Abstract
The American College of Sports Medicine endorses physical activity for improving health and well-being; their motto is “Exercise is Medicine.” Outdoor activities such as gardening and yard work are important means of physical exercise and can be personally rewarding due to the self-satisfaction of improving one’s quality of life. Stewardship of Copeland Creek requires physical human power to clean the watercourse of refuse and artificial materials, to maintain biking and biking paths, to plant native species and remove invasive non-natives, and to strengthen the water base for native fish. Therefore this class project examined the effects of self-paced gardening and yard work on Heart Rate (HR) responses and rate of metabolism.

Introduction
The purpose of this class project was to examine the effects of self-paced everyday physical activity (such as gardening, yard work, or Copeland Creek clean up) on HR responses and metabolic rate. Generally speaking, gardening is seen more as a leisure time activity, not as a form of exercise. Throughout our class project, we hope to debunk this common misconception by proving that everyday activities can increase heart rate enough that it will partake significantly in increasing metabolic rate and energy expenditure. The outcome of the class project might be important for the public to know different alternatives to going to the gym in order to maintain a healthy life.

Obesity is a growing epidemic throughout the world, especially in the United States. Being overweight is defined as having excess body weight for a particular height from fat, muscle, bone, water, or a combination of these characteristics. Obesity is a step above this and is defined as having excess body fat. These conditions seem to be the result of a “caloric imbalance,” meaning that there are too few calories expended for the amount of calories that are consumed, leading the body to retain these calories as excess fat. There are many different factors that can affect a predisposition to being obese or overweight including genetic, behavioral, and environmental factors. In the United States, the percentage of people, especially children, who are considered to be obese, has sky-rocketed in recent years.

According to the Center for Disease Control and Prevention, “more than one-third of U.S. adults (35.7%) are obese.” (CDC). There are many issues that go hand-in-hand with obesity, many of those being health related. Being obese puts one at risk for the following conditions: heart disease, stroke, type II diabetes, certain types of cancer and early death. Not only are the health related conditions associated with obesity cause for concern, but obesity can also affect a person’s financial situation. "In 2008, medical costs associated with obesity were estimated at $147 billion; the medical costs for people who are obese were $1,429 higher than those of normal weight (CDC). With all of these concerns taken into account, it is important for people to know how to effectively increase their metabolic rate, especially concerning increasing their heart rate and energy expenditure.

Throughout our class project we hoped to demonstrate that increasing one’s metabolic rate is not solely dependent on the actual activity itself, but also on the duration of the activity. Often gym sessions or other traditional forms of activity tend to last anywhere from 45 minutes to 1.5 hours, but every day activities like gardening can be an all day event. So while 45 minutes of gardening is not equivalent to 45 minutes of high intensity training in a gym setting, perhaps 2 hours of gardening may provide the desired results that could be attained through a short gym session.

Participants. 21 healthy participants (11 women & 10 men) (20.1±1.78 years; 69.7±9.3 kg; 171.8±5.2 cm) in KIN 101 Physical Activity and Copeland Creek Stewardship Class volunteered for this class project. Each individual wore a HR monitor at least once while doing their class participation such as gardening, cleaning, and yard work at the Copeland Creek and SSU garden. Table 1 shows the participants anthropometric characteristics (see Table 1).

<table>
<thead>
<tr>
<th>Age</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
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<tbody>
<tr>
<td>20.1</td>
<td>171.8</td>
<td>69.7</td>
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</tbody>
</table>

SD +/-
1.78
5.2
9.3

Methods.

Methodology. This class project conducted at Sonoma State University’s garden, Copeland Creek, and Osborne Preserve was where the class participants performed various self-paced gardening related activities, varying in physical activity intensities. How gardening affects HR and metabolism subjects wore Polar HR monitors during the class activity. Each participant resting HR were recorded prior to gardening and yard work to get baseline values. Each subject worked in the garden in their comfortable pace and record their HR responses every 10 min for 60 min. We later calculated average HR responses of the class and exercise intensity through Karvonen Method (Table 2).

Calculations.
Max HR = 220 – age

Target HR = % intensity of Physical Activity (HRmax – HRrest) + HRrest

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
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<tbody>
<tr>
<td>Max HR=220</td>
<td>Max HR=220</td>
</tr>
<tr>
<td>HRmax – HRrest</td>
<td>HRmax – HRrest</td>
</tr>
<tr>
<td>% intensity (70-90%)</td>
<td>% intensity (70-90%)</td>
</tr>
</tbody>
</table>

Results

Energy Expenditure Calculations.

Men (Calories/min) = (-55.0969 + (0.6309 x HR) + (0.1988 x weight) + (0.2017 x age)) / 4.184
Calories per min = 6.25

Women (Calories/min) = (-20.4022 + (0.4472 x HR) – (0.1263 x weight) + (0.074 x age)) / 4.184
Calories per min = 4.85

References