Introduction:

Watersheds are a geographic range in which water flows across land and drains into a common body of water, whether a stream, river, lake or ocean. Watersheds in the United States provide economic gain and recreational opportunities. In 1992 the Monterey Bay National Marine Sanctuary (MBNMS) was established, a federally protected marine area along California’s central coast. The MBNMS extends throughout the Central California coast from Marin County near San Francisco southward to Cambria in San Luis Obispo County and consists of ten watersheds (Michael. 2008). In fact, the Salinas Valley is the largest in the MBNMS zone (Figure 1). These coastal watersheds are extremely important because they directly impact not only the land within the watershed but the Marine Sanctuary as well.

Over the past decades, coastal watersheds and their ecosystems have become threatened due to increasing demand for freshwater, climate change, urban development. Therefore, restoration proposals and initiatives have been established to restore watersheds throughout the United States.

One restoration method is re-planting native plants from local nurseries to all watersheds that have been lost or damaged due to various environmental factors, such as urban development, invasive species, erosion; to preserve ecosystems, to increase biodiversity, and maintain the natural habitat. Typically, in plant nurseries, the plants are kept in greenhouses with irrigation, but these warm wet environments can breed disease within the pots and materials. This is a poor management practice because plants can be exposed to diseases and then they are transported to restoration sites where the diseased plants are then installed, thus damaging the environment (Upper Salinas-Las Tables RCD. 2004).

For the past five years, the Lightfighter Restoration Site (LRS) has had over 3500 native plants installed from local plant nurseries to preserve the ecosystems, to prevent loss of species diversities, and to prevent changes in the food chain. The Lightfighter Restoration Site (LRS) is a coastal shrub habitat approximately 3.7 acres, the northern portion of the site connects to the greater local watershed. In December of 2014, samples of restored plants selected from throughout Central California including the Lightfighter Restoration Site (LRS). It was discovered to be infested with the pathogen Phytophthora tentaculata, which translates to "plant destroyer." It is a water mold pathogen that needs water to reproduce via spores that spread in...
wet soil and can be viable for up to three years. The pathogen causes symptoms of root rot and stems cankers, which may result in the collapse and death of infected plants. Infected plants may appear undersized and off color. Animals that depend on local plant species as a food source could feed on the infected plants possibly becoming ill leading to death (Ronney-Lathnam et al 2014).

The fear is the *Phytophthora tentaculata* could impact acres of coastal ecosystems, causing lasting environmental damage to the local watersheds. Currently, there is limited research on how *Phytophthora tentaculata* could impact the water quality, aquatic species, estuaries, and if the pathogen could spread from the site to the watershed into the ocean. For this project, we are monitoring and assessing the effects of the pathogen *Phytophthora tentaculata* on Lightfighter Restoration Site (LRS) to monitor how the pathogen is responding to the environment and if it can spread.

Challenges:

The first challenge was determining which plants in the restoration area were infected or just affected by seasonal change. When this project started, it was the end of the summer, because of seasonal change there had been a lack water to nourish the plants. Therefore, the majority of the plants throughout the restoration site appeared to be infected with the pathogen, brownish and fallen, shriveled leaves. It was hard to determine which plants were infected by the pathogen and which ones were showing normal effects of seasonal change. This also contributed to the second challenge we had, which was coming up with a proper way to monitor the infected plants without having too many different variables. Infected plants may be in various stages of the infection, are of different sizes, in different locations throughout the restoration site, and showing stress caused by a seasonal change (drought). My mentor and I needed to come up with effective protocol to determine and monitor all the infected plants. After going to the restoration site and recording several observations, collecting GPS coordinates, and trying different survey methods, we determine the best method to use (detailed below).

Method:

Each suspected infected plant was tagged with a number along with GPS coordinates and surveyed for vigor, height, canopy cover, and more. Plants that show signs of infection during spring and fall monitoring will be flagged. Flagged plants will be analyzed via a series of questions about the health of the plant and overall appearance that will be added to a Google Form. The Google Form will be used over the course of three years to detect any changes in plant appearance. Any suspect plants that appear to be exhibiting symptoms of *P. tentaculata*
will be monitored carefully, and if determined that sampling should take place, the plant will be bagged and removed from the site for analysis.

Future Implications:

In the spring, my mentor and I will be continuing to monitor the pathogen *Phytophthora tentaculata*. An analysis will be done on the fall’s samples of five individuals plants based on small vigor differential (vigor spring –vigor fall) to determine which plants might be infected with the pathogens. We are also aiming to have a finished the protocol and a final report documenting the work that we did and results of our monitoring for the LRA restoration site. The final report will be given to local agencies to improve plant nurseries and watershed management to implement better practices to stop further outbreaks of spreading diseases and will help to understand the pathogen and how it responds to the environment.

Literature Cited
