

Title: The Use of a Native Plant Sod Buffer to Reduce Invasion of Non-indigenous Species From Residential Areas Into Wildland Areas
(awarded 2006)

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Proposal Abstract

Gallatin County, MT has been experiencing rapid residential growth (Hernandez, 2004) in recent decades; a phenomenon experienced in many parts of the western United States. With the expansion of human population, and thus residential acreage, the surrounding natural habitat continues to be fragmented and reduced (Wilcox and Murphey, 1985). In general, and especially in the Rocky Mountains, the demand for large parcel home sites instead of smaller clustered home sites is growing (Johnson and Maxwell, 2001). The urban/suburban plot size has increased and most of the new development is landscaped with non-indigenous plant species, many of which require more water and nutrients than the native flora. Invasion of non-indigenous plant species into native plant communities is an issue worldwide, and some of the most invasive species are horticultural escapes (Pimentel et al., 1999). Invasion is defined as an increase in density and spatial extent.

Our research has examined the ability of native sod to establish with minimal supplemental irrigation as well as act as a buffer zone to reduce the spread of non-indigenous plant species potentially into the adjacent indigenous natural ecosystems. The non-indigenous monocot *Poa pratensis* (Kentucky bluegrass) and the dicot *Cirsium arvense* (Canada thistle) have been used as target species in our studies.

The specific experiment has a hexagonal design. Hexagons were divided into six 4m² sections and randomized so that three sections were composed of native sod and three sections were left bare as a control. *C. arvense* or *P. pratensis* was grown in the middle 0.23m² of each hexagon, with four hexagon replicates in each of two watering regimes. The high water treatment received an average of 2.54 cm of water per week (a typical watering rate for *P. pratensis* residential lawns) and the low water treatment received no supplemental irrigation, and natural precipitation was recorded.

Native sod establishment was evaluated by percent cover data. Percent cover contained no more than 7% bare-ground in the high water treatments, and no more than 10% bare-ground in the low water treatments, indicating that native sod is capable of establishing in both high and low water treatments and may therefore be a more sustainable choice for residential lawns. Furthermore,

native sod greatly reduced the number of *C. arvensis* propagules and the average distance that they spread when compared with the bare-ground control. Analysis of *P. pratensis* plots is not yet completed but appears to have a similar trend to that of *C. arvensis* with greater invasion into the bare-ground areas and suppression in the native sod plots.

Results

Invasion of *C. arvensis* was assessed by measuring the number and distance from the center sown hexagon to each new shoot emergence, in both the native sod and bare-ground control plots. All new shoots were labeled with wire rings and their spatial location recorded to scale. Native sod reduced the overall density of new *C. arvensis* shoots and the distance that they spread relative to the bare-ground plots (Figures 1 and 2). The median number of new shoots was 0 and 0.5 in the wet and dry native sod plots respectively, and 4.5 and 6 in the wet and dry bare-ground control plots respectively. The median distance the *C. arvensis* shoots spread was 0 cm in both the wet and dry native sod plots, and 61cm and 102cm in the wet and dry bare-ground control plots respectively.

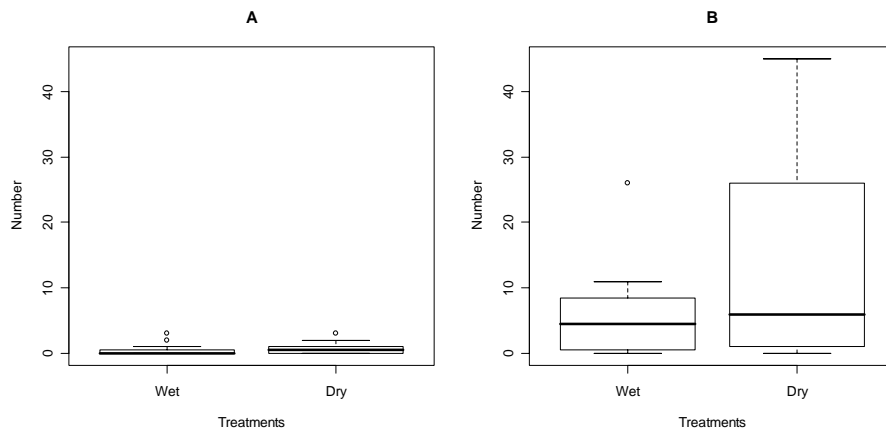


Figure 1. *C. arvensis* new shoot counts (per 4m² plot) in A) native sod and B) bare-ground control plots, as of July 18, 2007. Data are displayed as box and whisker plots with the boxes representing 50% of the data, the dark solid line the median value, and the whiskers 95% of the data values. The open circles indicate outliers, two large outliers (values 107 and 117) were omitted from visual representation of the dry treatment of graph B to present the data in a reasonable scale).

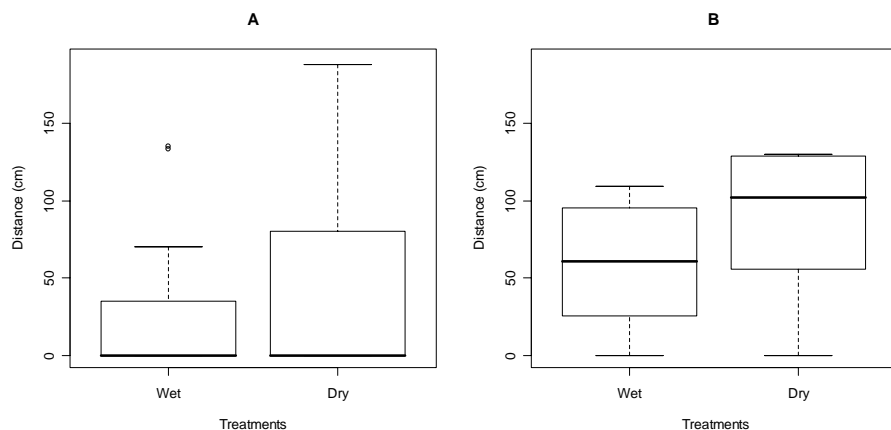


Figure 2. Spread distance (cm) of newly emerging *C. arvensis* shoots from a central mature population for A) native sod and B) bare-ground control plots, as of July 18, 2007. Data are displayed as box and whisker plots with the boxes representing 50% of the data, the dark solid line the median value, and the whiskers 95% of the data values. The open circles indicate outliers.

Discussion

While the overall density and spread of *C. arvensis* was greatest in all of the low water treatments, the number of *C. arvensis* propagules, and the maximum distance that they spread, was greatly reduced by a buffer of native sod. When native sod is placed on soil it represents a plant community. The native sod can therefore not only physically suppress the *C. arvensis* rhizomes and emerging shoots, but may also be able to out-compete new *C. arvensis* shoots for nutrients, water, sunlight, and space. The low water sod treatments were effective at suppressing new *C. arvensis* shoots without supplemental irrigation. This demonstrates that native sod may be a more sustainable choice for residential lawns.

The results from the high water treatments in both the sod and bare-ground control plots indicate that supplemental irrigation reduces the overall density and spread of *C. arvensis*. This may be due to the additional water contributing to the rapid establishment of the native sod, increasing the sods ability to compete for resources and thus possibly out-compete the *C. arvensis*. Percent cover observations suggest that, under the high water treatment, the native sod propagated by both rhizomes and seeds into the control plots and internal hexagon, further suppressing *C. arvensis* propagules. The low water treatments indicate less native sod percent cover change, however the native sod was still able to establish and persist without supplemental irrigation.

Publications

Not available at this time as the data are still being analyzed. We do, however, plan to present this study at the International Weed Science Meeting in Vancouver in summer 2008, and this research will also be included in Jennifer Stark's Master's thesis.

Literature Cited

- Hernandez, P. (2004) Rural Residential Development in the Greater Yellowstone: Rates, Drivers, and Alternative Future Scenarios. Montana State University. Available Online: http://www.montana.edu/etd/available/unrestricted/Hernandez_04.pdf
- Johnson, J. and Maxwell, B. (2001) "The role of the Conservation Reserve Program in controlling rural residential development." *Journal of Rural Studies* Vol. 17, No. 3, pg. 323-332
- Pimental, D., Lach, L., Zuniga, R., and Morrison, D. (1999). Environmental and Economic Costs Associated with Non-indigenous Species in the United States. Cornell University College of Agriculture and Life Sciences.
- Wilcox, B. & Murphey, D. (1985). Conservation Strategy: The Effects of Fragmentation on Extinction. *American Naturalist*, Vol. 125, No. 6. 879-887.

Products

Not available at this time.

Long-Term Goals and Continued Progress of Research

Data was collected for two field seasons, 2006 and 2007, with 2006 mainly devoted to initial plant establishment. Data will be collected for a third, 2008, field season and integrated into a series of spatial distribution maps which will further quantify spread and abundance of *C. arvensis* and *P. pratensis* in high and low water environments. Furthermore, change in native sod percent cover will be observed for this third field season to confirm the establishment success of native sod under the different water conditions. A long-term objective- to help reduce the use of non-indigenous plants in the residential landscape- is to demonstrate the benefits of native sod and how it can act as an example of an aesthetically pleasing practical landscape product that people may want to use as an alternative to *P. pratensis*. Future project results will be shared directly with landowners, managers, consultants, and developers. The product of this research will be master's thesis manuscript, data to support future funding, a presentation of the results to the Western Weed Science Society in Vancouver 2008, and peer-reviewed publication.

Benefits of Seed Money

The seed money has been vital in initiating this project and obtaining preliminary data concerned with weed suppression and native sod, which is part of an on-going Montana State University Project funded by the California Department of Transportation. We believe the seed money also aided with Jennifer Stark being awarded a fellowship by the Western Transportation Institute to fund two full years of graduate study.

Advancing this Research

This research could be advanced by enlarging its' scale in both plot size, longevity of time, and species. Additional funding to expand the number of non-indigenous species evaluated would provide more insight into the full suppression potential of native sod. If successful, native sod could be planted as a buffer zone adjacent to natural systems and reduce the spread of non-indigenous species into such areas.

Website

Not available at this time.

Budget

The original budget

	Requested	Spent
Salary and benefits	3433.00	3041.41
Contracted Services	230.00	230.00
Supplies	1087.00	1717.49
Rent	250.00	0.00
Total	5000.00	4988.90

We would like to request a budget change. Overall we underspent by approximately 11% in the salaries category and did not spend the rent category, but overspent in the supplies. A major reason for this deviation from the original budget was that Western Transportation Institute granted a Fellowship to Jennifer Stark which covers her salary and tuition but not supplies. It was therefore necessary to still use most of the salary category for undergraduate labor (as planned) but spend some extra in supplies to purchase the native sod for her experiment. We hope this is acceptable.