marketing and other activities associated with sales. When asked if they could manage the material in any way – without constraints or limitations – two decision makers who currently rely on sales replied they would stop spending time on sales.

Other Benefits: Accomplishing Multiple Work Objectives

Some stations that sell edible food crops earn little from sales. The amount of money is small in comparison to the station's annual budget and in the words of the decision makers is of "little consequence". Unlike private farming, in which farmers grow product to sell for income, the goal of the station is research. Therefore disposing of the products from research must be done in a way that is consistent with the farms multiple research objectives.

> "If in the course of doing an experiment, we harvest some [edible food] and we have them already harvested for our primary purpose of the experiment, and we

> can sell it, that's good. But we have border rows, guard rows, that aren't in an experiment. We will have to decide on whether or not to harvest and market those, depending upon the economics of it. It may be that we have people available at that time to make use [of] their labor or not...[Our market might say] 'Whatever you can get to me on Tuesday be fine.'...maybe we don't have labor to pick those extra [crops] by that day. So we don't do it."

As such, disposal decisions are rarely made solely for the purposes of raising revenue. Farm managers must juggle the research objectives of multiple researchers along with the goals of their station and MAES. As a result, sales and donations are more likely to become part of the overall management scheme if they accomplish other work objectives or provide other benefits to the station. For example, if it is important to remove a crop from the soil to prevent the proliferation of soil borne diseases or pathogens, then decision makers may seek partnerships with gleaners who will harvest the crop in exchange for the food itself. Similarly, some crops are difficult to till back into the ground. But if the market for this crop does not warrant the price of labor needed to harvest it, partnerships with gleaners can help to dispose of the crop in a way that is low-cost, and certainly better than the next possible alternative, which is to hire labor to remove the crop.

Some research stations have also developed disposal strategies as means to manage other farm problems. Trespassing, for example, is a problem that many research farms face. In response to ongoing trespassing issues, one decision maker developed two gleaning projects. He began to recognize that unharvested crops were tempting trespassers onto the station, resulting in stolen food crops, which potentially were unsafe for humans to consume. One project consists of volunteers who glean for local emergency food programs and the other involves individuals, including farmers and

hunters, who glean non-edible food crops for animal feed. The decision maker says that gleaning the crops has decreased the trespassing problem as well as potential safety concerns of thieves stealing unsafe food.

Finally, at another station, one decision maker uses volunteer gleaners to help harvest a research crop and prepare the crop for data collection. The farm manager explained that when researchers collect data it is often days before the crop can be donated. Harvesting and collecting data takes time and when the work is done the food crops are often too old to be consumed. Volunteer gleaners help scientists make the research data collection process move more quickly and in return receive edible food crops that are distributed to those in need. Said the decision maker,

> "I needed their help to complete the study. Otherwise, you figure, I would probably had about six employees working on that for about two weeks straight. So, as it was, we completed it, maybe they spent six mornings working on it. It was a considerable savings."

Other Benefits: Providing Food to the Hungry

In addition, benefits to the community are worth noting. One benefit is that most edible food donations go to Michigan residents facing food insecurity. Food security is the concept that people need access to healthy and nutritious foods to live a productive life (Keenan 2001). Those who are food insecure are families and individuals who may not only be lacking in the quantity of food necessary for an adequate diet, but may also lack in the quality of food that provides the nutrients needed for a healthful lifestyle (Anderson and Cook 1999). Edible foods provide diet diversity to clients of the recipient agencies. One recipient shared,

> "I think it's important to provide a range of opportunities for putting food on tables...when the food bank has more options it just can meet a wider range of needs...fruits and vegetables [provides] nutrition benefits."

Decision makers like knowing their food donations "help people in need" and give back something to those who do not normally benefit from the research at the station. Decision makers recognize the quantity of materials and the benefits of donating edible food.

> "That was quite rewarding that we could get rid of a lot of the excess. Instead of them just throwing it out and letting it rot. At least it would be used for somebody [in need]."

> "Well, I think we have enough quantity that...[what] could be done with them is send [the edible food] into centers that do emergency feedings."

Other Benefits: Meeting Public Expectations and Gaining Public Confidence

Michigan State University is funded in part by public taxes. Some decision makers perceive that the public has certain expectations of the research farm because it is publicly funded. As an example, more than one decision maker suggested a sense of public entitlement to the crops grown on the research farms.

> "I shut sales off completely because people got to where they were so belligerent...I can remember one guy called out and says, 'Do you know where I can get fruit?' I go, 'Yeah, down to the city market.' He says, 'Yeah, but do you know how much you pay for it down there?'...a lot of people started saying, 'Well you know I would like to be able to get MSU fruit.'"

Some farm managers stated that they felt the public also expects access to edible food crops, particularly when they are not being harvested. This expectation they maintain is related to the public's lack understanding of the work of the station.

> "...we didn't harvest them purposely because the research was to see how well they did. These apples stayed on the tree into November, but to the public, [they] came back [and asked] 'Why are you wasting all these apples?'"

Similarly when a volunteer gleaner was interviewed he stated, "I hate to see all that food go to waste." He added "I think there's a lot of it that goes to waste, and it should be picked." Despite all the gleaning this volunteer performs with others, his perception is that there is still a lot of food that goes to "waste".

As a result, one decision maker felt obligated to harvest the crops, because the public perception is that the University is "wasteful" if they see crops rotting in the research fields.

> "What does it look like to the public? Sometimes we'll go and harvest things even though the price may not be there because it looks good because if it's along the road front and if it sits there people don't like that."

Public perception plays a subtle role in determining the costs and benefits associated with any disposal pathway. If a farm manager feels the pressure from the public to make edible crops available to the public or to harvest crops for which they have no use, the benefit cost calculation changes. Benefits may now include increased public confidence. On the other hand, some farms have used public perception of waste as a means to access volunteer labor and thus make donation options more appealing.

Other Benefits: Strengthening Relationships with the Community

Working with community members provides a range of edible food disposal solutions for the research farm. Decision makers who work with community partners try to coordinate donation activities around their normal work obligations so that they do not require large amounts of staff time. These decision makers recognize working with

volunteer gleaners and other groups ultimately helps the station by providing a feasible disposal option, free labor, and often the opportunity to address other issues important or practical to the station.

An additional benefit of donating edible food is the connection made between research station and the community. Ongoing collaborative relationships and friendships have emerged as a result of these links. One decision maker also recognizes the educational value of his staff interacting with community volunteers.

> "When we're working in conjunction with [the gleaners], harvesting stuff, I think it's kind of neat to see the relationship between [the staff] and them. Because they range anywhere from fifty to sixty and maybe even on up...and I think [the gleaners] appreciate having [the staff] around...they're talking about things and so I think it's an educational process."

4.2.3. Factors that Affect the Magnitude of Perceived Costs and Benefits

There are various factors that influence the perceived magnitude of the costs and benefits described above. These include factors that are external to the decision-maker such as the nature of the crops grown, which could narrow the disposal options and determine if the crop is marketable. Size of the station or the quantity of product also affects marketability. Other factors include the skill level of community partners, and budget issues at the University and State level. Internal forces come from the personal values held by the decision maker and the action or inaction that results from these values.

Nature of the Crop

The nature of the crop grown will influence the perceived magnitude of costs and benefits associated with its disposal and will determine potential disposal options. Some crops for example, are easily tilled into the soil and do not pose any disease threats to the

plots. Decision makers recognize tillage provides fertilizer value for the soil by adding organic matter. When research farms till in edible food crops, they plow plant residuals under the soil and gain organic matter, which increases soil quality (Magdoff 1992). For these crops tilling is a cost-effective disposal solution that is difficult to beat. One decision maker shared that tillage is easier than sales. If it were not for the income from the sale they would, "...plow the whole thing right under and not worry about hauling [the crop] to market."

Other crops, however, should not be tilled in and left on the soil to rot as they have the potential to cause future problems, including soil borne diseases and/or injury to plants, if not harvested.

> "It's nice to have those gone for disease purposes. [When] you've got rotting [food crop] out there, they tend to build up problems in the soil...if you ever come back to that field, will cause rotting problems again, so it's nice to have them gone."

For these crops, the disposal options are more limited as the crop must come out of the ground. As a result, the characteristics of the crop can alter the magnitude of a benefit of a given disposal method (as there may now be a greater benefit associated with getting the crop harvested) and the magnitude of the potential costs (labor must be used to harvest the crop). Depending on other external factors such as marketability of the crop, the availability of volunteer laborers from the community, the relationship with a recipient agency, the decision maker will choose a disposal pathway that makes sense given the various constraints and resources available to him. The nature of the crop greatly influences what is possible, but also what final disposal pathway the decision maker chooses.

Marketability of the Edible Food Crop

Depending on the nature of the market for a specific crop and the quantity of crop available, sales can be the easiest way to dispose of a large amount of food crops. At stations that have large quantities of marketable crops, selling can be the least costly disposal method. Research farms with small quantities of product face greater challenges in making sales cost effective. The costs of marketing small quantities, precludes two stations from selling edible food crops. Instead, these food crops are donated or tilled into the ground.

> "I could take it to the farmer's market...but I'd end up spending more than I'm going to make."
>
> "If we could find a place to sell it we'd sell it. Most of it would cost us more to sell it than we would get out of it."

Decision makers who manage smaller quantities of crops do not have the option of selling their crops as the transactions costs make it is too costly. However, many decision makers have developed alternative disposal methods that include recovering edible food for human consumption, which benefits the community.

Availability of competent partners

The availability of skilled community partners has an important effect on the perceived magnitude of costs and benefits associated with each disposal option. Some community agencies provide teams of skilled volunteer gleaners to harvest crops in the fields. Other agencies provide volunteers and/or staff with transportation to distribute food to community food banks, homeless shelters and senior housing complexes.

Community agencies that provide volunteers to glean and distribute food for the farm greatly reduce the cost of a disposal pathway that allows for human consumption of the edible food.

> "Well it does help us, you know, from throwing the stuff out. And over the years...going in the field and [harvest] the stuff that we don't need for yields. You know, they'll clean it up for us. So it does, in reality it saves money, in some ways. And like I say, then I don't need to dispose of it."

In addition, coordinating donations of edible food donation is much easier when a community partner is experienced and organized. Having skilled partners greatly decreases the transactions costs associated with making an edible food donation, particularly when gleaning is involved.

> "They just have been very good to work with, in terms of being able to take what we have and then redistributing it to other organizations...that's what I like about them."

> "The coordinators have been workable people. I mean they don't try to take advantage of us in any way, they just, what we have for them is fine and... they have a good bunch of people and we really don't have problems with them either, it's been good."

Both the research stations and community organizations benefit from these partnerships. This collaboration takes leadership skills and personal initiative on the part of decision makers to communicate their needs and constraints and what they need to make a partnership work. The challenge becomes finding partners that understand MAES' goals and can work within the research farm's limitations.

Personal Values and Personal Initiative

The decision maker's personal values also affect the perceived set of costs and benefits to a given disposal pathway. Interviews with decision makers indicated that personal values were strong motivators for decision makers to invest time seeking community partners and maintaining those relationships. Seven of the eight decision makers stated that edible food should not be wasted and recognized it is a resource worth

distributing. Their desire to distribute this food suggests that they believe that the product has value beyond its original use as research data. The eighth decision maker sees the edible food's value in only providing data. This is not to say he likes to "waste", but rather does not view the product as a resource but as a product that has already completed its intended objective.

Most decision makers expressed that working to recover or divert at least a portion of the food was a "good thing." For those that view the material as a resource, most work hard at juggling multiple goals and objectives to ensure the crop is sold or donated for human and/or animal consumption. Distributing edible food to the "needy" or "those in need" was recognized as important at all stations that donate food crops. In fact, giving to those in need was a prerequisite for donations to an outside agency.

> "The thing is I feel [a] responsibility to, we have the products and if there's a way that we can get rid of it to help MSU and help people out, than it's worth doing it. And I guess that comes down to the bottom line, and like I said, it does a lot for MSU too. And there's a lot of times, yeah, we could just take it out back and dump it or do whatever, and there it sits. But if we can [donate it] it's just a, just a tremendous plus."

Five of the six decision makers who regularly donate food shared similar sentiments. They feel an obligation to avoid wasting the food, and use it to help people. As a result, connections are made with community members who might not normally have strong ties to the university.

Donating food presents costs in terms of extra time needed to coordinate and carry out creative food recovery projects. When asked if donating and working with local agencies were part of their job five of the six decision-makers that actively donate said it was not. As a result, decision makers regularly engaged in these projects on their

own time. One decision maker, after avoiding the question, admitted it was part of his job, but added,

> "Well, I can kind of hide that to a certain degree. And I can also defend it and say that it doesn't take that much of our time. And on the flip side of it is, we get a lot of benefit from [the gleaners]."

By contrast, all decision makers stated that choosing to till the crops into the soil, leave the crops in the field or "dump" edible food *is* part of their job. The choice of selling the crops was viewed as part of the job by all but one decision maker.

Clearly, decision makers engaged in these activities because they found it personally rewarding to divert food that would otherwise be wasted. This was also obvious as we learned of other projects that had nothing to do with food disposal that decision makers voluntarily organized. One decision maker, for example, organizes special events outside of "his work" in which urban children and their parents visit the farm to learn about agriculture and the work of the research station. He described his motivations for doing so, "I guess the love for the people and all. The joy of seeing that

> they are getting something that they ordinarily not getting... the families have a chance to come out and do something as a family... helps MSU and it helps agriculture. Cause I do have a love for agriculture too."

This quote illustrates that values are indeed at the heart of what motivates decision makers to "go the extra mile" on special projects that involve the community. This activity was not motivated by a desire to recover food, but a desire to pass on an appreciation for agriculture.

The Changing Administrative Landscape

Farm staff, research agendas and budgets change over time and with these changes come new influences and forces for how decisions are made about edible food

disposal. As such, the current set of factors that affect edible food disposal decisions is likely to change in the future.

Changes in annual budgets affect decisions about food disposal. Receiving public funds, the University and thus MAES are affected by cuts in the state budget. The threat of huge budget cuts, including the closing of a research farm are very real fears among those interviewed. As a result administrators and thus decision makers are looking for ways to reduce costs and increase revenue. Some decision makers say that they have been encouraged to increase sales to raise additional funds for their research stations.

Another proposition for increasing revenue is to begin charging researchers for "special projects" or to encourage grants to provide funds for station overhead. As a result research scientists may increasingly feel pressure to raise revenue. In response, some decision makers at the farm predict that researchers will seek to sell food crops as a way to recoup funds. While it is encouraging that researchers are becoming involved with the disposal of their research by-products, decision makers on the farms often feel that researchers lack an understanding of the complete set of costs and benefits associated with various disposal decisions.

Recent budget cuts and concerns about future funding make the lack of a policy or the confusion of the policy more apparent. The issue of competing with researchers to manage edible food crops surfaced during interviews at two research farms. It has led some decision makers to ask, "Who owns the research crops once the research is over?"

One decision maker shared that researchers are ultimately responsible for deciding how crops should be disposed after the data collection process. Once the researcher has "signed off" on the edible food, the decision maker assesses if the crop

will make the station money if sold. Researchers often do not realize the costs associated with harvesting and marketing. Nor do researchers realize that many farms rely on funds from crop sales for basic overhead costs.

> "[Disposal of the crop] is at the discretion of the project leader. So in other words, the [researcher] can say "Yeah or Nay." If they use a bunch of my [edible food], which I can sell, they can say, 'Here, I'm going to give them away to everybody under the sun.'"

If the decision-making moves to researchers who may not fully understand the costs and benefits, there could be labor and cost implications for farm personnel who are likely to be responsible for carrying out such disposal activities.

Food recovery projects rely on the strong leadership of farm decision makers and a change in leadership could result in changes in the disposal methods. However, support from the University to continue and expand disposal practices that are sustainable and benefit the surrounding community, could also encourage the maintenance of beneficial disposal projects. The changing landscape adds challenges, but maintaining current sustainable practices and increasing these efforts is attainable.

V. OPPORTUNITIES AND CONSTRAINTS TO RECOVER MORE FOOD FOR HUMAN CONSUMPTION

This research uses the EPA's food scraps hierarchy as a guide to sustainable management of edible foods produced on MAES research farms. Results from this research indicate that individual decision makers often dispose of edible food in a sustainable manner, with most of their edible food consumed by humans, which follows the EPA food scraps hierarchy (see Table 2.3.). While overall MAES decision makers tend to dispose of edible food sustainably, there is room for improvement. Many of the decision makers view tillage and letting crops rot on the vine and other "low priority"

uses, according to EPA, as an acceptable disposal method of edible food. What challenges currently prevent MAES from disposing of *more* edible foods in sustainable ways?

5.1. More Edible Food Can be Recovered From Research Farms

This research has not measured the *quantity* of edible food generated at MAES and thus has not uncovered how much more is available. However, the estimated percentages provided by decision makers suggest the relative importance of various disposal pathways at each station (see Table 2.3.). These data suggest more edible food can be diverted to higher uses at certain research stations. Interviews with decision makers also suggest there is an opportunity to recover more edible food crops. Said one decision maker,

> "We do have a lot of other [crops] out there that could be given to [the food bank] if they would take them."

Decision makers may be willing to donate edible food, but without labor to harvest the crops diverting edible food can appear to be an insurmountable challenge.

> "If evaluations are done with it, basically you want to stop spending money on it...there still may be some good fruit out there, but you've gotten the data that you want. There's no point in harvesting it any more and spending money because it's really expensive for labor to go out and harvest."

Clearly, there are more opportunities to recover more edible food through gleaning partnerships. Although gleaning activities create more opportunities to divert edible food for human consumption, gleaning is not without challenges. Bringing gleaners into the research fields is also seen as risky. Decision makers fear volunteers will stray and ruin years of research.

> "You don't have to go too far along the fields to destroy thousands of dollars worth of an experiment. What seems like a good thing turns out to be not so good. And at times, we just don't have the personnel to even manage or oversee an activity like this. We have a fairly small staff for all the things we need. So there's all those things that impact on what we can do."

At the same time, decision makers who currently work with volunteers find the benefits of working with gleaners outweigh the "limitations".

> "They are volunteer help. I don't expect them to know that we want a certain area harvested...if you put checks and balances in place I don't have a problem. Or if we have another field that's part of a field, we will try to put a rope or ribbon around so we section off an area so they can pick it."

Volunteer gleaners represent a diverse group of individuals. At one station they are primarily, though not exclusively senior citizens. One station used to have a team of mostly young men working community service hours through the county court. Another team of gleaners is composed of "clients" from the mission for which they glean.

5.2. Increasing Partnerships Between Research Farms and Competent Community Groups

More sustainable food diversion can occur if there are more partnerships with community groups who can assist with the disposal plan. However, there are many challenges to develop partnerships with community agencies or develop gleaning projects. Some challenges are more perceived than actual, the result of pre-conceived ideas or perceptions of what an agency can or cannot do. Whether they are fact or fiction these perceptions may prevent decision makers from investigating their options with local community groups. Said one decision maker,

> "I just think the skill level [to harvest] is [too] involved. I don't believe that it would be worth [volunteers'] time to go out and harvest."
> "Sometimes I get a little upset with [the food bank] because they want [the crops] all washed, I don't know if people aren't hungry enough yet or what."

Another perception is that emergency food programs cannot handle the quantity – whether it's too little or too much or the fact that they have fresh foods which need to be refrigerated and/or distributed in a timely fashion.

> "A real limiting factor [is that] the charities are not set up to handle [or] distribut[e] fresh food very well."
>
> "If there's only a bushel or two of something...lot of times they don't want fresh produce because they're only open one day or two days a week. It's hard for them to handle it."

When asked how they know this information, in many cases it is not based on actual experience with an agency or communication with an agency, but rather an assumption they hold, and perhaps have held for many years. While perceptions may prevent fact-finding efforts, ultimately the challenge is that decision makers often lack the time to verify facts about how an agency operates and locate an agency willing to receive donated edible food.

5.3. Perceived Lack of Institutional Support

What makes decision maker's efforts most challenging is that they believe they are not fully supported by the University. When asked about the actions they do, most said coordinating donations was not part of their job – some admitting they hide their work. Yet the work they do, partnering with community organizations and recognizing the University has resources that would benefit the community is part of the University's mission.

One decision maker said his efforts were appreciated – but further inquiry discovered this appreciation was from professors, and not his supervisors or the administration.

> "I mean it's not, it's definitely not what they hire me to do but they all [the professors] seem to be appreciative of it."

The lack of support or the type of support provided by the University can be positive or negative, as well as conscious and unconscious. The results of this study suggest that values held by decision makers do affect decisions to divert edible foods and to determine whether it will be diverted to a more sustainable use. While values can be deeply rooted in our past experiences, they may also change in the work environment of the research station.

> "It took an adjustment when I started working here. [A superior] helped me make that transition by saying that 'we're not farming crops here as much as we're farming information. And when I looked at it that way then it's easier to accept that, you know, we're throwing some good food out...So when I changed my way of thinking about farming at this place. It helped me out."

> "The first couple of years here I had an awful time throwing [the crop] away. My Dad always said, that's your profit that's going back out to the field. It's true, it is. You just can't get rid of it all."

5.4. Making Sustainable Disposal Plans Part of Research Design

Researchers also have a role in creating a more sustainable edible food management system. Currently, protocols for most research projects do not include a plan for disposing of by-products from research, unless regulated materials such as hazardous wastes are involved. It is not the norm for researchers to take a "systems" approach when designing their research. If research designs considered the impact of research by-products and a plan to minimize or reduce negative impacts more, edible food might be diverted from lower-end uses such as landfilling and nutrient cycling.

One decision maker stated that researchers should include funds in their research grants to cover crop disposal. This would provide additional funds and options for decision makers to manage edible food in a more sustainable manner.

> "It gets to be difficult even if a charity can handle fresh produce. We have to be very careful that we don't get caught up in spending a lot of time and money where we shouldn't be. If there was a way of funding, billing something like that into the grant proposals, or funding a way of disposal of produce, then that would be a different story."

There is already some precedent for this practice on student farms. Some student farms conduct research that includes a distribution plan for edible food crops (Rutgers University; Dartmouth College 2003; Office of Campus Sustainability and University Committee for a Sustainable Campus 2003). Food crops from student farms are sold to the community through farmers markets, private sales and community supported agriculture models, donated to emergency food programs and composted when crops become spoiled and inedible. In some cases student farms grow produce with the intention of giving a portion to emergency food programs, donating not just excess or surplus, but incorporating growing food for the food insecure into their vision of sustainability or more equitable system of distribution (Rutgers University; Sayre 2004).

VI. CONCLUSION

The results of this study indicate that Michigan Agricultural Experiment Stations are disposing of edible food in sustainable ways, but more food crops could be diverted for human consumption and other more sustainable methods. University farm staff, researchers and administrators all have a role in creating a more sustainable system to dispose edible food. In general, on the farms studied, the decision makers' actions are a "good thing" which should be acknowledged, supported and encouraged. Leadership on

the farm can be further developed and where it already exists, should be shared with others. Farm staff would also benefit from the learning environment of the University by hearing how other stations manage edible food and other food crops generated at the station. Those that have developed creative solutions could have the opportunity to share their experiences.

In addition, more can be done. Researchers who conduct field experiments must recognize the impact of their projects in the field and the by-products generated from their research. Research designs could incorporate funds or assist with plans to ensure edible food by-products are disposed of in a sustainable manner.

As the 'pioneer land grant institution', MSU has a responsibility to continue to work in service to its communities and to develop mechanisms to make its research practices more sustainable. In the early years of the land grant system, these colleges and universities were viewed as a "repository of [the] world's stock of knowledge" (Kerr, Davenport et al. 1931:33). The intent was to provide research institutes with specialists and equipment and to support a stock of knowledge that would benefit the development of the state as much as resources would permit. In addition, the college would provide a meeting place where "specialists and citizens" would meet to discuss difficult problems and "lay plans for further development of the state". With these responsibilities, creating a more sustainable path for developing Michigan with assistance and input from the community is a positive direction.

Creating a more sustainability university takes time. The UCSC (2003) reminds the MSU community in its Campus Sustainability Report that sustainability is a process and as "knowledge and wisdom unfurl overtime we will need to continually rethink and

recalibrate our definition of sustainability" (Office of Campus Sustainability and University Committee for a Sustainable Campus 2003:7).

Chapter Three

FRESH FOOD RECOVERY AT MICHIGAN AGRICULTURAL EXPERIMENT STATIONS

"To every waste, there is a gatherer - or there could be."
- Joseph McConnell

I. Introduction

Households that rely on food stamps and emergency food assistance have poor access to fresh fruits and vegetables. Food banks distribute fresh produce when it is available, but the demand is much greater than supply. What can be done?

This bulletin describes a little-known source for fresh produce, the research farms at Michigan State University (MSU). These research farms, or agricultural experiment stations, are different from private farms as their primary mission is to conduct research. With over 450 acres devoted to fruits and vegetables, the farms generate fresh produce as a by-product of the research process. Scientists conduct experiments on a small sample of the crop, leaving a large amount of edible food that must be disposed. MSU's research farms currently partner with community groups to "recover" some of this food and make it available to Michiganders in need.

The purpose of this bulletin is to share examples of successful food recovery partnerships that occur at the Michigan Agricultural Experiment Stations (MAES) at MSU. It is written for community leaders of all kinds who are interested in increasing the amount of fresh produce in local emergency food programs. This audience includes community members and agency professionals, as well as staff at research farms who would like to partner with local agencies and community groups.

The examples are not offered as blue prints for replication. Rather, they are meant to highlight lessons learned from current efforts and to inspire new partnerships that are defined by local opportunities and constraints. The possibilities are limited only by our own creativity and initiative.

II. Adopting Management Techniques that Benefit the Local Food Bank

Cliff Zehr has been the Farm Manager at MSU's Plant Pathology research farm for over thirty years. His work shows that farm managers can adopt simple management practices that benefit local food programs while simultaneously accomplishing necessary farm operations.

In between research projects, it is sometimes necessary to plant crops that will replenish the soil and reduce future pest problems. The crop is not needed for any other purpose and Cliff must dispose of it. Cliff chooses a rotation crop that is in high demand with his partners at the Greater Lansing Food Bank. When possible, he plants sweet corn instead of an inedible crop. He does not apply fertilizer or provide additional care so it does not cost more than other rotation crops—but it does provide fresh produce for the Food Bank's programs.

Providing food to a food bank is *not* an explicit goal of the research farm. However, Cliff's work demonstrates the art of developing "win-win" situations. With a little creativity and planning, and a good sense of his partner's needs, Cliff's management decisions show that one can provide food crops to a local emergency food program while still accomplishing the research farm's work.

Gleaners Help Expedite the Research

Creative management is also evident at the Horticulture Research and Teaching Farm in East Lansing. The "Hort Farm" uses volunteer field-harvesters, or "gleaners," to

ensure timely data collection and maximize the amount of food that is recovered for the local food bank. Some research projects require so much labor to harvest and collect data that by the time the team finishes with a crop it is no longer in prime shape for consumption. As a result, some edible foods rot before they can be recovered for food programs. "If you take some of these vegetables and you leave them for an extra half a week or so, they go from being very tender, very appetizing, to very tough," Bill Chase, the Horticulture Farm Manager explained.

To help speed the process, Bill has developed a system that uses volunteer gleaners. The gleaners make the work go faster by doing simple tasks for the research, such as pulling the fruit off the stalks to prepare it for data collection. Since the researchers make the scientific measurements, the integrity of the research is maintained. In addition, the extra help maximizes the amount of produce available to The Garden Project, a part of the Greater Lansing Food Bank. The Garden Project distributes the produce to local agencies, including food banks, soup kitchens and low-income housing units.

"[The Garden Project has] been very helpful in that they will have their people come out and help us harvest for research projects," Bill said. "They know when they get done the material goes out, gets weighed [and then is available to the food bank and the gleaners]."

III. How to Create a Successful Partnership

The partnership between the Southwest Michigan Research Experiment Center (SWMREC) and Harbor Haven Rescue Mission in Benton Harbor, Michigan is largely

successful because Harbor Haven understands how to work with the constraints set by the research station.

3.1. Understanding Each Other's Abilities and Limitations

A couple of years ago, Pastor Tom Williams, Director of Harbor Haven, realized that his food distribution program was primarily sharing food that was heavy in fat, starch and salt. Pastor Tom stated, "There's a lot of obesity when you're poor...you eat what you get." He added that at Harbor Haven, "I want to make sure I stress balanced meals and I try to give away some wholesome food."

Pastor Tom contacted Ron Goldy, a Vegetable Extension Agent at SWMREC. At their first meeting, Ron identified his limits to collaborating on a community food recovery project. He had little labor to offer and he could not deliver the produce.

Despite these conditions, Harbor Haven felt there was enough to start a good working relationship. The two men worked out an arrangement that respects the constraints of the research farm and the agency. Harbor Haven provides containers for the produce. The research farm now packs the produce into the containers instead of returning the food to the fields to decompose. Harbor Haven picks up the produce and Pastor Tom distributes it to organizations that serve low-income populations including soup kitchens, pantries, and housing projects for the elderly.

Ron likes the arrangement with Harbor Haven. It is important to him that they make it easy. Ron shared, "I can't be dealing with six, eight [organizations]." He added that the station has "worked with other agencies in the past and other agencies continue to contact me. But Harbor Haven is the only one so far that has been amenable to our way of doing things." Working with Harbor Haven has provided Ron and other

administrators with peace of mind. They know that their produce will go to good use and Pastor Tom will make it easy for them to work together.

3.2. A Willingness to Take Risks. A Partnership Based on Trust

Another reason for the success of this partnership is that Ron and Pastor Tom are willing to experiment—to try new things that have the potential to do more than just distribute food.

Pastor Tom and Ron also coordinate field-gleaning by Harbor Haven clients. The clients glean food for Harbor Haven, but the rewards to the individual gleaner are deeper. As individuals who often live at the margins of society, they develop the self-respect that comes from a day's work. They also develop teamwork skills and learn how food is grown. As for the research station, SWMREC uses gleaners to harvest crops that cannot be left in the field. The gleaners, therefore, provide a necessary service of helping to remove of the crop.

This gleaning program is not without risks, however. The Harbor Haven clients are not experienced gleaners. They are often low-skilled individuals with little knowledge of farming or research, so there are risks to having them on the research farm. First, there is concern that volunteers who do not understand the research process might not see the harm in entering the wrong field and/or harvesting the wrong crop. If volunteers do wander, valuable research projects, sometimes amounting to many years' investment, might be ruined. Second, there is concern that volunteers might help themselves to crops that should not be consumed. Some research, for example, may use new pesticides or other "unregistered" chemicals. The research farm does not release these crops into the food chain because they are not safe for human consumption.

To reduce the risk to all, Ron organizes gleaning activities only once or twice a growing season, under very controlled circumstances. He invites a team of only 5 or 6 gleaners at a time, and is firm that no children are involved. He also supervises the gleaners himself. If knives are required to harvest the crop, Ron is the only one who uses a knife. The gleaners move the product from the field, pack it into boxes, and load the truck.

This program has the potential for expansion if Ron can establish conditions that keep the risks low and Pastor Tom can provide gleaners that will abide by the rules of the research farm. One gleaner stated that the work was "hard, but it was awesome!" She added that she hopes the station will continue to allow volunteers to glean. Pastor Tom would also like it to continue. He would like to provide his clients more opportunities for work skill development at the farm. As for Ron, he recognizes how much food had been wasted before linking up with Harbor Haven.

This story demonstrates the value of taking a risk and trying new things. In this case, it is not clear whether the activity will continue in the long run. Still, Ron and Pastor Tom took a chance —and that is important. The Harbor Haven gleaners may not be an ideal group of gleaners to work with, but the benefits to everyone make it worth the effort.

3.3. When Partnerships End

Many collaborations between research farms and community groups end almost as quickly as they form. Below are examples of what can make a partnership turn sour. The list may appear to include points that are based on common sense. But each

represents an actual experience or concern shared by at least one research farm or community group.

Food is not distributed to the intended recipients

Food donations from research farms are made under the assumption that they will be distributed to an agreed-upon group or will be used in a specific way. A partnership will end quickly if an agency does not keep its word. Staff at one research farm became disillusioned with community partnerships when they learned that produce was not distributed to the needy.

Volunteers do not show up

Agencies call and are excited about receiving recovered food. They schedule a date and never show up. This wastes research station staff time and jeopardizes future relationships. The way to get around this? Do as you say. Only promise what you can deliver.

Lack of communication

Projects can slow or end if partners stop communicating. Keep talking. Call the station to see if food is available. Or call the agency to ask if they can pick up available food. If your needs change, let your partners know.

Understand the constraints agencies face

Whether or not it is true, some research farms feel that agencies ask for too much to accept a food donation. Agencies have been known to request that the product be washed, bagged, or packed in containers of a specific size. Most of the time this is due to specifics of their infrastructure and distribution system. Rather than getting annoyed, work with the agency to see if they can be flexible in their requirements, or explore if

there is any way that you can jointly meet their needs. Sometimes it is not possible, but often it is.

Research station property is not returned

One farm provided the donated produce in reusable boxes and the agency never returned them. That's a betrayal of trust and will not result in a strong partnership.

Gleaners stray

If a gleaning team strays off the field they are asked to harvest, the gleaners and the station's research projects are at risk. The result? The farm manager will not ask them to come back.

IV. Successful Long-Term Gleaning Programs

Research stations that work with established gleaning programs are likely to divert more food crops for human consumption. Established gleaning programs, however, are no accident. They owe their existence to strong leadership that makes an institutional commitment to gleaning. The first story describes a long-term gleaning program in Lansing and illustrates the importance of strong institutional support in determining its success. The second story describes a successful gleaning program that had strong institutional support from the top, but fell apart when new leadership assumed control of the organization.

4.1. A Well-Established Program

The Garden Project, a program of the Greater Lansing Food Bank, provides field gleaning for two research stations on the MSU campus. In response to growing hunger in the 1980's, The Garden Project began to help people grow their own food in community gardens and have access to fresh foods through gleaning efforts. Gleaning crews

consisting of youth and senior citizens gleaned at private farms and research farms in the greater Lansing area to bring fresh foods into the food bank system.

Over the last ten years, Roberta Miller, Director of The Garden Project, has fine-tuned a gleaning system that has become institutionalized into the yearly cycles of her organization. Her work includes coordinating a large group of enthusiastic volunteers, planning the gleaning to coincide with the farm managers' schedules, and coordinating distribution of the food crops immediately after they are harvested. Her gleaners are experienced and have generally volunteered for 5-10 years, sometimes longer. Some gleaners have been harvesting the research station fields longer than some of the farm employees.

Most harvesting occurs in the late summer and early fall. Farm managers contact Roberta when the crops are ready and they schedule a day for gleaning. Roberta contacts her volunteer gleaners, most of whom are senior citizens, by email and telephone. Two part-time food bank staff meet the gleaners at the research station on the appointed day. Harvesting occurs in the morning, before the sun gets too hot. As gleaners harvest the produce and load it into boxes, the food bank employees weigh the boxes and pack it in the food bank's van. By noon, if not before, the van is full. Volunteer gleaners fill their own buckets, which are also weighed and recorded, and take home a small share of the harvest. Then the two food bank staff members distribute the fresh food to a wide range of agencies including soup kitchens, missions, low-income housing complexes, community centers, and food pantries.

The Garden Project gleaners harvest a lot of produce. In 2002 they harvested 105,378 pounds of fresh produce from these two research stations. Gleaners work hard

during harvest season, but they also have fun. Socializing is an important aspect of the project. Friendships have blossomed among the gleaners as well as with the farm staff.

Roberta's volunteer crew is committed to the gleaning effort. Many start volunteering when they hear about the project through their church or friends. It's a combination of benefits—the physical exercise, fresh food and socializing—that keeps them volunteering. Gleaners also believe that allowing volunteers to take home a small portion of produce provides a small incentive for involvement.

The Garden Project's gleaning efforts are successful because gleaning has become institutionalized—it's just another way of doing business at The Garden Project. Several factors contribute to its success. First, they have a crew of committed volunteers who return each year and provide excitement and energy to the entire gleaning effort. Continuity from year to year yields a crew with high gleaning skills and engenders the trust of the research station. Second, The Garden Project receives organizational support from the Greater Lansing Food Bank. The Food Bank provides funds for staff to coordinate the harvest schedule, gather the necessary materials, communicate with gleaners and research farms, oversee the gleaners and distribute the food the day it is harvested. This support makes it possible to partner with research farms every year and to make good on their promise to bring fresh food to the community.

4.2. When Priorities Change

This story illustrates that institutional support can disappear quickly when key leaders leave an organization. In 1995, Darwin Noah, County Executive Director, at USDA's Farm Service Agency in Stanton, Michigan, was asked to investigate the potential for field gleaning in Michigan. At this time, one of USDA's top priorities was

to increase food recovery through various means, including gleaning. Darwin learned quickly how other programs developed and identified the needs of emergency food programs in his community. After networking with others interested in field gleaning, he developed a new gleaning partnership with the Montcalm Research Farm in Lakeview, Michigan.

Darwin soon realized he needed to find a team of volunteers to help with the harvest because the research farm had no staff to harvest potatoes. He contacted the County Circuit Court and asked if community service volunteers (people required to do community service as part of their sentences) might be available to harvest food for local food banks and pantries.

The community service group was only available on certain days. Darwin scheduled them to work on days that were convenient for Richard Crawford, the Research Technician at the Montcalm Research Farm. A probation officer drove the workers to the research station. Darwin found that the volunteers, primarily men, were not dangerous. They were "the younger types that got themselves in a little bit of a problem with the law," Darwin shared. They appeared to be happier harvesting crops on a farm than collecting trash on highways.

Richard Crawford pitched in and drove a harvester that dug the potatoes and left them on the soil. The volunteers gathered them from the field and put them in boxes that were donated by the regional food bank in Grand Rapids, Michigan. The volunteers loaded them into Darwin's truck, and he delivered them to food pantries and soup kitchens in the region.

This project ran successfully for four years, largely due to Darwin's efforts. He coordinated the volunteers, secured the boxes, and delivered the produce using his personal truck and wagon. The project ended when a new Secretary of Agriculture took over USDA and gleaning fell off of its agenda. The priorities at USDA changed as did Darwin's work priorities.

Although Darwin's efforts were largely responsible for the success of this program, this story illustrates the importance of institutional support for food recovery activities. Without support from USDA Darwin would have never initiated the project. Darwin did point out that it wouldn't take much effort to restart this project. "I would think a person could get a gleaning project going...four work days would probably do [to harvest the surplus potatoes at the station]."

V. Opportunities for Nutrition Educators

When research farms donate produce, such as eggplant, rhubarb, or cabbage to local food programs some farm managers worry that it will not be eaten. Many people do not have the skills or knowledge to prepare fresh foods any more. Nutrition educators can partner with a research farm or their community partner to provide information to clients who receive the crops through local food programs. Food pantries in the past have provided cooking demonstrations and recipes for foods that are unfamiliar to clients. In addition, nutrition educators can work with community leaders to encourage partnerships between the research stations and community groups. This audience includes research farm staff, professional staff at agencies, and community members with a special interest in community food issues.

VI. If You Represent A Community Group: Gleaning on a Research Farm

For organizations involved in emergency food issues, receiving fresh produce is an attractive prospect. But take note, accepting fresh produce does require extra planning, a vehicle to transport the food, and people to deal with the distribution of this perishable product (Table 3.1.). At Michigan State University, experience has shown that the potential for food recovery is much greater when gleaning teams are available to partner with a research farm.

6.1. Agricultural Experiment Stations

Michigan Agricultural Experiment Stations (MAES) conduct and support agricultural research at Michigan State University (MSU). It's important to respect the mission of the research station, even though you may not fully understand what is involved in the research process.

Staff at research stations, like at any place of work, have specific tasks to accomplish. Their jobs do not include assisting agencies to obtain or distribute surplus food crops. In most cases, it is personal initiative and interest that motivates their desire to partner with community groups. Be respectful of staff time and try to understand the constraints they face when working with you.

Field gleaners might wonder why all crops at research stations are not harvested. The research staff harvests crops when they are needed for research projects, but when crops are not needed, crops are often left in the field. Food that is harvested but not used for experiments is usually disposed through donations, sales or returned to the field and tilled in.

To establish a partnership with your local research station you need to make it easy for them to work with you. Coordinating pick-ups and locating recipient agencies

can be a lot of extra work for research station staff; many juggle numerous responsibilities and projects. To make things easier for them, provide suitable boxes and transportation and fit your activities into the farm's research schedule.

6.2. Donated Food Is Safe

Donated food is safe for human consumption. No unapproved substances have been used to grow these foods. Foods that are not safe do not enter the food chain and are not released for human consumption.

6.3. Report Your Harvest

Often research farms appreciate knowing the quantity of produce you harvest from their fields. One station at MSU also appreciates knowing the different agencies that receive the donations.

6.4. Finding Gleaners

Determine what resources already exist in your community. Gleaning teams can be comprised of local youth, faith-based groups, community members, court-appointed volunteers, or employees of a local business. A community group looking for a long-term project may be a good partner to establish a field-gleaning team for your food bank. For more information about establishing a field-gleaning project see Appendix E.

6.5. How to find a Research Farm

Most agricultural research is conducted at agricultural experiment stations at land grant universities. U.S. Department of Agriculture's Agricultural Research Service and other colleges may also conduct research that generates recoverable foods. The Michigan Agricultural Experiment Stations are administered by MSU.

TABLE 3.1. Locating Agricultural Experiment Stations

AGENCY	WEB ADDRESS
Michigan Agricultural Experiment Stations	*http://web2.canr.msu.edu/maes/stations.cfm*
Regional Associations of State Agricultural Experiment Stations	*http://www.agnr.umd.edu/users/NERA/usamap.htm*
U.S. Department of Agriculture – Agricultural Research Service	*http://www.ars.usda.gov/pandp/places.htm?mt=places*

VII. If You Work at a Research Farm: How to Donate Food

Currently, MAES has no policy that dictates how to dispose of food crops on research farms. Everyone, however, agrees on one principle: disposal practices should not compete with local farmers. Donating edible food crops to the emergency food system does not compete with local farmers because the food ultimately goes to consumers without buying power.

7.1. What Type of Organization are you Looking for?

The emergency food system includes food banks, pantries, soup kitchens, missions and shelters. If your group wants to distribute excess food, first consider which partner in the system is best for you.

If your research farm generates more fresh food than a single soup kitchen or food pantry can handle, a regional food bank is the most likely partner for you. Regional food banks work like warehouses to distribute food to member agencies. All of Michigan's regional food banks have the capacity to distribute fresh food.

Smaller amounts of food may be donated directly to agencies in your community. If you do not know of one, regional food banks can help direct you to local agencies that can use smaller quantities.

MSU's research farms currently donate fresh produce to emergency food programs, social service agencies and children's groups. Although most food crops are donated to hunger relief efforts, some are donated for fundraising efforts and educational opportunities. Local chapters of Habitat for Humanity, Hospice, and other agencies have created value-added products including pies, pastries, and cider to raise funds for community projects. Children's groups also consume the food while learning about local agriculture and the food system.

Agencies often record how much food is donated and where it goes. If these records are of interest to your farm, ask your partner before the donation is made.

7.3. Fit Donations into Your Current Work

Depending on your current management system and the type of crops you grow, working with one agency may be easiest.

Whether you work with one or more partners, identify your needs and constraints and make them clear to your partners. Work to understand how to best fit the donation into both of your plans. Ultimately you need to ensure the donation fits within the work of the research station.

Finally, keep your partners in mind when possibilities for new projects develop in the future.

7.3. Reduce Risks to Research Projects

Some research farms are concerned about having volunteers on site that do not understand the research process. If, for example, the wrong crop is harvested, a research project can be destroyed. Volunteers are not scientists, but clear instructions and explanations for on-farm rules go a long way to make things manageable. Most MAES staff who have partnered with community groups have had positive experiences. "You

need to know their limitations," says Bill Chase of the Horticulture Farm. "They are volunteer help," he continued. "I don't expect them to know that we want a certain area harvested. So if you put checks and balances in place, I don't have a problem."

7.4. How to Find a Food Program

The Food Bank Council of Michigan can direct you to your closest regional food bank. Outside of Michigan, contact America's Second Harvest (see Table 3.2.).

TABLE 3.2. Locating a Food Program

AGENCY	WEB ADDRESS
The Food Bank Council of Michigan	*http://www.fbcmich.org/*
America's Second Harvest	*http://www.secondharvest.org/*

VIII. Gleaning Publications and Resources (see Appendix E)

Chapter Four

"At first people refuse to believe that a strange new thing can be done, then they begin to hope it can be done – then it is done and all the world wonders why it was not done centuries ago."

- Frances Hodgson Burnett

I. CONCLUSION

This thesis investigates how the Michigan Agricultural Experiment Station (MAES) makes edible food disposal decisions. In this study, *edible food,* is defined as food crops grown at MAES that are 1) edible immediately after harvest without further processing and 2) safe for human consumption. Valuable resources such as water, soil, and petroleum-based fertilizers and herbicides are used for agricultural research at MAES and food crops are generated as an unintended consequence of this research. The purpose of this research is to identify the pathways for the disposal of these crops and to examine the sustainability of these disposal practices.

The premise of this thesis is that edible food is a valuable resource that can be utilized in a way to enhance sustainability. The EPA (2000) food scraps hierarchy provides a practical guide to assess the sustainability of various methods of edible food disposal (Figure 2.1). It suggests a hierarchy of actions, each progressively less preferred from a sustainability perspective. The EPA's approach focuses on maximizing the use of valuable resources and encourages generators of excess food to first "feed people who are hungry" (Environmental Protection Agency 1999). After human consumption, food should be fed to animals, composted and then lastly sent to a landfill.

The analysis of edible food disposal at MAES provides the scholarly basis for this thesis. Two different research products were developed for the thesis: an article to be

submitted to the International Journal of Sustainability in Higher Education and an MSU extension bulletin designed to inform community leaders of this resource. The extension bulletin also encourages new partnerships to develop between research farms and community groups. It was a strategic decision to tell this story from two different perspectives and for two different audiences. It is a less traditional format for a thesis, but provides multiple opportunities to share this story with a larger audience. Developing these products was more than an exercise for the student-researcher to learn about reporting research results. Developing products in the form required by an academic journal *and* an extension bulletin ensures that a wide audience learns about the phenomenon of edible food disposal from the MAES. The products are intended to educate the academic community, university professionals and the public regarding edible food, a valuable resource produced at MAES, and the unique partnerships developed around edible food disposal.

II. Summary of Research Findings

The results from this study indicate that decision makers at MAES dispose of edible food in many different ways. Key decision makers estimated the percentage of total edible food disposed of through each major pathway. These rough estimates help to distinguish which research stations currently practice more sustainable edible food disposal and which stations could improve their disposal practices.

For the most part, this research found individuals disposing of edible food in a sustainable manner. By the farm managers' estimates, a majority of edible food is sold or donated for human consumption at all but one research farm. Donated food is gleaned from research fields and distributed to those in need. In addition, when food is not

suitable for human consumption, research crops are gathered for animal consumption. At some farms tillage, a form of nutrient cycling, is not the first disposal option, but is practiced after gleaning.

Before choosing any disposal method for edible food, MAES staff typically conduct a mental cost-benefit analysis based on many factors such as the availability of labor and the transactions costs of getting a product to market. The decision about how to dispose of edible food is also dependant on a number of external factors such as the crop that is grown, the size of the farm and market conditions for the edible food crop. However, personal values and personal initiative also affect this informal analysis.

Those who dispose of edible foods in highly sustainable ways incorporate their individual values of wanting to "do the right thing," or not wanting to waste the edible food, into their analysis. Through interviews, these individuals suggested that they recognize the value of the edible food as a resource, and that this pushed them to recover the food for human consumption through sales or donations. In addition, many of these decision makers sought to donate edible food to organizations that could distribute the resource to those in need, suggesting an interest in maximizing the social benefits of the food recovery. These efforts are evidence of staff members' efforts to apply basic sustainability concepts by balancing the economic, environmental and social impacts of actions into otherwise routine operations decisions.

With respect to sustainability, this balancing act is a challenge that many universities and institutions face. Public universities, like land grant universities, have purpose beyond educating students and conducting research (Committee on the Centennial of the University of Illinois 1871; Association of State Universities and Land-

Grant Colleges 1961; Beale 1973). This has been true throughout their history. Bryan (1931) in *The Spirit of Land-Grant Institutions* states the "larger goals and purposes of the research...were to be aimed at producing results in persons and communities beyond economic or technical improvements" (Peters 1998:6). Four distinct spirits evolved in the land-grant system; the spirits of initiative, growth, equal opportunity for all and helpfulness (Kerr, Davenport et al. 1931). Mostly the product of conditions of the first half of the 19th century, this spirit continues to expand and diversify with changing values of U.S. society.

The pioneering spirit exists at all land grant institutions, however, and has proven to be strong at Michigan State University (formerly Michigan Agricultural College), which mapped a new trail for education when it was established in 1855 before the Morrill Act was passed (Blair and Kuhn 1955). The interest in growth and development of the land-grant sought to inspire the community "to be forever alert to improve [their] existing conditions" (Kerr, Davenport et al. 1931:13).

The idea that everyone should have access to an education and training was central to the land-grant spirit. Education for all encouraged greater democracy in the young Republic. It perhaps is helpful to understand that the Morrill Act, which created the land-grant system, came at one of the "darkest period of the Civil War, and yet, full of confidence in the future of the Republic, and largely, indeed, to better that future" (Association of State Universities and Land-Grant Colleges 1961:6). Educating students was viewed as important, however, the spirit of the land-grant system is that the student body does not exist for the institution but rather "as a means to an end and that end an advancing civilization" (Kerr, Davenport et al. 1931:24).

The final spirit that evolved within the land-grant system is service. This spirit set the land-grant system apart from the "Old World scheme into the New World pattern" (Eddy 1957:269). In a 50th anniversary celebration of the Morrill Act in 1912, William Oxley Thompson, President Emeritus of Ohio State University said, "the tendency...to operate an institution for the sake of maintaining standards is all wrong as I see it. An institution is to be operated for the good it can do; for the people it can serve; for the science it can promote; and for the civilization it can advance" (Eddy 1957:269). Through education and research the public institution seeks to help communities and develop individuals.

Today, serving community needs continues to be an important goal of the university. This goal includes the "maintenance of environmental quality, protection of community, protection of family farms, and reduction or elimination of harmful technology" (Zimdahl 1998:79). However, Middendorf and Busch (1997) maintain that research from agricultural experiment stations benefits only a small part of the population and as a result there are clear "winners and losers" from the research. Winners are those who directly benefit from the research such as people working in the agricultural industry. When MAES staff seek to use edible food produced at their station as a resource, the pool of "winners" increases.

Yet, the social ramifications of MAES activities are often overlooked, including those resulting from disposal of edible food. Michiganders facing food insecurity receive fresh foods, and members of the local community are empowered to help their neighbors through gleaning and other community projects. Donating edible food links MAES staff and research farm to community groups and active citizens. Projects result in greater

connection to the community and citizen participation while providing food for the hungry, opportunities for community organizing and agricultural experiences for children.

Perhaps one of the most interesting findings from this thesis is that the farm staff appeared to be at the center of decisions to recover food from less sustainable means of disposal. Educating and engaging citizens is commonly viewed as a role for faculty and students at universities, but this research highlights the role that MAES staff play in their work with local citizens. The literature reports relatively little about the role of operations staff in these efforts. Glasser et al (2002) found of 519 colleges investigated, operations staff only developed 16-20% of the sustainability initiatives (Glasser, Nixon et al. 2002). By contrast, most projects were initiated by students through their coursework or thesis research. While student efforts are to be commended, operational and administrative staff efforts can also be encouraged and recognized. Engagement with the community supports MSU's mission, which includes developing the potential of all citizens. This is driven by the belief that "education of its citizens is the state's best investment in its future" (Michigan State University 1982).

There are great benefits to local communities and society in general when public institutions learn to incorporate sustainable approaches within their operations. Clark (2000) reported that university administrators who attempt to move their campuses toward a more sustainable existence find it a challenge to move from concepts and visions to practical applications.

In addition, the Global Reporting Institute (2002) works to help universities and businesses understand how sustainability concepts can be realized or are already being

practiced within their institutions. To measure sustainability in quantitative and qualitative methods, GRI examines an organization's impact on 1) economic systems at all levels and how these affect the stakeholders directly and indirectly; 2) natural systems including air, water, land and ecosystems; and 3) social systems within which the organization operates (Global Reporting Institute 2002). GRI's (2002) reporting guidelines include measuring social dimensions of an organization by examining its impact on community stakeholders at the local level.

Typically, sustainability issues continue to be viewed as *only* environmental issues (Allen 1994; Newport, Chesnes et al. 2003). Walter and Reisner (1994), for example, found that agricultural researchers are more likely to incorporate environmental concerns into their practices than social aspects as they move from conventional agriculture to a more sustainable agriculture. However, without balancing all "three legs of the stool", the economic, environmental and social aspects of sustainability, universities or researchers are not fully embracing the concepts of sustainability before attempting to put them into action (Newport, Chesnes et al. 2003). If sustainability continues to be seen only in terms of economics and the environment, we will continue to miss opportunities from other sectors of the university that can provide new perceptions and expertise to the conversation.

In this sense it appears that the research arm of the university might have something to learn from those who are charged with some of the operations work at the farms. In this study, the decision makers perceive that that the University is indifferent towards their efforts to make practices more sustainable. Efforts to recover edible food and work with members of the local community are often hidden by MAES staff. One

staff person shared, "it's not my job here...it's definitely not what they hire me to do." The fact that decision makers do not view their actions as part of their work may be an indicator these activities have not been supported by administrators in the past.

If Michigan State University is to become a more sustainable university, encouraging and rewarding the work of staff who engage with the public (Peters 1998) and who include social and environmental considerations in their work will help achieve this goal. Meadows et al (1992) states that moving towards a more sustainable world includes cultivating "leaders who are honest, respectful, and more interested in doing their jobs than in keeping their jobs" (Meadows, Meadows et al. 1992:225). As such, MAES staff deserve acknowledgement, encouragement and support for their efforts, which move us toward a more sustainable university. Their work has increased public participation in research (disposal of its by-products) and created strong university-community partnerships. Key MAES and MSU administrators may be aware some edible food is sold or donated, but their awareness to the degree to which this takes place and how it happens seems to be limited. Without encouraging decision-makers to account for social and environmental costs and benefits, administrators may unintentionally limit sustainability efforts at MAES.

Promoting and supporting the vision of sustainability is a challenge, however, as a land-grant university, Michigan State University was created to evolve with change. "Evolution marks the land-grant colleges, a gradual, slow, but steady evolution reflecting the needs of the nation. Sometimes the colleges were ahead of need, sometimes behind, but almost always they responded in some fashion to demands and changes" (Eddy 1957:267).

III. Areas for Future Research

This research used qualitative methods to explore how edible food is currently disposed. While the data are rich with participants' stories and experiences, many who have heard the stories continue to be interested in the *quantity* of edible food generated, diverted and wasted. Future research could investigate the quantity of edible food recovered and/or diverted.

One edible food decision-maker shared his experience attending a regional conference of farm directors and others that run research farms. He explained "disposal" of product from agricultural research is a major concern of research farms in other states. A specific issue discussed at this meeting was how to dispose of product from genetically modified organisms (GMO) in an environment where some GMO products were difficult to market. Products that are difficult to dispose is another area that could be studied.

For the purpose of this project edible food was defined as plant material to narrow the focus, but MAES also grows field crops and raises farm animals including sheep, poultry and fowl, swine, beef and dairy. How these animals and/or the products from these animals are disposed could be explored qualitatively and/or quantitatively.

Additional research investigations could examine the input (water, labor, petroleum based chemicals, fuel) of resources for agricultural research projects. Outputs (crops/animals) could also be investigated. Such studies would help examine social and environmental impacts of the research.

Finally, MSU has a student food bank, which at this time is the only known university food bank that is run by and for students. While MAES worked primarily with community agencies on local hunger in the community, the issue of student hunger arose.

Examining the extent of student hunger and whether student hunger is being met with local resources may be worth pursuing.

IV. Recognizing Our Past to Move Toward the Future

"We neglect history and pride ourselves on being modern, but the experience of men and women before us is not to be disregarded if we are to make the best success of our efforts. All things are rooted in the past."
- M.C. Burritt

In addition to the two written products from this thesis, results were shared in public forums and presentations to the university community. During the development of these presentations, two photographs of research farms were discovered. These photographs provide a glimpse of MSU's past and possibly a lesson regarding edible food disposal. One depicts faculty children in their back yard and the other is a milkman and his dairy truck. The first photograph, c. 1890, showed children in the backyard playing with pigs. The caption describes "faculty row homes" as being spacious and having an area in the back of the house for a garden or stable (Miller 2002:17)

The photograph of the milk truck, dated 1933, shows a man standing beside the truck and the letters and words "M.S.C – Dairy Products" [MSU was formerly known as Michigan State College] (Miller 2002:64). The caption underneath the photo explains residents who did not have any farmland relied on the university for dairy products from the university farm. The milkman delivered milk, cream, butter and cottage cheese to residents who could not maintain a "home cow".

These photographs provide a glimpse of life in the 1890's and 1930's when faculty and students were growing their own food or receiving food from research farms. It is assumed that as the university grew and the campus community became more urban it became difficult for residents and faculty to be self-sufficient – with no land for

growing vegetables or raising animals. This thesis demonstrates that today the connection between the research farms and the surrounding communities continues with the edible food by-products generated from research.

It is important to look to our past – not to recreate the past, but to take lessons from it as we move forward. A more sustainable university is not something that will be created and will remain static. "We can learn much from examining the old ways, but stability comes from equilibrium and equilibrium is balance, which is not static" (McAllester 1992:4).

Examples of sustainable edible food disposal practiced at MAES serve as a model for the greater community and other land grant universities. With influence over the thinking of future leaders, universities have the freedom to act boldly and creatively and can make a difference (Clark 2000). The challenge of embracing sustainability is that it implies or means embracing change.

Appendix

Interview Guide: DECISION MAKER

What's your job?
- How long have you been with MSU?
- What type of research do you do?

Experience/past on farm/farming?

Who is responsible for the materials or by-products from the research?
- Is managing the materials part of your job?

I understand for a while some food crops were being donated to a FB.
How did you get involved in this – was this part of your job?
- How did this happen?
- Who found who?
- When did this happen?
- How did this link occur?

How receptive was the farm manager to your idea? (Is this the current FM or the one before him?)

How long has this connection been with Anthony?
Were there other groups in the past?
What makes this connection successful?
- Why have other links or groups not worked?

What are some of the reasons you can think of on the challenges to donate more?
- If connections, why are they not working with the station anymore?

Is it important to be able to sell?
- How come?
- Do you think this should be part of the FM's responsibilities?
- Does it matter where or how it is marketed?

Is it important to be able to donate the food crops to charities?
- How come?
- Do you think this should be part of the FM's responsibilities?
- Does it matter who gets it?

Is donating food crops competition like selling?

Is there a policy on how to dispose of plant materials/by-products/edible food?

What role does this research station play in the community?

Interview Guide: RECIPIENT/LINKER

How did the idea of gleaning come about?

How did you get involved?

I heard you visited Second Harvest – what did you learn from this visit?

So how did you link up with MAES?
Did you work with other farms?

How did you come up with your volunteers?
Did this work?

How long has it/did it go on?

Is this part of your job?
What's your job?
Length of service?
Farming background?

What happened to the crops? Where did they go?
How do they use/distribute them? (WHO)
Where they overwhelmed with the donation?
If it stopped: Have they contacted you to restart? Is their a need?

When was the last time you did any harvesting?
Why do you think it didn't last?
What would it take to start again? How to make it sustainable?

Did you find that Amos was helpful?
How did he help you?
Did you or he suggest more harvests?
Describe the partnership

Why did it end?

What would it take to continue? Or start it up again?

Interview Guide: LINKER

Interview Scheduled: Frank Mendum

Tell me about gleaning at the experiment stations. How did this begin?
- How did you come to the idea of gleaning?
- How did farm managers react to your idea?
- How did faculty/researchers react to your idea?

I understand there was a also a faculty member that was instrumental –
- What was his role?

And did you need to go to the legislature?
- Why?
- What was involved?
- What were the issues that led you to this?

How did you get involved in this – was this part of your job?

How did you link with the FB?
- Did you seek them out? Why?
- When did this happen?
- How did this link/connection occur?
- How did farm managers react to this idea?

How did administration react to this idea?
- What were the issues?

Who favored? Who opposed?
- How come?

How do you see the University linking with the community or rather its role in the community?

Do you think it's important to donate food crops? (vs. sell)
- How come?
- Do you thin this should be part of the FM's responsibilities?
- Do you think it's important the university donate these food crops?

POLICY FOR DISPOSAL OF EXCESS PLANT MATERIAL AND PRODUCE

Guidelines:

1. All material is the property of Michigan State University.
2. Materials may be offered to laborers on a project in exchange for services without pay.
3. Materials may be made available, at no cost to others in the University, for use in teaching, research, or extension activities. This includes materials for University Public Relations.
4. Reasonable personal consumption of materials is allowed for persons working directly on a project. Sale or distribution to a second party is not considered personal consumption.
5. Materials may be distributed to Departmental faculty, staff, and students for their personal consumption at the discretion of the faculty project leader.
6. Materials may be donated to MSU student or outside service or charitable organizations or agencies (e.g. food bank, retirement home, school). Donations of products to outside agencies will be recorded and a signature obtained from the organization accepting the donation.
7. Materials may be sold to an outside agency or consumer

   -A sales outlet is available,
   -Materials are of sufficient quality to be sold, and
   -Sufficient quantities of the material are available.

8. The decision to sell a product is made by the faculty project leader and/or the unit manager.

   -Materials for sale should be priced at wholesale or retail fair market value

   -Careful consideration should be made to assess what impact, if any, the sale would have on private industry.

   -Revenue from the sale of materials must be deposited into a revolving account.

-Receipts must be issued to consumer upon sale of material/products. Cash handling/deposits procedures are to conform with those established in the MSU Manual of Business Procedures and specific procedures that have been developed for the various department areas (e.g. Sparty's Flowers, Horticulture Farm, Garden).

-Materials/products not for human consumption will be charged sales tax in accordance with laws mandated by the State of Michigan.

Policy for DISPOSAL OF EXCESS PLANT MATERIAL AND PRODUCE
Approved: 2/9/98

Gleaning Publications and Resources

U.S. Department of Agriculture
A Citizen's Guide to Food Recovery (1996) is a USDA publication on food recovery programs for businesses, community-based profit or nonprofit organizations, private citizens, and public officials. It also outlines key considerations relating to legal issues and food safety.
http://www.usda.gov/news/pubs/gleaning/content.htm

University of Maine Cooperative Extension
Food for ME Fact Sheets: Citizen action fact sheets on community food recovery. Order all 6 using bulletin #4315 (Free).
#4301 - Food for Your Community: Gleaning and Sharing.
#4303 - A Donor's Guide to Vegetable Harvest and Storage.
#9031 - Plan Before You Donate Produce.
http://www.umext.maine.edu/publications/foodnutrition.htm

U.S. Department of Agriculture and National Hunger Clearing House
National Hunger Clearing House provides information on how to find food resources if you are in need, where to find local food banks if you are interested in donating food, private farms that allow gleaning and agencies that provide field-gleaning services.
(800) GLEAN IT
http://www.worldhungeryear.org

Where are Agricultural Research Stations?

Michigan Agricultural Experiment Stations
http://web2.canr.msu.edu/maes/stations.cfm

Regional Associations of State Agricultural Experiment Stations
http://www.agnr.umd.edu/users/NERA/usamap.htm

U.S. Department of Agriculture, Agricultural Research Service
Link brings you to map of USDA research station locations.
http://www.ars.usda.gov/pandp/places.htm?mt=places

How Do I Find an Emergency Food Program in my Area?

America's Second Harvest
35 E. Wacker Drive, #2000
Chicago, Illinois, 60601
(312) 263-2303 or (800) 771-2303
http://www.secondharvest.org

The Food Bank Council of Michigan
501 North Walnut Street
Lansing, Michigan 48933
(517) 485-1202 or (800) 552-GIVE
http://www.fbcmich.org/

If you have a small amount of produce, the Food Bank Council of Michigan can direct you to the closest agency or your regional food bank. If you have a very large amount of produce (half of a semi truck load or about 40,000 lbs) they can provide funds to wash, bag, and transport the produce to a regional food bank.

Disposing of Deer

Like farms in general, research farms may have deer crop damage leading to deer control efforts. The organizations below provide another opportunity to donate fresh food to the emergency food system and make disposal of venison easier.

Michigan Sportsmen Against Hunger (MSAH)
P.O. Box 30235
Lansing, Michigan 48909
(313) 278-FOOD
http://www.sportsmenagainsthunger.org/
Since 1991, the Michigan Sportsmen Against Hunger (MSAH) has been working to create linkages between donors, wild game processors and charities that feed needy individuals. MSAH pays for processing deer culled from airports, parks, hunting preserves and other facilities. In 2000, MSAH donated 50,000 lbs of wild game (primarily venison).

Call or visit their website for an updated list of drop off stations.
Everything for Hunters - Donating Game Meat to Charity
http://everythingforhunters.com/donating_game.html

Hunters Helping The Hungry
http://www.camohunter.com/huntersforthehungry.html

Additional Publications

Don't Throw Away That Food: Strategies for Record-Setting Waste Reduction. Environmental Protection Agency. 1998. Pages 6. Washington, DC: EPA. EPA-530-F-98-023

Waste Not, Want Not: Feeding the Hungry and Reducing Solid Waste Through Food Recovery. Environmental Protection Agency. 1999. Pages 53. EPA 530-R-99-940 *http://www.epa.gov/epaoswer/non-hw/reduce/wast_not.pdf*

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