Monitoring Sustainability Culture at the University of Michigan:
An Overview from a Multi-Year Program

Robert W. Marans
University of Michigan

Illinois Sustainable Technology Center
University of Illinois
April 2016
Overview

• U-M Overview
• U-M’s Sustainability Integrative Assessment
• U-M’s Sustainability Goals
• The Big Picture
• A Conceptual Model for Measuring Cultural Change
• Sustainability Cultural Indicators Program (SCIP)
• Research Design & Process
• Approaches to Analysis
• Some Findings
• Current Status – Future Directions
Ann Arbor and The University of Michigan

5 campus's:
- >3,000 acres (>12 sq. km)
- >450 buildings - 3.4 million sq. ft.
- >40,000 students; >38,000 faculty & staff
- >80,000 computers

Releases more than 722,000 metric tons of greenhouse gas emissions annually
# Integrated Assessment Themes

<table>
<thead>
<tr>
<th>THEME</th>
<th>GUIDING PRINCIPLE</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>Purchase 20% of U-M food from sustainable sources. Purchase 20% of U-M food from sustainable sources. Protect Huron River water quality by: • minimizing runoff from impervious surfaces (outperform uncontrolled surfaces by 30%), &amp; • reducing the volume of land management chemicals used on campus by 40%</td>
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<td><strong>We will pursue stakeholder engagement, education, and evaluation strategies toward a campus-wide ethic/culture of sustainability.</strong></td>
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</table>
Sustainability Progress Report highlights achievements; reports on campus goals

By Dave Dymott

The University of Michigan’s efforts to foster a healthier planet under the Planet Blue initiative are highlighted in the 2015 Sustainability Progress Report released March 26.

The report features campuswide sustainability achievements in the areas of climate, waste prevention, healthy environments, and community awareness and engagement.

The UNiverSity of Michigan is more than 90 percent of our campus excellence due to the efforts of our faculty and staff. The University of Michigan, our work on sustainability, is more than a part of our daily life. We take pride in being part of a community that is committed to sustainability.

ON HANSCOM Campus, new research facilities opened for U-M researchers and students.

In 2015, ON the world’s first commercial renewable-energy system that can be connected to any commercial building.

The system includes a solar panel array, a battery storage system, and a data management system. The system is expected to be operational by summer 2016.

As temperatures warm, grounds crew transition from winter to spring

By Kevin Darr

The temperatures are warming, and the grounds crew is getting ready for the spring season.

The crew is working on irrigation and landscaping the grounds. They are also planting flowers and trees. The crew is also working on the construction of a new building.

The crew is also working on the construction of a new building. The building is scheduled to open in the fall.

Progress toward the 2025 campus sustainability goals

- **Goal**: Decrease vehicle carbon output per person by 30 percent.
  - **Status**: On track. Reduced vehicle carbon output by 14 percent.
- **Goal**: Reduce the amount of waste sent to landfills by 20 percent.
  - **Status**: On track. Reduced waste sent to landfills by 15 percent.
- **Goal**: Increase the amount of ground water captured and reused.
  - **Status**: On track. Ground water captured and reused increased by 20 percent.
- **Goal**: Increase the amount of energy generated from renewable sources.
  - **Status**: On track. Energy generated from renewable sources increased by 20 percent.
- **Goal**: Increase the amount of food purchased from local and sustainable sources.
  - **Status**: On track. Food purchased from local and sustainable sources increased by 20 percent.

View the 2015 Sustainability Progress Report: reports.sustainability.umich.edu

**FACULTY SPOTLIGHT**

"...Women have left an inspiring and instructive legacy of leadership..."

- **Georgina Hickey**

**DARP lecture**: Susan Ganzman to talk on human rights knowledge

- **Engineering professor selected to lead IRENE program**

**Digital Innovation**: Innovation project to help students with course decisions

**Inside**

Lincoln Project: The importance of AI and robotics in our future.

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“To increase the involvement of students, faculty and staff, the university will enhance its community engagement and behavior programs, such as the Planet Blue Ambassador, Student Leaders and Student Innovation programs; the Sustainable Food Program; and the **Sustainability Cultural Indicators survey Program** that tracks progress and informs operational improvements.”

President Mark Schlissel
November 5 2015
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The Big Picture
Engagement & Education MEASURING, MONITORING, & EVALUATION TOWARD A CULTURE OF SUSTAINABILITY
Toward a Culture of Sustainability: Engagement & Education

**Staff & Faculty**
- Sustainable Workplace Certification
- Sustainable Lab Recognition Program
- Green Teams
- Energy Managers

**Students**
- Earthfest
- Planet Blue Ambassadors Program
- Sustainability Town Halls
- Annual Sustainability Guide
- Annual Report
- RecycleMania
- Planet Blue Student Leaders
- Water Bottle Initiative
- Planet Blue Room
- Student Groups (SSI)
- Sustainability Courses
What is Culture of Sustainability?

“..........a culture in which individuals are aware of major environmental (and social/economic) challenges, are behaving in sustainable ways, and are committed to a sustainable lifestyle for both the present and future”

How do we measure, monitor, and evaluate it?

...through a program called SCIP...

*Sustainability Cultural Indicators Program*

a multi-year U-M program of research designed to measure and track the culture of sustainability on campus so as to inform /guide university operations and policies
Culture Indicators
Conceptual Framework

INDIVIDUAL INDICATORS
survey based

awareness/knowledge

behaviors

engagement/commitment

other (research)

OBJECTIVE INDICATORS
non-survey based

general travel building food recycling land/water

STUDENTS

FACULTY

STAFF

ALUMNI

Culture Indicators
Conceptual Framework

INDIVIDUAL INDICATORS
survey based

awareness/knowledge

behaviors

engagement/commitment

other (research)

OBJECTIVE INDICATORS
non-survey based

general travel building food recycling land/water

Survey based:
- general
- travel
- building
- food
- recycling
- land/water

Non-survey based:
- general
- travel
- building
- food
- recycling
- land/water

Conceptual Framework:
- Awareness/knowledge
- Behaviors
- Engagement/commitment
- Other (research)
Sustainability Cultural Indicators Program - SCIP

What do we measure?  How do we measure?  How do we know if it's changing?

Knowledge, Awareness
Behaviors, Actions
Commitments
Values, Dispositions

Travel & Transportation
Waste Reduction & Conservation
Natural Environment
Sustainable Foods
Climate Change

CLIMATE ACTION
reduce GHG emissions by 25%; decrease GHG/passenger trip for UM trans. options by 30%

WASTE PREVENTION
reduce waste tonnage to disposal facilities by 40%

HEALTHY ENVIRONMENTS
protect Huron River water quality by reducing volume of chemicals used in land management by 40%; purchase 20% of U-M food from sustainable sources.

COMMUNITY AWARENESS
educational programs; monitoring/evaluating progress; reporting

general
U-M specific
Research Design

**WEB SURVEYS**—annually

Undergraduate students (2000)
Graduate students (400)
Staff (750)
Faculty (750)

*Undergraduate student panel (800)*

**SUPPLEMENTAL DATA (OBJECTIVE INDICATORS)**—annually

Building Information covering:
- Energy Use (BTU/sq ft)
- CO2 emissions metric tons per sq ft
- Recycling material (lbs per sq ft)
- Waste sent to disposal facilities (lbs per sq ft)
- Sustainability program initiatives.
<table>
<thead>
<tr>
<th>SURVEY MODULE</th>
<th>Knowledge</th>
<th>Disposition</th>
<th>Behavior</th>
<th>Other</th>
<th>Demographics</th>
<th>Total</th>
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</thead>
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<tr>
<td>Travel &amp; Transp.</td>
<td>9</td>
<td>10</td>
<td>21</td>
<td>1</td>
<td>0</td>
<td>41</td>
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<tr>
<td>Cons. &amp; Waste Prev.</td>
<td>5</td>
<td>5</td>
<td>33</td>
<td>1</td>
<td>0</td>
<td>44</td>
</tr>
<tr>
<td>Natural Environm't</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>0</td>
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<td>Food</td>
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<td>6</td>
<td>19</td>
<td>2</td>
<td>0</td>
<td>34</td>
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<tr>
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<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<td>0</td>
<td>20</td>
<td>13</td>
<td>3</td>
<td>0</td>
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<tr>
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<td>45</td>
<td>103</td>
<td>18</td>
<td>42</td>
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Sample questions

How much do you know about the following at U-M?

<table>
<thead>
<tr>
<th></th>
<th>A lot</th>
<th>A fair amount</th>
<th>A little</th>
<th>Not much/Nothing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling glass</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Recycling plastic</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Recycling paper</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Recycling electronic waste (i.e. computers, cell phones)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Property Disposition services</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Resources

  - Response distribution tables
  - Maps
  - Indicators

  - Students (Undergraduate and Graduate)
  - Faculty & Staff
  - Undergraduate Panel

- Composite Table of results from each year
Sustainability Cultural Indicators

Primary

Climate Action
  Travel Behavior (1)
  Conservation Behavior (4)

Waste Prevention
  Waste Prevention Behavior (4)

Healthy Environments
  Protecting the Natural Environment (3)
  Sustainable Food Purchases (3)

Community Awareness
  Travel and Transportation (4)
  Waste Prevention (5)
  Natural Environment Protection (4)
  Sustainable Foods (7)
  U-M Sustainability Initiatives (8)

Secondary

Sustainability Engagement
  U-M (3)
  General (4)

Sustainability Commitment (1)
Sustainability Disposition (3)
Evaluating U-M Sust. Initiatives (8)
Mining the Data

Descriptive statistics
Spatial analysis
Linking survey data to environmental data
Causal Modeling using panel data
## WASTE PREVENTION & CONSERVATION - AWARENESS

(percentage distribution)*

<table>
<thead>
<tr>
<th>2014</th>
<th>All Students</th>
<th>Undergraduate Students</th>
<th>Graduate Students</th>
<th>Staff</th>
<th>Faculty</th>
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<tbody>
<tr>
<td></td>
<td>Students</td>
<td>Fresh</td>
<td>Soph</td>
<td>Junior</td>
<td>Senior</td>
</tr>
<tr>
<td>Recycling glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A lot</td>
<td>16</td>
<td>11</td>
<td>14</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>A fair amount</td>
<td>31</td>
<td>28</td>
<td>26</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>A little</td>
<td>32</td>
<td>33</td>
<td>37</td>
<td>31</td>
<td>38</td>
</tr>
<tr>
<td>Not much/nothing</td>
<td>21</td>
<td>28</td>
<td>23</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Recycling plastic</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>A lot</td>
<td>21</td>
<td>20</td>
<td>23</td>
<td>19</td>
<td>23</td>
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<tr>
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<td>36</td>
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<td>29</td>
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<td>Total</td>
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<td>39</td>
<td>39</td>
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<td>42</td>
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<td>A little</td>
<td>26</td>
<td>27</td>
<td>25</td>
<td>27</td>
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</tr>
<tr>
<td>Not much/nothing</td>
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<td>9</td>
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<td>6</td>
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<td>Total</td>
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</tr>
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<td>Recycling electronic waste</td>
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<td></td>
</tr>
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<td>A lot</td>
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<tr>
<td>Property Disposition services</td>
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<td>A lot</td>
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<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
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<tr>
<td>A fair amount</td>
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<td>7</td>
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<tr>
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<td>28</td>
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<td>100</td>
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</table>
# Waste Prevention & Conservation Behavior Over Time

(percentage distribution)

## Waste Prevention & Conservation Items

**How often do you do the following:**

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<tr>
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<th></th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Set thermostat to 65 degrees or lower during cool or cold weather</td>
<td>Q37</td>
<td>Q44</td>
<td>19</td>
<td>20</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td></td>
<td></td>
<td>19</td>
<td>20</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rarely</td>
<td></td>
<td></td>
<td>18</td>
<td>19</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td></td>
<td></td>
<td>23</td>
<td>24</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always/Most of the time</td>
<td></td>
<td></td>
<td>23</td>
<td>20</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable</td>
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<td></td>
<td>17</td>
<td>17</td>
<td>17</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
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</tr>
<tr>
<td>Number of respondents</td>
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<td>2395</td>
<td>3178</td>
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Signif. between current yr. and prev. yr.

<table>
<thead>
<tr>
<th>Test</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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</thead>
<tbody>
<tr>
<td>n.s.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Signif. between current yr. and 2012

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<th>2017</th>
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</thead>
<tbody>
<tr>
<td>n.s.</td>
<td></td>
<td></td>
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</table>

Set thermostat (a/c) to 78 degrees or higher during warm of hot weather

<table>
<thead>
<tr>
<th>Question</th>
<th>Question</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<td>Q38</td>
<td>Q45</td>
<td>24</td>
<td>28</td>
<td>27</td>
<td></td>
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<tr>
<td>Never</td>
<td></td>
<td>24</td>
<td>28</td>
<td>27</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Rarely</td>
<td></td>
<td>17</td>
<td>17</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td></td>
<td>20</td>
<td>19</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always/Most of the time</td>
<td></td>
<td>17</td>
<td>14</td>
<td>15</td>
<td></td>
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<tr>
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<td>22</td>
<td>22</td>
<td>22</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of respondents</td>
<td></td>
<td>3032</td>
<td>2396</td>
<td>3171</td>
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<td></td>
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</table>

Signif. between current yr. and prev. yr.

<table>
<thead>
<tr>
<th>Test</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>p&lt;.01</td>
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</tbody>
</table>

Signif. between current yr. and 2012

<table>
<thead>
<tr>
<th>Test</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>p&lt;.01</td>
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<tr>
<td>p&lt;.01</td>
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</tr>
</tbody>
</table>
CULTURAL INDICATORS CHANGES – AWARENESS
DIFFERENCES AMONG STAFF AND FACULTY

Natural Environment Protection
Waste Prevention
Sustainable Foods
Travel & Transportation
U-M Sustainability Initiatives

STAFF
FACULTY

↑ Significant change from 2012
**Cultural Indicators Changes – Behavioral**

**Differences Among Staff and Faculty**

- **Waste Prevention Behavior**
- **Conservation Behavior**
- **Protecting the Natural Environment**
- **Sustainable Food Purchases**
- **Travel Behavior**
- **U-M Sustainability Engagement**

Significant change from 2012
CULTURAL INDICATORS CHANGES – BEHAVIORAL AMONG STUDENTS

- Travel Behavior
- Waste Prevention Behavior
- Conservation Behavior
- Sustainable Food Purchases
- Protecting the Natural Environment
- Sustainability Engagement Generally
- U-M Sustainability Engagement

Significant change from 2012

STUDENTS

STUDENT PANEL
CONSERVATION BEHAVIOR INDICATOR
DIFFERENCES AMONG STAFF-FACULTY –2012 & 2014

Campus
- West Campus
- East Campus
- North Campus
- Medical Campus
- Health Sciences
- South Campus
- East Campus

2014
2012
WASTE PREVENTION BEHAVIOR INDICATOR
DIFFERENCES AMONG STAFF-FACULTY –2012 & 2014

- Central Campus-West
- Central Campus-East
- North Campus
- Medical Campus
- Health Sciences
- South Campus
- East Campus

Campus Sciences

- 2014
- 2012

High
Low
Analysis of Environmental Data and Survey Data

Environmental Data

- Waste (tonnage)
- Recycled Material (tonnage)
- Energy (BTU/sq.ft.)
- CO2 Emissions (metric tons)
  - energy, electricity, steam, natural gas

Merged Objective and Subjective-Behavioral Data

Objective Env. Data (annual)

Survey Data (annual)
- students
- staff/faculty

DATA ORGANIZED BY:
- CAMPUS, REGION, SUB-REGION (staff/faculty)
- U-M HOUSING (students)
# Relationships between Changes in Waste Prevention Behavior, Recycled & Trash Material

## Change in Recycling, Trash*, & Waste Prevention Behavior among Students in U-M Housing by Place of Residence: 2012-2014

<table>
<thead>
<tr>
<th>U-M Housing</th>
<th>Recycling Pounds per Square Feet</th>
<th>Trash Pounds Per Square Feet</th>
<th>Change in Waste Prevention Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Quad</td>
<td>0.24</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>West Quad*</td>
<td>0.43</td>
<td>0.40</td>
<td>0.35</td>
</tr>
<tr>
<td>South Quad*</td>
<td>0.45</td>
<td>0.44</td>
<td>0.02</td>
</tr>
<tr>
<td>East Quad*</td>
<td>0.29</td>
<td>0.30</td>
<td>0.54</td>
</tr>
<tr>
<td>Stockwell</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Mosher-Jordan</td>
<td>0.71</td>
<td>0.83</td>
<td>0.86</td>
</tr>
<tr>
<td>Mary Markley</td>
<td>0.53</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>Alice Lloyd***</td>
<td>0.04</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>Couzens</td>
<td>0.18</td>
<td>0.21</td>
<td>0.19</td>
</tr>
<tr>
<td>Bursley-Baits</td>
<td>0.37</td>
<td>0.35</td>
<td>0.18</td>
</tr>
<tr>
<td>Northwood Apartments</td>
<td>0.23</td>
<td>0.25</td>
<td>0.26</td>
</tr>
</tbody>
</table>

*The term Trash is sometimes referred to as Waste. In the context of The University of Michigan, it refers to non-recyclables that are diverted to disposal facilities (i.e. landslides, etc).

*Data are excluded for the smaller residence halls having relatively small numbers of respondents. These include: Betsy Barbour, Martha Cook, Fletcher, Henderson, Newberry, and Oxford.

*Data are based on pounds of recyclables and trash collected from dumpsters associated with each building for the proceeding 12 months. For example the 2012 data cover the period from September 2011 to August 2012.

*In 2005, U-M launched a long-term program of selective upgrades and complete renovations to its housing stock. In 2012, East Quad was closed for renovations followed by the closure of South Quad in 2013 and the West Quad closure in 2014. Figures for recycling and waste during renovation do not reflect the normal occupancy use.

**During renovations, residence halls were unoccupied. Therefore, there were no East Quad students in the 2012 SCIP sample while the 2014 SCIP sample had no West Quad participants. Consequently, survey data covering both 2012 and 2014 were not available to measure change scores for students in these residence halls.

***2012 data covering recycling and waste for Alice Lloyd are low since the building was being renovated and therefore unoccupied during the previous year. Change for this building is based on the difference between 2014 and 2013.
Panel Analysis

Conceptual Model – Hypotheses

- School/College
- Gender
- Student class
- Change in housing type yr1+yr2
- No. of roommates yr2
- Pre-college neighborhood
- Degree of commitment

STUDENT ENGAGEMENT yr 2

WASTE PREVENTION AWARENESS yr 2

CHANGE IN WASTE PREVENTION BEHAVIOR yr 2-yr 1

CHANGE IN CONSERVATION BEHAVIOR AT HOME yr 2-yr 1

- Waste prevention behavior yr 1
- Conservation behavior at home yr 1

- Degree of commitment
- Environmental
- Demographic
- Commitment

Conceptual Model – Hypotheses
SCIP Annual Reports

SUSTAINABILITY CULTURAL INDICATORS PROGRAM:
THIRD YEAR REPORT

MONITORING THE CULTURE OF SUSTAINABILITY
AT THE UNIVERSITY OF MICHIGAN: FALL 2014

Issued: September 2015

Robert W. Marans, Ph.D.
John Callewaert, Ph.D.

http://graham.umich.edu/media/files/SCIP-Year-3-Report.pdf
Current Status-Next Steps


Design and conduct interventions (tests/experiments) in conjunction with U-M operational units

On-going analysis

- Develop and test causal models using panel data
- Examine relationships between behavioral change & changes in energy consumption, CO2 emissions, & other “hard” indicators
- Other

Continue to promote uses of the data within U-M and elsewhere

Explore Opportunities for Replication

- Other universities
- Other organizations
- Cities and neighborhoods
FUTURE CULTURE OF SUSTAINABILITY STUDIES:
OTHER WORLD UNIVERSITIES

CORE ISSUES/QUESTIONS

WORCESTER ?
Great Britain

SICHUAN ?
China

MARMARA ?
Turkey

RUTGERS ?
U.S.

NYU
U.S.

MICHIGAN

ILLINOIS ?

NATIONAL CHENG KUNG ?
Taiwan

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Taiwan
Questions?

marans@umich.edu
http://graham.umich.edu/leadership/scip
AWARENESS OF U-M SUSTAIN. INITIATIVES INDICATOR
DIFFERENCES AMONG STAFF-FACULTY –2012 & 2014

2012 vs 2014 awareness of U-M sustainability initiatives indicator across different campus locations and divisions.