Overview
In the summer of 2010 The Natural Areas Land Management Crew of Green Mountain College manually controlled *Alliaria petiolata* (Garlic Mustard). The management crew consisted of two part-time positions (20 hours/week): Kelsy Allan and Erin Burch, and one full-time position (35 hours/week): Brandon Gowdy. Throughout the 2010 control period\(^1\), 137 person hours were spent eradicating Garlic Mustard and a total of 44,082 individual plants were removed.

Garlic Mustard is a flowering biennial. The species out-competes native plants throughout the Northeast habitats in the U.S. The control of Garlic Mustard on Green Mountain College land is a continuing effort to decrease the proliferation\(^2\) of this invasive plant, thereby increasing native populations that are of resource to local fauna.

Methods
The management plan was created and approved by the Land Use Committee. The management plan involved decreasing numbers of Garlic Mustard on Green Mountain land. This was accomplished by hand pulling each flowering plant, ensuring all of the plant (including the root system) was fully removed from the soil. Each individual plant\(^3\) was counted, bagged, and moved to an exclusive compost pile which was covered by tarp to contain the spread of seed\(^4\).

The management efforts involved keeping record of where the invasive species was found. The Green Mountain College natural areas were divided into sectors (see map). The areas controlled involved 37 sectors on the map in addition to areas surrounding Endless Brook on Deane Preserve. Time spent in each sector was variable depending upon number and size of plants in the area. Each sector was combed once at the start of the control period, and again following this preliminary search. The control period for Garlic Mustard began on May 19\(^\text{th}\), 2010 and ended on June 24\(^\text{th}\), 2010.

Data
Refer to Excel file: CrewDataGarlicMustard2010.

Discussion
2010 was the sixth year of Garlic Mustard control on Green Mountain College lands. It began as a service learning project in 2005 and continued into annual Earth Day pulls and summer removal crews. A distinctive trend in control (or lack thereof) of Garlic Mustard plants cannot yet be determined, due to various inconsistencies and variables. The first two years (2005 and 2006), the removed plants were recorded in volume (cubic feet), as

\(^1\) 2010 control period: during the plant flowering season: May and June

\(^2\) Proliferation: spread of seed to the seed bank and or other natural areas. Each Garlic Mustard plant produces an average of 165-868 seeds (se-epcc.org/manual/garlicmustard.html)

\(^3\) Individual Plant: all the aerial portions of one tap root

\(^4\) Spread of seed: seed is dispersed by mechanical means (rupture of seed capsule), humans and animals, in addition to water.
opposed to counting and recording individual plants in latter control efforts. Additionally, the range of plants removed over a summer spanned from 17,083 (2008) to 77,262 (2007). As can be seen by the following figure, there is no consistent trendline in control yet. This may be due to data and crew member error, but it may also be due to the lifecycle properties of Garlic Mustard. Since the plant is a flowering biennial, every other year should produce similar numbers of new plants, and consequently similar numbers of plants removed. If this is true, control efforts may be producing a reduction of the invasive species, as 2,000 less were found in 2009 as in 2007. The low numbers found in 2008 may be an outlier in the average control efforts due to possible outside environmental variables.

In 2010, fewer person hours were spent eradicating Garlic Mustard than in all previous years. Whether this was crew error or a positive sign of reduction in plant density is still to be determined. It may also become increasingly harder to eradicate Garlic Mustard as the dense patches are removed and the seed is dispersed to more varied areas by the river. The largest patch of Garlic Mustard in 2010 was found in area B9 (see map). This is near a bend in the river, and could reflect seed dispersal patterns. It is also a location not owned by Green Mountain College, and thus indicates the need for control of invasive species in areas surrounding college lands as well as within for effective land management.

One unsettling observation over the 2010 control period was that Garlic Mustard appeared in rather large quantities in the riparian restoration area of campus lands. This indicates a change from native species succession (the intention of said area) to invasive plants which could outcompete and take over the area, thus reducing biodiversity and ecosystem function. The restoration area is also controlled by yearly Garlic Mustard pulls in the spring, but as in other areas, seedlings and fully developed Garlic Mustard plants were found in the restoration area during summer removal. Perhaps more effort should be put into eradicating invasive species in this sensitive area in the future.

Conclusion
There is no definitive data yet to conclude whether the control efforts of Garlic Mustard over the past six years have been effective in reducing the species on Green Mountain
College lands. Since it is a biennial plant, and since the seeds spread rapidly from areas upstream, it is hard and/or impossible to ever completely diminish Garlic Mustard from campus. However, continued efforts to reduce the plants’ range will be helpful in creating more native biodiversity throughout GMC natural areas; this increase in mature native plants will in turn change the ecosystem to a less hospitable environment for some invasive species.