Distribution of the invasive wetland plant, *Lythrum salicaria,* and its effects on the pollinator community

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Project Goals:

This project had three identified areas of focus:
a. Develop baseline data for Purple Loosestrife distribution for selected areas in Erie County, New York and utilize mapping techniques with GIS to evaluate this database.

b. Monitor plant communities which contain purple loosestrife and determine whether pollinator visitation rates on other plant species are affected by the presence of this invasive species.

c. Determine the relative amount of purple loosestrife pollen present on bee species as they visit other plant species as an indicator of potential pollen transfer between species.

a. Purple Loosestrife distributions
Locations of patches of loosestrife plants were recorded during the blooming period (July-September). At some locations, GPS coordinates were obtained; while at other locations, street addresses were recorded. Street addresses were geocoded to provide x-y coordinates for use in GIS. All spatial data have been compiled in a database that will be updated annually. Purple loosestrife patches vary in size from one isolated plant to hectares of plants; a qualitative scale of abundance was used to record abundance at each location. Annual censuses will indicate whether this plant is increasing its coverage. Additional information can be included in this data base. Several biocontrol agents have been released for this species and when observed, they can be recorded for a site. This will allow us to monitor dispersal of these control insects.

For representation, base maps for the county were downloaded from public sites. The New York State Data Clearinghouse has aerial photos available for download for all of Erie County. Maps were reprojected to be aligned with aerial photos.

Figures 1 and 2 illustrate patch locations for two areas of the county. For each location, we have information on approximate patch size. We can also add information on biocontrol agents, other herbivores or pollinators to this file. These points can also be superimposed on aerial maps as shown in Figure 3. Unfortunately, downloadable spatial data for hydrography information is not accurate at the same resolution. The blue line in Figure 3 represents spatial data for Ellicott Creek as provided by New York State. The creek is visible in the photo and its meandering nature is underestimated by the available spatial data. If needed, we can digitize our own hydrography data from the aerial photos and site visits.

These baseline data can also be used in conjunction with data on biocontrol agents. Several beetle species have been released in western New York to control purple loosestrife populations. With known estimates of their dispersal ability along with their locations, we can estimate their potential range of influence. Figure 4 illustrates how these data could be used to highlight beetle control areas.

Figure 1. SW Erie County Sites for Purple Loosestrife

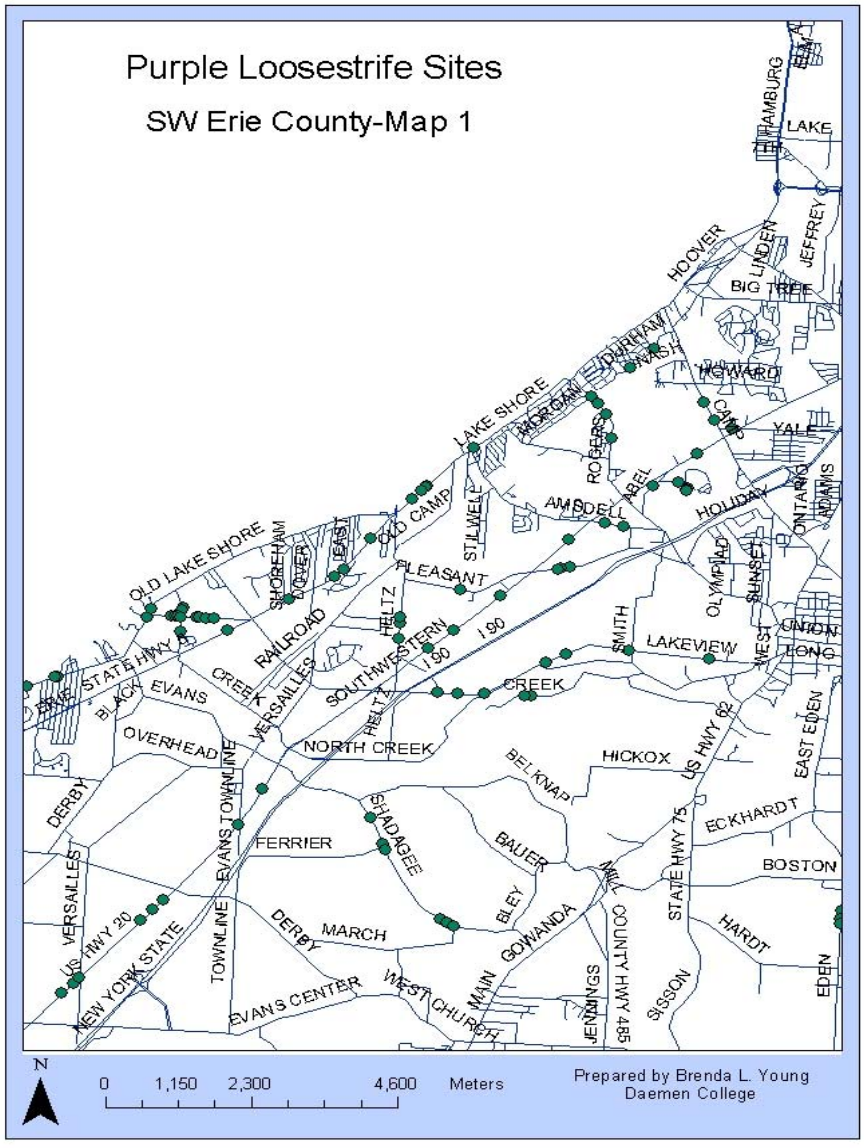


Figure 2. NE Erie County Sites for Purple Loosestrife

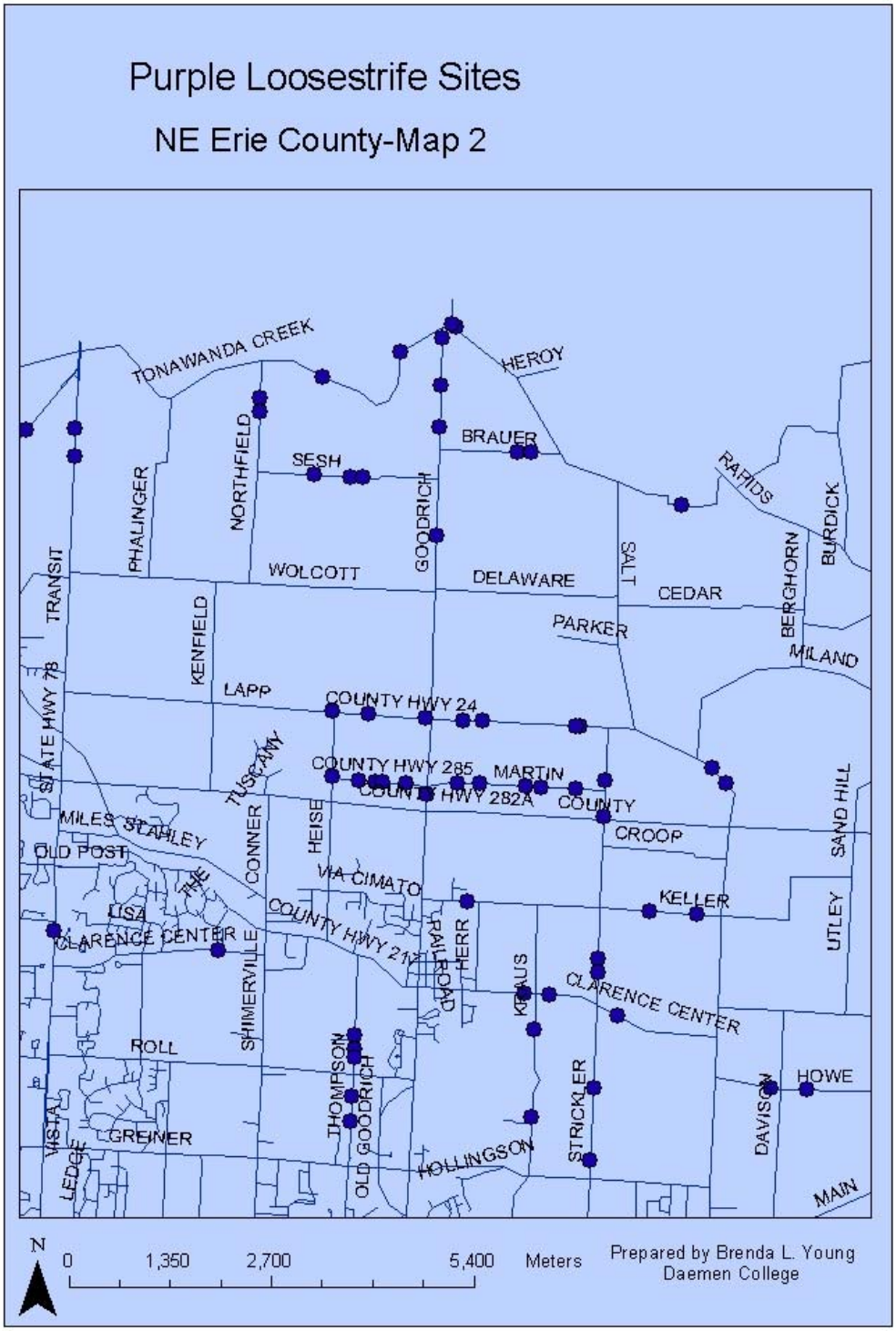
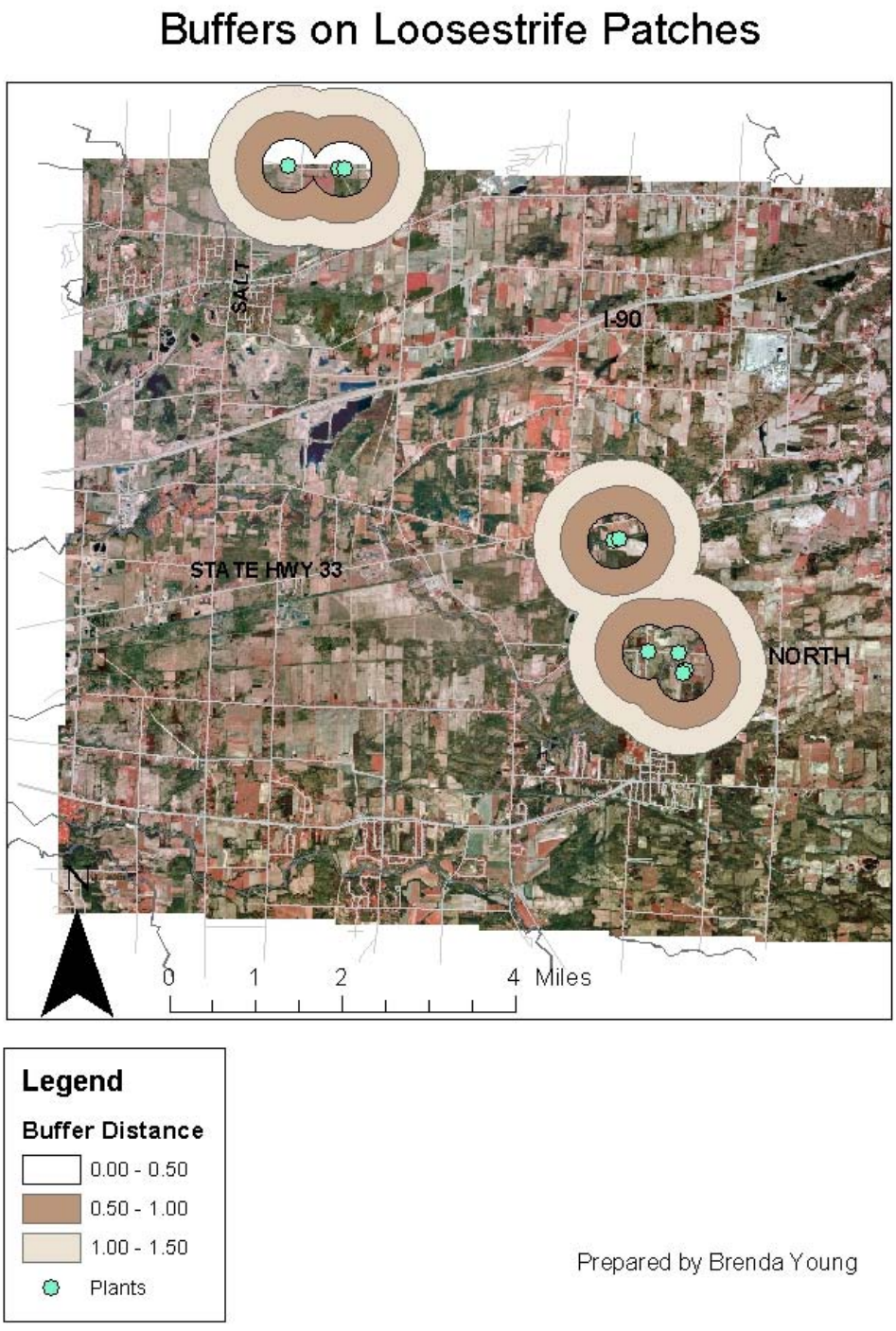


Figure 3. Map of GPS points superimposed on aerial photos. The blue line indicates the stream information generated from hydrography files.

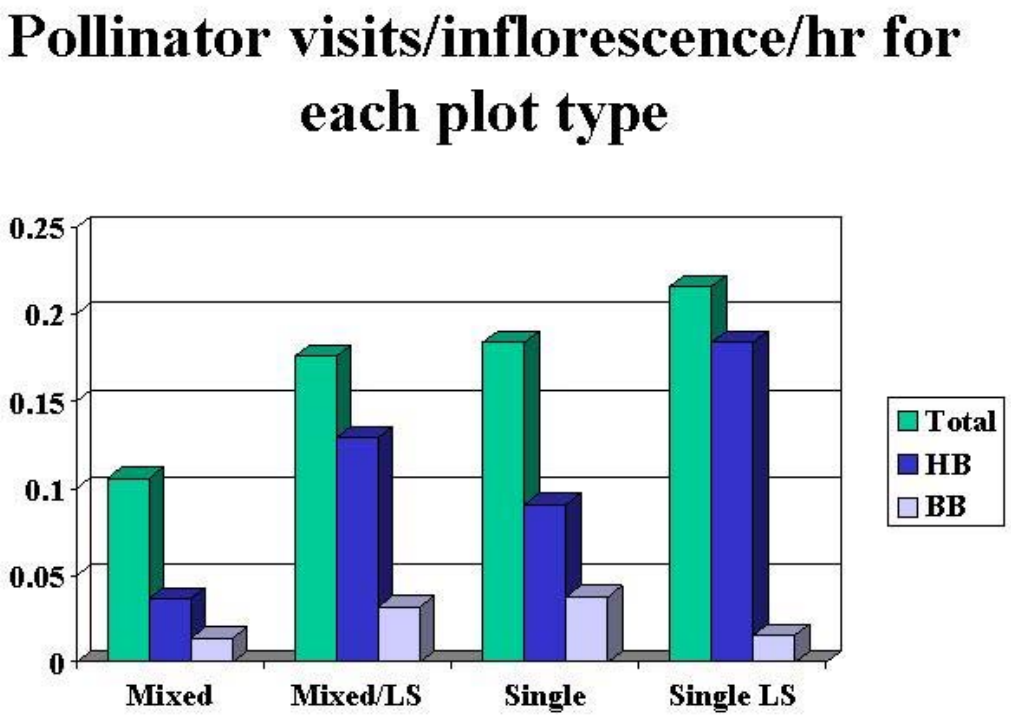
Figure 4. Buffer zones depicting areas of influence of beetle biocontrol agents on purple loosestrife populations.



b. Bee visitation rates

In order to determine whether the presence of purple loosestrife influenced pollinator activity on other species, mixed and single plant species plots were established. Pollinators were observed at five minute intervals for sixty minutes daily on each plot. Visitation rates were adjusted by the number of flowers per plot (inflorescences).

Figure 5 reports the mean visitation rates by all insects (total) and honey bees (HB) and bumblebees (BB) to mixed species and single species plots. LS indicates data for purple loosestrife (either mixed with other species or in isolated plots). Although there is variability in visitation rates among dates, there is a consistent trend for higher total visitation rates to purple loosestrife whether it is alone or mixed with other species. Honey bees were the most frequent visitor and their trends mirrored those for total visitation rates. Although there were more bumblebee visits to loosestrife than to other species in mixed plots, certain plant species attracted more bumblebee visits in isolation. Numbers of bumblebees were lower in 2002 relative to the previous two years.

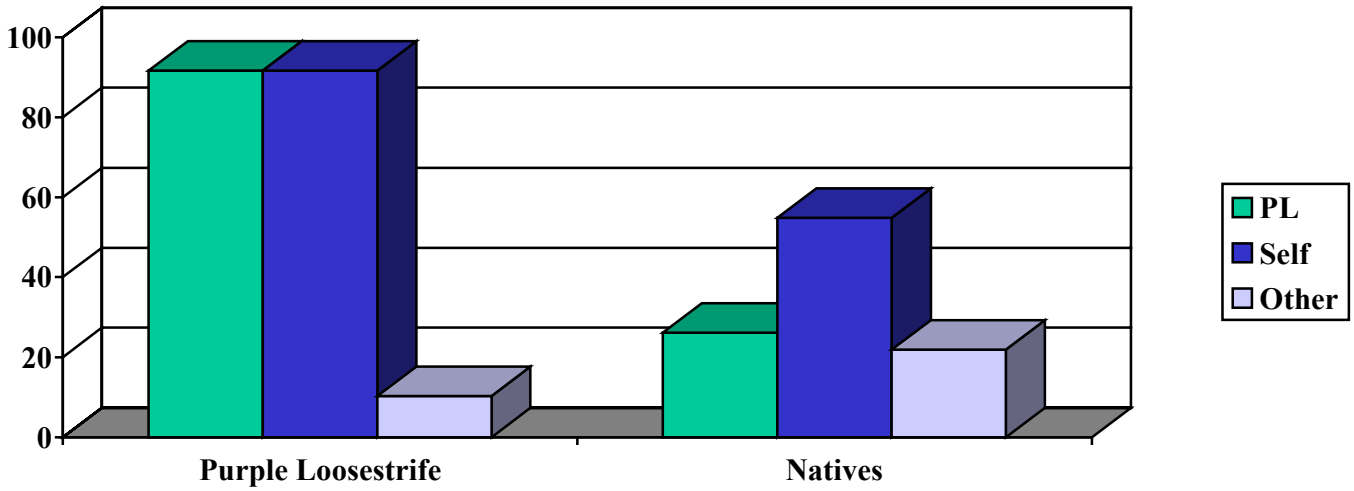


c. Pollen utilization rates

Pollen species were identified using a reference collection of slides that was made from all wildflowers blooming from June to August. To determine whether bees selectively collect pollen from purple loosestrife, pollen was removed from bees foraging on different species. Microscopic analysis of these samples is ongoing.

Our preliminary data suggest that bees vary in their level of faithfulness to different plant species, thus each species will need to be evaluated separately. For example, bees visiting different goldenrod species (*Solidago spp*.) rarely carried purple loosestrife pollen grains; however, visitors collected from other plant species sometimes carried twice the number of purple loosestrife pollen grains than grains from the native plant species. In analyzing all pollen loads from bees, purple loosestrife pollen comprised approximately 20% of the pollen carried by bees visiting other species (Fig. 6). Bees visiting purple loosestrife did not carry exclusively loosestrife pollen (Fig. 6, purple loosestrife-self < 100%).

Figure 6. Pollen percentages from all bee species visiting purple loosestrife or natives. PL indicates purple loosestrife pollen and self indicates pollen from the plant on which the bee was collected.



Future Work:

I anticipate that the database for purple loosestrife will be maintained and expanded in future years. These data will be available for student use in projects and will offer students an opportunity to learn GIS skills which will aid them in the job market. We will also be able to add information on biocontrol agents and plant spread that may be helpful to policy makers.

Several studies have suggested that purple loosestrife negatively impacts the pollination of a closely related species (*Lythrum alatum*). Our data suggest that the presence of purple loosestrife may depress visitation rates for many plant species (both native and non-native). The transfer of mixtures of pollen from different plant species is known to have deleterious effects on fertilization rates. In order to know the long-term impact of these mixed pollen loads on plant reproduction, we will need to measure how much pollen is transferred to stigmas of flowers and also how seed set varies with mixed and pure pollen application. We will be attempting these controlled pollination experiments in the summer of 2003.