

Integrated Pest Management

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What is Integrated Pest Management (IPM)?

The City of Boulder’s IPM policy defines IPM as a decision-making process which selects, integrates, and implements pest control strategies to prevent or control pest populations. Integrated Pest Management uses a "whole systems approach," looking at the target species as it relates to the entire ecosystem. In choosing control strategies, minimal impacts to human health, the environment, and non-target organisms are considered.

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Citywide Overview of IPM in Boulder

The purpose of this report is to provide an overview of the City of Boulder's Integrated Pest Management (IPM) program and an update on current city activities. This is the first comprehensive report of the IPM program since 2006. This report will provide a baseline for evaluation of the city's IPM goals in future years, when annual reports will be released regularly. It also provides a heads up for IPM-related projects or plans in the coming year.

Highlights from 2011 include:

- 90 percent of IPM-related city staff hours were spent on non-synthetic chemical methods.
- The turf program has not used synthetic pesticides since 1999 and will be piloting an organic program at six parks in 2012, which will use only organic fertilizers.
- 99 percent of Parks and Recreation and Public Works departments' staff time was spent on non-chemical maintenance of landscaped beds in parks, street medians, bikeways and creek corridors.
- Management of natural lands included the use of goats for control of noxious weeds at Boulder Reservoir; a large-scale volunteer project, which used hand-digging for Mediterranean sage over an area of 2000 acres; and restoration projects

The city has established the goal of becoming a nationwide environmental leader among communities and a role model for exemplary environmental practices. Environmental priorities set by the city include reducing pesticide use, reducing waste and over-use of resources by promoting re-use and recycling, reducing greenhouse gas emissions, promoting energy efficiency and water conservation, continuing our strong leadership in preserving native plant and wildlife habitat, and strengthening our efforts to improve air and water quality.

2010 Boulder Valley Comprehensive Plan

involving removal of invasive trees and replanting with native tree varieties.

Why does the city use IPM?

The City of Boulder has been a leader in IPM practices and pesticide reduction for many years. The goals of the IPM program are to manage pest issues on city-owned properties and maintain these properties to the highest quality possible, while also providing a safe and healthy environment for community members and protecting the environment. IPM is an effective approach to help the city achieve and balance these goals.

The city assumes that all pesticides are *potentially* hazardous to human and environmental health. In the last 50 years, scientific studies have increasingly shown that

What is a pesticide?

The Environmental Protection Agency defines pesticides as "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses. Though often misunderstood to refer only to *insecticides*, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests."

many pesticides are linked to a number of serious human health issues including cancer, reproductive and fertility problems, disruption of hormonal systems, autoimmune diseases, cognitive issues and other health problems. Due to human health concerns, as well as environmental concerns and the potential adverse impacts on non-target organisms, reduction and/or elimination of pesticides is the foundation of Boulder's IPM program. However, IPM also provides many other benefits besides pesticide reduction.

Prevention of pest problems is the basis of a sound IPM program. This requires a knowledge of the environment and the pest and its life cycle so that steps can be taken to disrupt food, shelter or habitat to keep the pest below an acceptable threshold. As an example, taking steps to grow healthy turf by proper irrigation and mowing height, grass variety selection, aeration and fertilization can crowd out pest weeds and establish an environment favorable to grass and less favorable to weeds. This reduces or eliminates the need for pesticides, but also produces healthy, beautiful turf that is sustainable and requires few inputs, including lower water requirements.

IPM relies on a combination of knowledge and common sense. The earlier a pest problem is identified and preventive steps are taken, the less likely it is to become a serious issue at a later time and the more potential there is for long-term cost saving.

Steps in the IPM process

The City of Boulder follows a step-wise progression for treating pest issues, with the use of pesticides, both synthetic and natural products, being a last resort. The pest is first assessed. For example, noxious weeds on natural lands are mapped and the location and density is recorded. Next, a threshold is established. For many pests, tolerance for pests can be fairly high. But in some cases, laws and regulations may require zero tolerance. An example is the Colorado State Noxious Weed Act, that requires the [eradication of specific weeds](#). This law not only applies to public lands, but to privately-owned lands as well. In this case, the threshold is set by legal requirements which mandate that action be taken whenever specific weeds are present. But in most cases, thresholds are set based on maintenance priorities for specific sites. Broadleaf weeds, such as dandelions, are tolerated at higher levels in general-use park

grass than on athletic fields, for example. If the threshold is exceeded and treatment of the pest is necessary, the [city's IPM Policy](#) directs staff to follow this hierarchy of actions for addressing pest issues:

- **Prevention** is the first and most important step in the IPM program. Prevention can occur at either the design or management stage. Examples of prevention are sealing cracks and holes to prevent mice from entering a building or using seed-free mulch or soil to prevent weeds from invading.
- **Cultural control** is a broad set of management techniques that manipulate the environment to make it less favorable to pests. Examples of cultural control include vegetation management such as mulching, aeration and pruning, or sanitation to clean or remove a source of pest infestation.
- **Mechanical control** is the physical control of pest populations. This can be done by hand or with equipment. Examples include weed-whipping, hand-pulling weeds or removing insects or insect eggs by hand.
- **Biological control** utilizes natural enemies to control pests through either an introduction of natural enemies or providing harborage for natural enemies. Examples of biological control include release of ladybird beetles for control of aphids or the use of wasps in sewer tunnels that parasitize cockroach egg cases.
- **Chemical control** of pests is the last resort used by the city when all other methods have failed or are cost prohibitive. When chemicals are applied, products may only be used if they are on the city's prescreened Approved Pesticide List or

follow interim guidelines that were put in place in 2011, while the pesticide approval process was evaluated. The method and timing of any treatment must give consideration to protecting human health, non-target organisms, water quality and the environment. In almost all cases, spot treatments or hand application to cut stems or stumps are the methods used for chemical applications.

Outcome of IPM Policy

From the time Boulder's first IPM policy was adopted in 1993, significant pesticide reduction has occurred across all city departments. Applying the principles of the city's IPM policy has resulted in the majority of staff time being used for non-chemical management of pests. Successful IPM utilizes a variety of control measures to prevent a pest from becoming adapted to a particular method. Staff uses a variety of control methods, some of which include hand-pulling and mowing weeds, goat grazing, insect pheromone traps and repellents, revegetation, and as a last resort, the targeted application of pre-screened pesticides.

The following sections provide details about specific areas of pest management, highlights successes and approaches used by staff and gives examples of goals and projects that are planned for future years.



Youth volunteers hand pulling Scotch thistle at Settler's Park.

IPM in Turf

The City of Boulder has over 1,000 acres of irrigated turf including high-use areas such as sports fields, open active and passive areas in parks, and landscaped areas around public facilities and street medians. The Parks and Recreation Department manages the majority of these turf areas, while the Public Works Department is responsible for street medians and some smaller pocket parks.



Pleasant View sports field, summer 2011

The level of care for each area is based upon the type of use the area receives and its location. For example, rented sports field user groups demand safe, good quality turf, while turf located on medians requires less intense management. All City of Boulder turf areas are managed through IPM practices.

Managing Turf Using Best Practices

No synthetic pesticides have been applied to any city turf areas since 1999. A drought in 2002 forced water managers to limit water to all customers, including publicly managed areas. Due to lack of sufficient irrigation during this period, many turf areas became dormant or died; weed species that are more adapted to drought conditions infested turf areas. Due to no pesticide use and limited resources over subsequent years, many turf areas became heavily infested with undesirable grasses and broadleaf weeds such as dandelions and clover. In the areas that have received more intensive management such as athletic fields and other high-use areas, weeds

are not present to the extent seen in some general parks turf.

Current cultural practices used to manage the turf areas include:

- Proper irrigation, including plant-appropriate water schedules and good coverage
- Mowing one to two times per week
- Annual core aeration (more frequent in high-use areas)
- Leaving grass clippings after mowing to return nitrogen and other nutrients to the soil
- Annual fertilization
- Fertilization programs based on soil samples in some areas
- Top-dressing with organic matter, such as compost

Grass is typically mowed at three inches in height to encourage root growth and to block sunlight to competing weeds. An exception is sports turf where lower grass height is required. Mower blades are maintained frequently. Sharp blades prevent tearing and

Pilot Parks for Organic Turfcare

In 2010, the city partnered with the University of Colorado (CU) for training with a nationally recognized expert on organic turf care, Chip Osborne, of Osborne Organics. Working with Mr. Osborne, Parks staff identified six park areas and facilities to be part of a pilot program to develop organically-managed landscaped areas. The sites that were chosen had soil samples taken in 2011. In 2012, staff will begin an organic fertilization program for the turf areas and will document results. Parks staff will continue to partner with CU staff in organic turfcare practices and share information and resources.

The pilot park areas are:

- The Downtown Municipal Complex (this site has been 100% organic since 2010)
- Greenleaf Park
- Shanahan Ridge Park
- Columbine Park
- Foothills Community Park
- Stazio Sports Fields 3 and 4



Clover patch at Greenleaf Park that will be addressed through the organic pilot program in 2012. Soil testing was conducted and a treatment plan was developed specifically for this site.

damage to grass leaves, which can increase the risk of disease.

Irrigation and Turf Refurbishment

All managed turf areas need proper irrigation in the arid Boulder climate. The Parks and Recreation Department uses environmental management approaches when developing new parks or refurbishing existing parks including riparian area enhancement, increased water conservation, and the use of plant material that



is most adapted to the climate. As part of the Parks and Recreation Capital Improvement Project (CIP) and Repair and Restoration (R&R) programs, funds are dedicated to sustainable development and refurbishment of park areas. In addition, as part of a three-year CIP, the Parks and Recreation Department is installing a state-of-the-art soil moisture irrigation controller system at all properties. Both the Public Works and Parks and Recreation departments have adopted the use of water efficient irrigation system components. The City of Boulder Water Conservation Office has partnered with both departments to support and provide funding for water conservation efforts.

Components of the CIP and R&R programs include expanding natural areas to increase wildlife habitat and natural lands benefits; highly efficient irrigation systems; increased soil fertility by adding organic material; use of new turf species that handle high traffic and use less water; and increased use of low-

maintenance, four-season, low-water landscape bed areas.

New Products and Approaches

Turf managers in the city have a high level of landscape management training and attend turf-related conferences regularly. Staff continually looks for new environmentally-sound products that will promote healthy organic turf in the future.

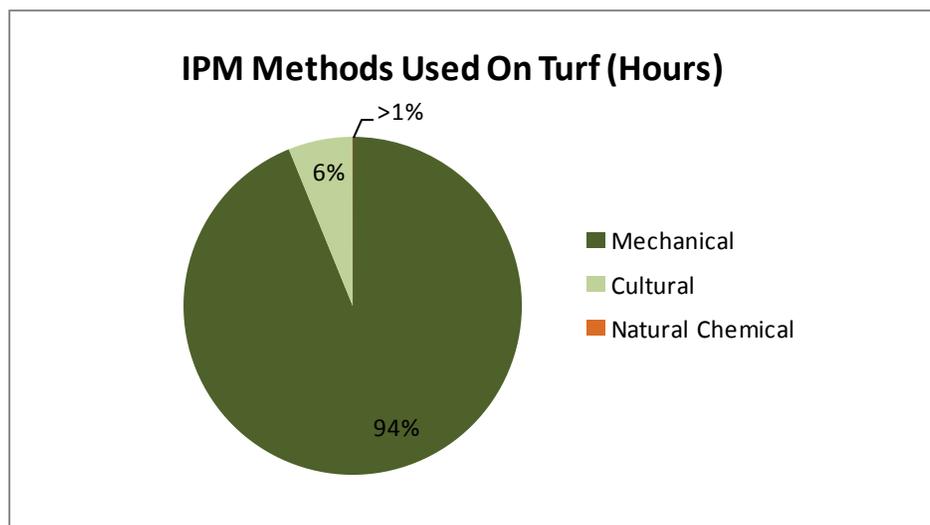
In 2011, a new natural herbicide product that targets broadleaf weeds in turf and is registered in Canada became available for use in the United States. This product, Fiesta, is a bio-herbicide with chelated iron as the active ingredient. Parks staff conducted limited testing of Fiesta in 2011 with inconclusive results. Parks staff is consulting with a research scientist for further testing of Fiesta in 2012 and will continue gathering data to determine the effectiveness of this product in Boulder's climate.

New Turf Garden Demonstration Project

New turf varieties are constantly being developed and evaluated by the National Turfgrass Evaluation Program (NTEP) and university researchers. City staff have tested different varieties over the years for use in both natural land development/refurbishment and in managed turf areas. The City of Boulder Water Conservation Office is partnering with the Parks and Recreation Department in the development of a Low-Water Turf Demonstration Garden at the East Boulder Community Center. The Turf Garden was planted in Fall 2011 with various turf varieties and irrigation systems in order to educate members of the community. Because these varieties are adapted to the climate of Boulder and the irrigation systems provide excellent coverage, natural management without the use of pesticides is easier to achieve. There will be a grand-opening of the Turf Demonstration Garden in July 2012.

Data

Synthetic pesticides are not used on turf areas. Fiesta concentrate (44 ounces) was tested on limited areas of the Municipal Complex in 2011. Mechanical control includes mowing and turf maintenance. Cultural control includes activities such as fertilization, aeration and top-dressing.



Next Steps — Turf

Continuing to create healthy and safe places for active and passive recreation and leisure activities is the overarching goal for turf managers. Since pesticides have not been used on city turf areas for over 10 years, turf managers are working to improve the quality of the turf using Best Management Practices that are inline with the city's IPM policies and goals.

In 2012, 100 percent organic turfcare will be piloted in five parks and facilities — organic care will continue at the Downtown Municipal Complex area. The organic fertilization program combined with increased cultural practices will be evaluated with periodic soil samples and weed inventories of the six park sites. As organic programs are focused on creating proper soils to promote plant health, it is anticipated that this program will continue for a number of years in order to determine if the desired results are achieved.

Staff will also be creating test plots to continue the evaluation of the natural herbicide, Fiesta, to determine its effectiveness for killing broadleaf weeds in turf.

Through the voter-approved 2011 Capital Improvement Bond, the Parks and Recreation Department received \$3.7 million dollars to address critical deficiencies within parks and recreation facilities, which include renovation of several park landscaping and irrigation systems. Approximately \$1.3 million dollars will be dedicated to the refurbishment of landscapes and irrigation systems in parks. Landscaping and irrigation renovations will reduce water use, improve system efficiencies and lower maintenance frequencies for the parks.

Through the voter-approved 2011 Capital Improvement Bond, the Public Works Department received \$1.0 million dollars to renovate the landscaping and irrigation systems along Foothills Parkway/US 157. Landscaping and irrigation renovations will reduce water use, improve system efficiencies and lower maintenance frequencies for this area.

IPM in Horticulture



The City of Boulder Parks and Recreation and Public Works departments maintain over 400 landscaped beds in parks, street medians and bikeways. These beds include shrubs, perennial flowers, annual flower beds or a mix of all three. Public Works is also responsible for maintenance of the city's creek corridors — the Greenways system.

Before the drought of 2002, the parks were filled with thousands of beautiful, annual flower beds. Since the drought, the city has developed a progressive philosophy of creating low maintenance, low-water, four-season, shrub and perennial beds that can be more easily maintained and potentially adopted by community members.

Landscape Bed Maintenance and IPM Practices

The City of Boulder uses IPM techniques to maintain all landscape beds on city property. As parks and medians are refurbished or developed, appropriate areas are identified for a landscaped bed, organic material is added to the soil, and proper plant combinations are

chosen for year-round aesthetic impact, easy maintenance and minimal water usage.

The most challenging horticultural issue is managing weeds, which the city addresses predominantly through non-chemical means. Preventive measures include sealing cracks in asphalt and concrete, ensuring compost used for soil amendments is weed-free, purchasing plant material from quality wholesalers with guarantees that their planting mixes are free of weeds, and using weed cloth and mulch.



Volunteer-maintained bed at Meadow Glen Park, demonstrating proper plant choice.



Garden-In-A-Box Demonstration

The Parks and Recreation department has partnered with the Center for ReSource Conservation and the City of Boulder Water Conservation Office to provide water-wise demonstration gardens for the community.

The Center for ReSource Conservation developed the Garden-In-A-Box program that provides homeowners a water-wise, affordable, and practical option for landscaping. The Parks and Recreation department's Garden-in-a-Box demonstration gardens give the homeowner a chance to view some of these gardens before purchasing and planting them at their homes. "The Big Easy" is located at the North Boulder Recreation

Center (3170 North Broadway) and is bright and bold with lots of yellow flowers. At the East Boulder Recreation Center (5660 Sioux Drive), "Cool Connections" is a celebration of purples and pinks for a more calming experience. The newest Garden-in-a-Box designed by Jim Knopf, a local xeriscape expert, is located at the entry of Chautauqua Park at Baseline Road and Grant Street.

In addition to showing homeowners correct plant selection for our climate and exciting new plant combinations, the demonstration gardens have highly efficient drip irrigation systems that deliver water to plants directly to their roots. These irrigation systems are easy to install. For more information about these systems, call the City of Boulder Water Conservation Office at 303-413-7407, or visit their Web site at www.bouldersaveswater.net.

For more information about the Garden-In-A-Box Program, call the Center for ReSource Conservation at 303-441-3278.

City staff, volunteers and members of work programs mechanically control the majority of weeds by hand-pulling or string-trimming before the weeds produce seeds. Natural products are also used in some areas. Natural herbicides, made of ingredients such as vinegar or citrus oil, are referred to as "burn-down" products. They are most effective on young weed plants and often only kill the above-ground portion of the weed, which then regrows from its roots. This requires repeated applications throughout the season. The city also uses torches to burn weeds in asphalt, concrete and crusher fine beds. Occasionally, staff uses glyphosate, a synthetic herbicide, for spot spraying of weeds. During the 2011 season, Round-Up™, which contains the active ingredient glyphosate, was not used in parks or street medians, due to toxicity and health concerns related to an adjuvant ingredient in the product. Staff is evaluating glyphosate products with less toxic adjuvants, to decrease toxicity if glyphosate is used.

Volunteers and Work Programs

The city relies on volunteers for the many hours of hand-pulling that are required to maintain the city's landscaped beds with minimal pesticide use. Boulder City Improvement Association 2 (BCIA2), a proactive volunteer group, is an important partner with the city for maintenance of park landscaped areas. BCIA2 has donated flowers; watered 37 pots in the downtown area throughout the summer of 2008; and is a partner in the annual Community Clean-Up Day, which attracts between 400-600 volunteers each year. Close to 300 people volunteered in 2011 through the Parks and Recreation Department's Adopt-a-Park and Adopt-a-Flower Bed programs.

Since 2006, the city Open Space and Mountain Parks, Public Works and Parks and Recreation departments have contracted a Boulder County Sheriff's Work Crew. This crew has been integral to the success of weed management in

many of the city's high-use areas. Individuals from court-ordered community service programs also assist in park maintenance.

Due to the cost of work programs, it is becoming more important to recruit increasing numbers of volunteers to assist with hand removal of weeds. The city will be exploring opportunities to interest residents in assisting with hand-pulling, as well as ways to encourage volunteers to stay involved once they join a program.



Pearl Street Mall

The annual and perennial flower plantings on the Pearl Street Mall help contribute to the economic success of downtown Boulder by providing a welcoming and beautiful place to visit. The spring tulip blooms bring visitors from all over the United States and are paired with locally-grown pansies to provide a spectacular display. When the spring blooming tulips are removed, staff adds amendments to the soil and plants annual flowers in the majority of the beds. The raised beds have recently been changed into perennial beds planted with many *Plant Select* flowers that have proven to be successful in this climate. All of the beds have been maintained without herbicides for over 10 years and since 2009, only natural fertilizers have been used to ensure plant health. Beginning in 2013, the Parks and Recreation Department will be refurbishing the irrigation system on the Pearl Street Mall and during that process, the soils in each bed will be evaluated and may be replaced with clean weed-free soils if deemed necessary. The efficiency of the improved irrigation system will provide more plant-specific water allotments that will increase plant vigor.

Medians and Bikeways

The Transportation Maintenance workgroup of the Public Works Department is responsible

for median and bikeway maintenance and more than 125 acres of landscaped and hardscaped surfaces, with the exception of the Boulder Creek path, which is maintained by the Parks and Recreation Department. Major tasks include mowing, vegetation control, pruning and trash removal.

Throughout the year, maintenance occurs to improve of the overall appearance of medians and rights-of-way. Most medians are mowed by a contractor every other week during the season, while the Transportation Maintenance workgroup is responsible for pruning, cleaning, mulching and rock installation as well as hand-weeding and mechanical control of weeds.

The Bikeways Maintenance team focuses more on safety and pruning of vegetation, overhanging branches and mowing of native grasses, which grow alongside the bikeways. The bikeways include several underpass areas which are landscaped and require weeding and occasional pruning of shrubs.

Preventive measures such as weed cloth, sealing cracks, mulching and efficient irrigation systems are used to discourage weed growth. Mechanical control of weeds is the predominant method used for these areas. During 2010, almost no synthetic herbicide

was applied. During 2011, mechanical control and the natural herbicide Nature's Avenger were used during most of the season for weed control. By August of 2011, weeds had become too plentiful in some areas and limited spot spraying with glyphosate was done on approximately 10 percent of medians. Therefore, 90 percent of medians had no chemical treatments for two years. Most of the sites that did receive glyphosate treatments were non-pedestrian areas.

Greenways

The city's Greenways system is comprised of the riparian corridors of Boulder Creek and 14 of its tributaries. Unlike other IPM programs within the city, Greenways corridors don't have distinct boundaries. The Greenways crew works with other city departments, public agencies and private landowners to manage the shared areas along the Greenways trails with the primary focus of improving the quality of riparian habitat.



Youth Core volunteers working on a wetland at Pleasant View.

For several years, all Greenways weed management was done exclusively by mechanical means. During 2011, after careful consideration, several infestations of a new invasive weed to the region, Japanese knotweed (*Fallopia japonica*), were treated by cutting and removing the aerial portions of the weed to one to two inches tall and then injecting the cut stems with a synthetic herbicide glyphosate to kill the extensive underground rhizome system of the weed.

Japanese knotweed is a threat to flood control and structures such as retaining walls, sidewalks, streets and building foundations and was designated by the State of Colorado for eradication in 2011. Due to the requirement for eradication and destructive potential for Japanese knotweed, the city will be developing a long-term policy for control of this weed, while protecting the fragile habitat and water quality of the riparian system.



A greenways crew member cuts and removes each Japanese knotweed stem in this large stand, before injecting the stem with glyphosate.

Data

The only synthetic herbicide used in the horticulture programs for urban parks, street medians and bikeways and the Greenways system was glyphosate.

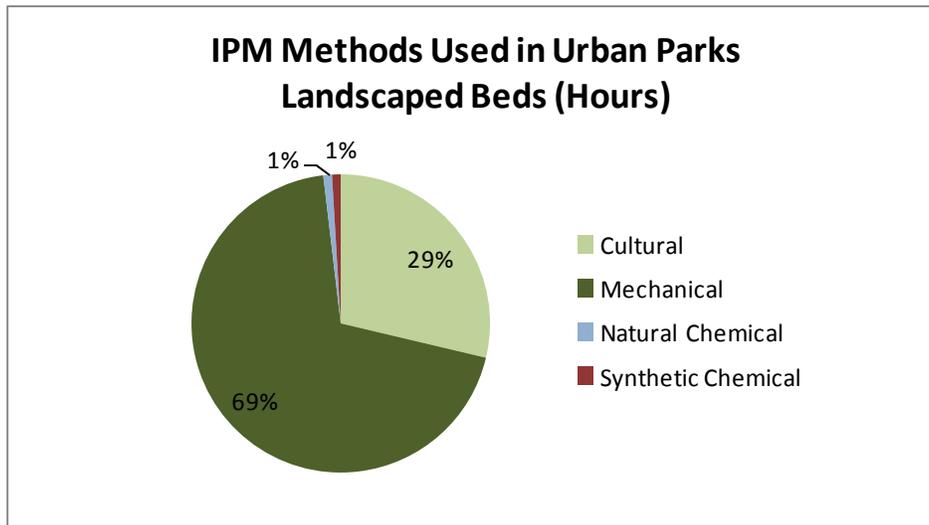
Pesticides Used in Landscaped Horticultural Areas

Key: Synthetic Product Natural Product

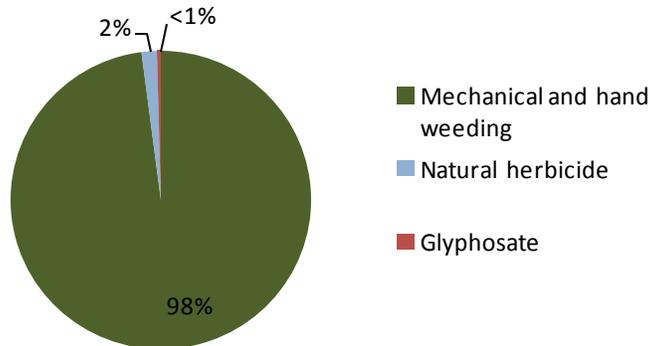
Pesticide	Target Pest	Amount Applied		
		Urban Parks	Street Medians and Bikeways	Greenways
Glyphosate	Weeds	40.5 pounds	10 pounds	8 pounds
Ropel	Voles (repellent)	11.5 gallons		
Nature's Avenger	Weeds	36.25 gallons	0.8 gallons	0.2 gallons
20% Vinegar	Weeds	0.75 gallons		
Perfectly Natural	Weeds	1.0 gallons		
Moleout Liquid	Voles (repellent)	3 gallons		
Moleout granules	Voles (repellent)	15 pounds		

Note: Glyphosate is displayed in pounds of active ingredient since amounts may vary among brands. Natural products are reported as volume of concentrated product.

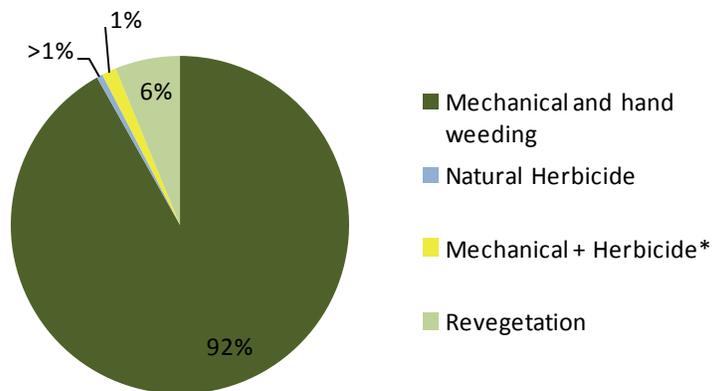
Mechanical methods used in horticultural areas included hand-pulling and weed-whipping. Cultural methods include activities such as mulching, reseeding, pruning and replanting. Several natural products were tested that are included in the table above. Synthetic products used were glyphosate for weed control and Ropel, a bitter compound, to repel voles. The majority — 99 percent — of all staff time did not involve synthetic chemical application and relied on other methods for weed control and maintenance of landscaped areas.



IPM Methods Used on Street Medians and Bikeways (Hours)



IPM Methods Used on Greenways (Hours)



*Japanese knotweed treatments, where approximately 60% of the time was spent on mechanical removal and 40% on injection of herbicide into cut stems.

Next Steps — Horticulture

Continue to promote volunteerism through the Adopt-a-Bed and Adopt-a-Park programs, volunteer events and volunteer recruitment, along and expanding the work programs already in place with Boulder County Jail and the Bridge House Ready-to-Work Crew.

Continue to identify and evaluate newly developed natural products for more effective weed control.

Identify park areas that can be enhanced by the removal of older, difficult-to-maintain, diseased ornamental beds with new installations of low-water, four-season, low-maintenance shrub and flower beds that may be adopted by neighbors or other organizations. Use proper design and plant choice to decrease maintenance requirements, increase the beauty of the beds and park areas, and provide examples of successful plantings that homeowners can try in their yards.

IPM in Forestry



The Urban Forestry workgroup maintains approximately 26,000 street trees and 10,000 park trees with a total value of approximately \$69 million. The urban forest is one of the few city infrastructure assets that appreciates in value over time. Urban

trees contribute to reductions in greenhouse gases and other air pollutants, improve water quality, reduce stormwater runoff, provide energy savings through shading surfaces, increase real estate values and extend the life of paved surfaces. In addition, trees provide habitat for wildlife and a welcoming and beautiful urban environment.

Monitoring

The greatest threat to urban forests is from introduced tree insect pests and diseases with the potential for massive ecological and economic damage. Examples across the United States include emerald ash borer, Asian longhorned beetle, *Sirex* woodwasp, gypsy moth, Japanese beetle and sudden oak death disease. The best defense against these pests is early detection and eradication. City Forestry staff works closely with the Colorado State Forest Service, Colorado State University (CSU), Animal and Plant Health Inspections Services (APHIS), Colorado Department of Agriculture, Boulder County and other municipalities to monitor for introduced pests, including trapping for emerald ash borer, Japanese beetle and gypsy moth. Staff is also coordinating with CSU to investigate red oak drippy blight, *Brennaria quercina*, suspected

in declines in both street and park red oak trees, and Thousand Cankers disease of black walnut trees.

Forestry staff also closely monitors native pest issues in urban trees. When trees are attacked and decline from mountain pine beetle, ips beetle and red turpentine beetle, it requires prompt removal of the tree. Monitoring for these insects and a rapid response can prevent larger scale infestations.



Red oak drippy blight, a bacterial condition, that is suspected in the decline and death of some red oak trees in Central Park.

Mechanical Control

Tree removal is a primary IPM strategy to eradicate introduced pests before they become established. City staff removes diseased public trees promptly. City code also allows enforcement of the removal of diseased trees on private property. Since 2003, staff has removed or enforced removal of over 1,300 black walnuts in the City of Boulder with Thousand Cankers disease. This disease was discovered by Boulder's Urban Forestry and identified by a pathologist at CSU. Although black walnut in Boulder comprises less than one percent of the total tree canopy, the black walnut is a valuable tree and an important industry in the US. Staff has worked closely with CSU on this issue since 2005 and has lead over ten tours in Boulder to train local, state and federal personnel on symptoms, diagnosis

and management. In 2011, Forestry removed 11 diseased black walnuts due to Thousand Cankers disease on public property and enforced removal of 52 black walnuts and one American elm with Dutch elm disease on private property.

Forestry uses pheromone traps in the Civic Center Plaza for the lilac/ash borer. Traditionally pheromone traps for this insect have been used as a monitoring tool to determine optimal timing for pesticide applications. Forestry, however, uses these traps as a mechanical control to reduce the number of pests, which has been effective at reducing damage.

Cultural Control

Cultural control methods used to care for trees include, mulching, fertilization, watering, pruning and planting. Forestry staff does not typically fertilize specifically for trees, although trees will be fertilized if testing shows deficiencies. Forestry staff tank waters several hundred trees up to three times a month during the warm months.



An accidentally introduced pest from eastern Russia and Asia, the emerald ash borer has already invaded 14 states and killed up to 100 million ash trees. As it spreads across the country, it could potentially kill billions of ash trees. Though not yet in Colorado, Forestry is monitoring for its presence. If the emerald ash borer is seen locally, it needs to be reported to the City of Boulder Forestry.

Pheromones for mountain pine beetles

Verbenone is a pheromone produced by mountain pine beetles. When mountain pine beetles first infest a tree, verbenone is released to recruit other beetles for mating and a mass attack of the tree occurs to overwhelm its defenses. Once the beetles become crowded and increasing amounts of verbenone are released, it has an opposite effect and repels new beetles from coming to the tree. In theory, the repellent nature of high concentrations of verbenone can be exploited by placing sources of it on pine trees to trick pine beetles into perceiving that large numbers of other beetles have already infested the tree. During the 2011 season, pouches of verbenone were placed in the Scotch and Austrian pine trees at Keewaydin Park and Pearl Street Mall. Results were inconclusive since mountain beetle populations were lower than the previous season and pine beetle infestations were low in nearby neighborhoods.

Chemical Control

Pesticides are considered only when the health of high-value trees is threatened, alternatives are not available or feasible, and low toxicity products such as insecticidal soap or essential oils are not effective. Pesticide application will be considered only if soil or trunk injection can be used, which limits exposure to humans and other non-target organisms. Aerial spraying tree applications are only used for alternative products, such as soaps and oils and the occasional use of low-risk products such as spinosad (derived from soil bacterium).

Pesticide applications to trees are not routine. Only when thresholds of insects have reached the point where damage is likely to occur to the tree, will the tree be treated. No applications took place in 2008 and 2009, and only 23 oaks in the Municipal Complex, which were in danger of dying, were treated in 2010.

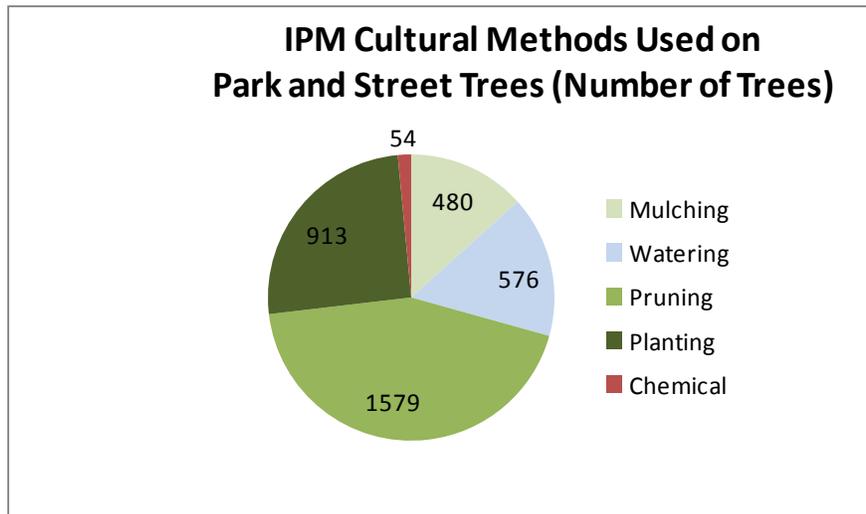
Resistance to pesticides by scale insects, a problem in other Colorado communities, has been delayed in Boulder by limiting trunk and soil injections and delaying re-use until pest populations exceed thresholds, which reduces

the odds of resistance to insecticide. Neonicotinoid pesticides (synthetic pesticides based on nicotine) are potentially harmful to pollinators. To protect bees, applications of neonicotinoids are limited to trees that are not primary foraging species for honeybees. When bees are present in diseased trees that must be removed, beekeepers are brought in to relocate the hives before work begins.

Only one pesticide, imidacloprid, was used by Forestry in 2011 and it was applied by either soil (Merit 75 WP) or trunk injections (Ima-Jet) to a total of 54 trees of the 36,000 trees that Forestry staff is responsible for in parks and street rights-of-way. Thirty-five trees were treated for European elm scale and 19 for Kermes scale with trunk or soil injection.

Data

Application Type	Total Amount Imidacloprid	Number of Trees Treated
Trunk Injection	57.8 ounces	49
Soil Injection	3.0 ounces	5



Next Steps — Forestry
 Increase diversity in city tree populations to guard against epidemic insect or disease problems to prevent a potential loss of a large percentage of city’s tree canopy.

Carefully monitor for potential pest problems with the goal of “Early Detection and Rapid Response” to reduce the pest spread, tree mortality and pesticide use.

Develop a template for a community response plan for emerald ash borer. Develop a training program in 2012 for local arborists, foresters, master gardeners, and others on the identification of invasive pests.

Develop a plan with local woodworkers to develop markets for urban wood, so if large losses occur from a tree disease or insect outbreak, markets are available to recycle the wood.

IPM at the Golf Course



The land at Flatirons Golf Course has been owned by the City of Boulder since it was acquired from the First Congregational Church in the late 1920's. The church is still in operation at the corner of Broadway and Pine Street. One of the founders of the church was a farmer, George Chase, who was also a part owner of Howard Ditch. It is speculated that Mr. Chase farmed the land that is now Flatirons with the same water that is currently used to irrigate the golf course. The course designed by golf architect William H. Tucker in 1933, was constructed through Roosevelt's Work Projects Administration program and



opened for play in June of 1938. Over 50,000 rounds are played each year and over 1,000,000 rounds have been played since 1986 when the Parks and Recreation Department took over golf course operations.

IPM Methods

The golf course is a 130-acre property with more than 1,400 trees and 16 flower beds. Some of the beds are designed to attract and feed butterflies and other wildlife. Turf areas consist of 50 acres of fairways and another 33 acres of mostly bluegrass rough, which is not maintained to special golf specific heights or standards. Cultural methods are predominantly used for control of insect, fungal and weed pests. Pest thresholds are similar to urban parks in non-green areas. Broadcast treatments are not used; only individual plants or areas are treated with targeted applications. Growing healthy turf helps to prevent pest problems. Disease-resistant turf varieties are used and soils are regularly tested to assess the nutrient contents of turf grass to determine deficiencies,

so that nutrients can be supplemented only as needed.

The golf course presents unique IPM challenges, since it is a revenue-generating facility and good green quality is required for play. Nevertheless, the golf course is committed to reducing and eliminating chemical use wherever possible and when pesticide products are used, the least toxic options are chosen.

A new irrigation system was installed in 2010 with an increased number of sprinkler heads that reduce the distance most heads throw water. The new system is projected to decrease water and electricity used for watering by up to 39 percent. More efficient watering also grows healthier plants and turf that are more resistant to disease.

Some natural areas are maintained specifically as habitats for wildlife by leaving dead trees for woodpeckers, creating undisturbed brush piles, and preserving eight acres of “no-mow” native areas with long grass for ground-nesting bird species. In addition, bat boxes, swallow shelters and duck houses are installed to provide shelter for wildlife.



Flatirons Golf Course is designated as a "Certified Audubon Cooperative Sanctuary" through the international Audubon Cooperative Sanctuary Program for Golf Courses.

Certification requires the demonstration of a high degree of environmental planning, wildlife and habitat management,



outreach and education, chemical use reduction and safety, water conservation, and water quality management. Recent improvements at the golf course include improving and installing 12 bird boxes and six bat boxes, and completing an irrigation upgrade.

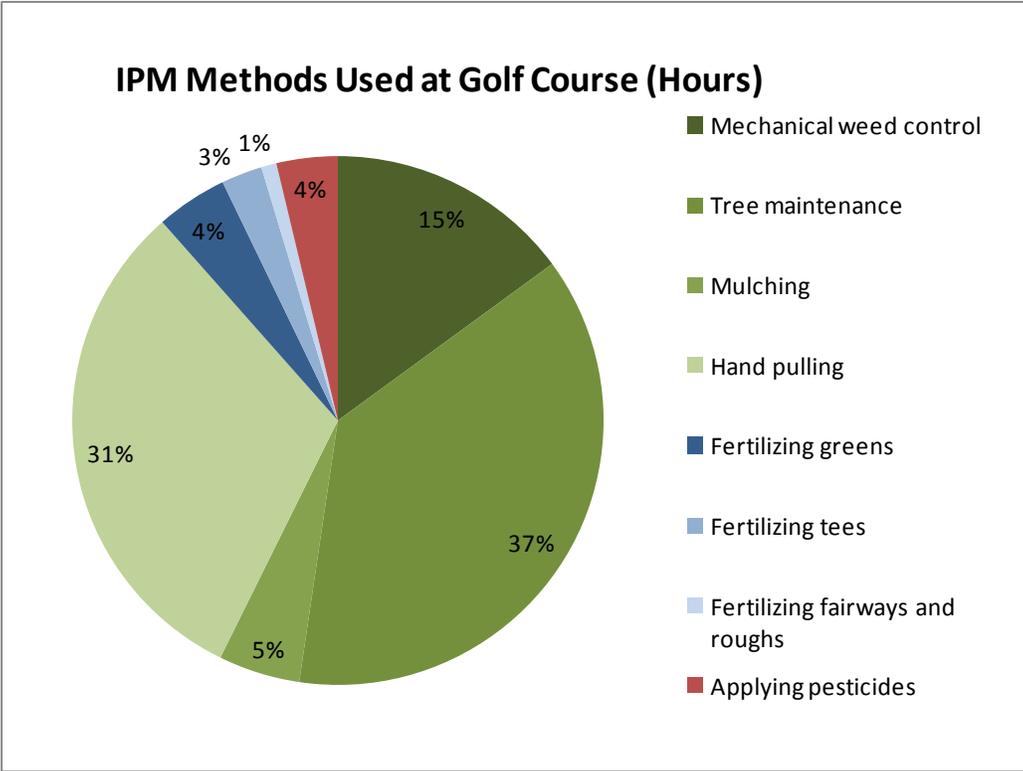
Data

Pesticides Used in Landscaped Horticultural Areas

Key: Herbicide Fungicide

Pesticide	Target Pest	Amount used (pounds of active ingredient)
Chlorothalonil*	Snow mold in greens	6
Propiconazole*	Snow mold in greens	0.9
Fludioxonil*	Snow mold in greens	0.2
Glyphosate	Weeds	20

* One of three active ingredients in Instrata



Next Steps

Develop improved, least-toxic approaches for control of silvery thread moss on greens.

Determine effective, least-toxic methods for control of broadleaf weeds in turf, to provide excellent turf for game play.

Continue certification in Audubon Cooperative Sanctuary program.

IPM of Natural Lands



The natural lands in and around Boulder provide beautiful and scenic areas as well as passive recreation and habitat and protection for wildlife. The Open Space and Mountain Parks (OSMP) Department manages 47,000 acres of native grassland, riparian areas, forest foothill communities and farmland. The Parks and Recreation Department is responsible for natural resource and wildlife management and IPM of approximately 1,000 acres of natural lands. This includes the natural areas of city parks and properties such as the Boulder Reservoir, as well as to-be developed park sites with properties ranging from grasslands and wetlands to riparian areas.

The primary pest issue facing both OSMP and Parks and Recreation is invasive species, particularly noxious weeds. This includes existing pest populations as well as preventing the establishment of new pests. Staff monitor

for the weeds of most concern and then map and track size and density. Best Management Practices are researched and developed for each pest. Chemical treatments are a last resort if other methods are not feasible or are ineffective. Thousands of hours are dedicated to eliminating invasive species using shovels, wrenches and hand tools on natural lands.



Parks and Recreation crew member weed whipping teasel.



Aquatic weed, Eurasian watermilfoil, in Boulder Creek.

More than 50 non-native species have been identified as a threat to the integrity of Boulder’s natural areas, including grass and broadleaf weeds, invasive trees and shrubs, snails and submerged aquatic weeds. Many have been designated by federal and state agencies as noxious species with mandates in place that require control and/or eradication. As invasive species are introduced into the region, new management strategies must be developed in collaboration with local ecologists, ranchers, Front Range resource managers and university scientists.

Biological Control



Utilizing multiple control tactics and management approaches often gives the best results for weed control. For the last 11 years, Parks and Recreation has employed approximately 300 goats to graze natural areas such as the dam faces of the Boulder Reservoir. Goat grazing is effective as a

control for many weeds, particularly noxious weeds that other herbivores, such as cattle, avoid. With proper timing, grazing can deter weeds from going to seed and deplete root system reserves. Goat droppings also recycle organic material back into the soil and goat hooves cultivate the ground, improving water infiltration, aeration and sunlight exposure.

In 2011, OSMP established monitoring to track the effects of cattle and goats in reducing chicory cover in xeric tallgrass communities south of Boulder. Spring cattle grazing is an important component of protecting the natural resource within the South Boulder Creek floodplain. This historical land use keeps species like Canada thistle in check, while maintaining native species richness.

Beneficial insects reared by the Colorado Department of Agriculture can be effective in suppressing certain invasives. Recent release efforts include thousands of weevils that eat the leaves and lay eggs inside the stems of Dalmatian toadflax, a widespread snapdragon-looking weed in Boulder’s grassland and foothill communities. Biological control will not eliminate the target species, but may reduce the weed’s populations below acceptable thresholds.



Mecinus janthinus feeding on toadflax flower.

Restoration and Integrated Weed Management

Invasive species management plays an essential role in most active restoration projects. Often, the initial step in restoring a natural area to a better functioning ecosystem involves exotic species removal.

The reintroduction of native plant species not only promotes better habitat for the native wildlife, but also provides competition for the non-native invaders. Several long-term OSMP riparian restoration projects involve the removal of non-native trees from Boulder and Bluebell creeks and re-planting native species. Parks and Recreation’s restoration efforts include the removal of Russian olive trees, which are replaced with native trees and shrubs, and also reseeding the areas where the removal of weeds has caused ground disturbance. These and other ongoing restoration projects require years of diligent management to ensure the invasive species are kept in check.

Management Using a Combination of Mechanical and Chemical Control



IPM crew member using a chainsaw to cut a Russian olive tree for a cut stump application.

Some pests, particularly invasive trees and shrubs, are most effectively controlled with a combination of mechanical removal and pesticide treatments. A cut stump treatment involves cutting a tree near the ground and applying herbicide to the ring of actively growing tissue (cambium) on the freshly-cut surface.

The majority of time spent on cut stump treatments involves cutting the tree, and in



Cut stump application using a syringe to apply herbicide to the ring of growing tissue of the tree. Blue dye is added to the herbicide to mark where it has been applied.

most situations, removing it from site either by chipping or loading it into a truck. Girdling involves cutting a groove or notch around the tree and applying herbicide to the freshly exposed cambium. In trees that re-sprout, targeted treatments allow the applicator to reduce non-target impacts to the environment by applying a small amount of herbicide to a limited area.

Volunteers

Volunteers and volunteer organizations are vital to the conservation of Boulder’s natural areas. Volunteers spent approximately 2,253 hours working in Boulder’s natural areas on IPM and restoration projects in 2011, with an additional 127 hours from community service and jail crews. Mediterranean sage is an A-list



Volunteers hand-digging Mediterranean sage.

weed requiring mandatory eradication by state statute. Although not found in most of Colorado, it is widespread in north Boulder County on over 2,000 acres. For the last five years, OSMP has been able to control Mediterranean sage without pesticides by hand

digging. This effort requires significant resources, due to the size of the area. Volunteers play a major role in the success of its control and future eradication. Visit the city’s website for information about [volunteer opportunities](#) for natural lands projects.

Protecting Natural Lands from Invasive Weeds

The Colorado Noxious Weed Act requires the control of certain noxious weeds and the eradication of those designated on an [A-list](#). The law applies to publicly owned land and also to private property. Many times, private landowners do not control noxious weeds on their properties, leading to the spread of weeds to public natural lands, which increases the resources that must be expended to control these weeds. Here, a dense stand of an A-listed noxious weed, myrtle spurge, on private property is spreading to neighboring property.



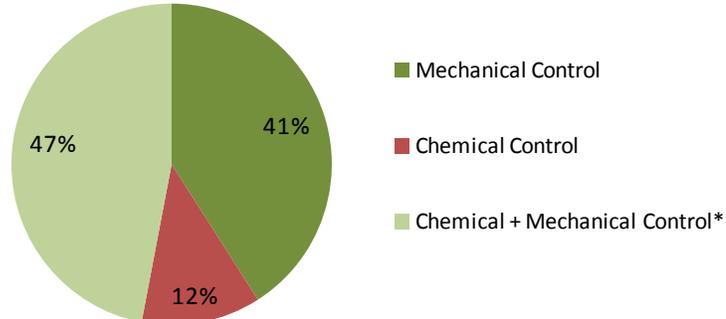
Data

Pesticides Applied to Natural Lands

Key: Synthetic Herbicides Natural Herbicides

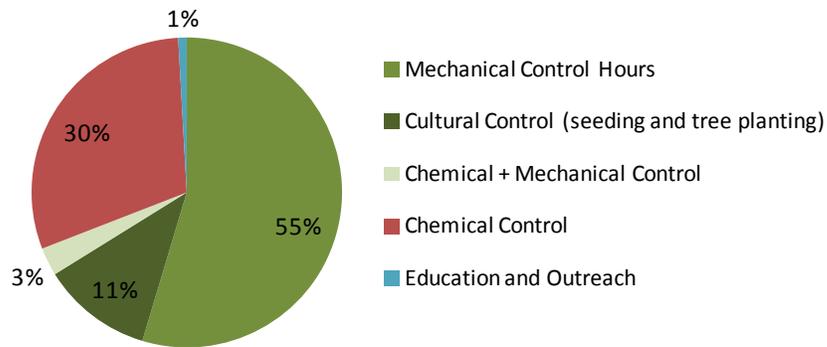
Pesticide	Target Pest	OSMP (Amount applied)	Parks and Recreation (Amount applied)	Total
Aminopyralid	Broadleaf weeds	1.89 lbs	2.14 lbs	4.03 lbs
Chlorsulfuron	Broadleaf weeds		0.053 lbs	0.053 lbs
Clopyralid	Broadleaf weeds	3.69 lbs		3.69 lbs
Glyphosate	Broadleaf and grassy weeds Invasive shrubs and trees	66.62 bs	14.47 lbs	81.08 lbs
Imazapic	Broadleaf weeds	0.006 lbs		0.006 lbs
Mutsulfuron methyl	Broadleaf weeds	0.024 lbs		0.024 lbs
Triclopyr	Invasive trees and shrubs	24.56 lbs		24.56 lbs
Alldown	Broadleaf weeds	1.25 gal		1.25 gal
Nature’s Avenger	Broadleaf weeds	1.25 gal		1.25 gal

Time Spent (Hours) on IPM Methods OSMP



*Time spent on control of invasive trees involved approximately 90% on mechanical removal and 10% on application of herbicide. Cultural controls are not estimated in this chart.

Time Spent (Hours) on IPM Methods Parks and Recreation



Note: Sixteen days of goat grazing is not included.

Next Steps — Natural Lands

Develop strategies to improve informational sharing and project collaboration between all city departments for natural lands management.

Complete a citywide inventory of invasive species with regulations for mandatory control or eradication.

Continue to develop methods to employ cultural and restoration practices to increase habitat conservation.

Develop outreach displays for the Farmers’ Market and more content for the city’s Web site to improve public education and awareness of invasive species and resource conservation.

Evaluate new species added to the Colorado Noxious Weed Act for incorporation into existing priorities and management plans.

IPM of Agricultural Lands



OSMP provides a significant contribution to the agricultural economy of Boulder County. The city charter lists the “preservation of agricultural uses and land suitable for agricultural production” and “preservation of water resources in their natural or traditional state” as OSMP purposes. Current agricultural practices on OSMP lands can accurately be described as a “multi-functional agricultural system.” In addition to agricultural products, agricultural producers provide wildlife habitats that enhance local biodiversity. Semi-native hay fields and the associated agricultural practices support wildlife not commonly found elsewhere on OSMP lands, such as bobolinks and other species that are of conservation concern. The federally threatened Preble’s meadow jumping mouse is present on OSMP land managed for agricultural uses. Irrigated pastures and the ditches that serve them support plant species of concern such as the federally-threatened Ute ladies’-tresses orchid, the locally-sensitive American groundnut and showy prairie gentian. OSMP agricultural lands are also providing landscape amenities that enhance the quality of life in the area.

Agricultural activity in the Boulder Valley helps to maintain a pastoral setting and create unique recreational opportunities for its residents.

Livestock Grazing and Natural Beef Program

OSMP leased 14,300 acres of land for agricultural production in 2011. Livestock grazing was the most widespread use of OSMP agricultural land including native grass pastures and irrigated pastures. A recent survey of livestock producers conducted by OSMP staff



indicated that 60 percent of livestock producers are using livestock production practices that would qualify for a natural beef certification program. This same survey indicated that 33 percent of livestock producers sell certified natural beef animals at the time of sale. These livestock owners produce animals without the use of antibiotics, growth-promoting steroids or medicated feed additives that control bacteria or enhance muscle growth. These animals also cannot ingest any feed that contains animal byproducts. One OSMP beef producer markets all of its animals locally, either to restaurants or to individual, residential customers. Several others market a few of their animals to local residential customers. However, most livestock are sold via traditional livestock auction to the highest bidder.

Cropland Production

The irrigated landscape that is most suitable for forages and crop production is approximately 5,500 acres. Of this, approximately 3,170 acres were actively harvested for hay and crop production. The rest of the irrigated landscape provided irrigated pasture and locally-enhanced environmental conditions including significant wetlands and the State of Colorado Tallgrass Natural Areas.



Hay production was the most widespread use of OSMP irrigated land – using 2,880 acres. Grass hay and grass/alfalfa hay mixtures are the most common crop harvested on OSMP agricultural

land. Most of this hay is not treated with herbicide; although, a significant proportion of this land receives commercial fertilizer applications. Hay as feed for horses has become a significant commodity in the last two decades with the increase in the numbers of rural residential homes where residents keep horses or other animals. Personal communications with local farmers and ranchers has shown that a majority of the hay that is brought to market is purchased by buyers within a 40-60 mile radius of Boulder. Hay that is produced, but not sold, is fed to the producers own livestock.

Alfalfa hay was grown on about 200 acres (part of the 2,880 acres) in 2011. Only about 500 acres of grain crops were grown on OSMP leased lands. The grain crops included 90 acres of corn, 160 acres of dry land wheat and 250 acres of irrigated barley or wheat. Seven acres of OSMP land are currently leased to an organic farmer for the production of locally sold organic vegetables. OSMP is evaluating other agricultural properties that are suitable for organic vegetable production and hopes to offer more lease opportunities in the near future. It is expected that one or two agricultural lease opportunities for organic vegetable production will be offered in 2012.

Integrated Pest Management Practices

There are a variety of cultural practices that are used each year to minimize the amount of pesticides that are used. Common cultural practices include:

- Weeds on fallow acres of dryland wheat/fallow rotations areas are managed by tillage rather than herbicide applications.
- Early cutting of hay crops is sometimes used to avoid the application of pesticides to control alfalfa weevil.
- Well-timed livestock grazing events are scheduled to impact weed populations in irrigated areas that are not cut for hay.
- Crop rotations are utilized to avoid the development of pest resistance.

Alfalfa, corn, barley and wheat receive a majority of the pesticide treatments on OSMP agricultural land. Pesticide treatments for agricultural purposes occurred on about 440 acres or about 8 percent of the irrigated land actively managed for agricultural production.

Alfalfa weevil is an especially troublesome agricultural pest in the Boulder Valley. Economic thresholds of this pest are reached virtually every year in the majority of OSMP alfalfa hay fields. If a field is not selected for an early cutting opportunity, an application of the approved pesticide is typically applied after dandelion bloom and before alfalfa bloom to reduce the potential for impacts to pollinating insects. Irrigated grain crops typically receive one pesticide treatment for annual weeds. Pre-plant, soil-persistent herbicides are not applied to grain crops so that a well-timed application of

the most appropriate herbicide can be made. Insect pests in grain crops are treated on a case-by-case basis as economic threshold criteria dictate.

The Future of OSMP Agriculture

OSMP is in the process of developing an agricultural plan that will describe sustainable agricultural practices on OSMP leased lands. It is expected that this plan will define and formalize the definition of natural beef production on OSMP land, identify agricultural lands most suitable for organic production and create an IPM program specific to agricultural lands. The department is currently conducting analysis to fully identify what will be included in this plan. Part of the analysis will be reviewing pesticide use on agricultural properties and looking for opportunities to minimize the amount and toxicity of pesticides applied to crops.

Data

Pesticides Used on Agricultural Properties

Key: Herbicide Insecticide Fungicide

Active Ingredient (Brand Name)	Crop	Target Pest	Amount Applied (Pounds of Active Ingredient)
Aminopyralid (Milestone)	Grass hay	Canada thistle	4.70
Diflufenzopyr & dicamba (Status)	Corn	Grasses and weeds	7.87 (diflufenzopyr) 20.24 (dicamba)
Fluroxypyr & clopyralid (Widematch)	Barley	Annual weeds	11.47 (fluroxypyr) 11.47 (clopyralid)
Glyphosate (Touchdown)	Wheat	Volunteer rye	103.91
Lambda-cyhalothrin (Warrior II)	Alfalfa Barley	Alfalfa weevil Russian wheat aphid	4.88
Lambda-cyhalothrin (Warrior)	Alfalfa	Alfalfa weevil	0.95
Propiconazole (Tilt)	Barley	Fungal diseases	4.39

IPM of Structures



The city owns 330 structures of many kinds, including office buildings, recreation centers, fire stations, parking structures, storage facilities and leased commercial and residential buildings. At one time or another, most facilities and associated building sites/grounds will likely experience some sort of pest issue, from spiders to rodents. The history of the city's IPM program has focused primarily on outdoor pest issues. When the IPM Task Force met from 2002 through 2006, they reviewed Best Management Practices and the pesticides used by staff and developed recommendations that included site assessment tools and a pesticide screening process, which only applied to outdoor, non-agricultural areas.

Although structural pests are not a major problem in most cases due to Boulder's climate, from the recent assessment of the city's IPM program, it is clear that the city needs to develop a comprehensive structural IPM policy to be uniformly applied across all city facilities. The city is in the process of gathering information about pest issues and needs for different types of facilities and developing interim structural guidelines that will apply to all city staff, tenants and contractors.

In 2011, the city began exploring opportunities for preventive structural IPM actions and also tested a natural product for wasp control. An

insecticide spray containing a botanical ingredient was field tested by Facilities and Assets Management staff with good results and will be used by other departments during 2012.

The most important step for structural IPM is preventing the pest from gaining access to the structure. This applies to insect pests as well as rodents. Weatherization not only helps to prevent pests, but also saves energy and reduces utility bills.

In 2011, the City of Boulder weatherized 47 city buildings totaling over 1.2 million square feet. Weatherization includes such things as re-sealing doors, replacing window strips and caulking, spraying foam insulation in cracks, and insulating bare metal roofs. The effort was part of the city's overall Energy Performance Contract, which is a budget-neutral method of completing energy projects by having energy savings pay for energy improvements over a 15-year period. For the city's weatherization project, the total cost was around \$300,000 with a payback period of 11 years. The work also reduces greenhouse gas emission by 450,000 pounds of carbon dioxide a year with annual utility savings of \$30,000. This program will play an important role in prevention of structural pest problems.

For more information on the city's Energy Performance Contract, visit www.BoulderColorado.gov/publicworks > Projects > Energy Efficiency Upgrades.

Next Steps — Structures

The city is collaborating with University of Colorado facilities staff and Colorado State University Cooperative Extension for the development of a comprehensive structural IPM program, including a manual with Best Management Practices that will direct all staff, contractors and tenants. The interim guidelines will be implemented during 2012 and the comprehensive policy and manual will be in place during 2013.

Summary of Data

The data provided in this report can serve as a baseline for future years. However, it is important to note that although work groups have collected data for their own use, there are differences between programs and collection procedures that need refinement before comparisons can be made between programs. In some cases, not all non-chemical data has yet been collected. For example, at the time of this report, OSMP staff had not tabulated hundreds of hours spent on reseeding and revegetation work that is an important aspect of IPM cultural practices. In the chemical application time estimate for the Parks and Recreation Department's natural lands program, time spent preparing for chemical treatments, posting notification signage, cleanup, and driving time were included, which increases the hour allotment for that area of pest management relative to other programs. During 2012, staff is working to report data more consistently among the departments and will determine the best method for providing an overview of the work accomplished from each program, so that progress towards the city's goals can be better tracked over time.

The following chart provides an estimate of how staff time is utilized for IPM activities. Please note that Urban Forestry's data is not included, because the data is not directly comparable to other programs, since activity is tracked by tree number. This data can be found on page 17. The OSMP agricultural program is also not included since this program was not part of earlier updates to the general IPM program and policy.

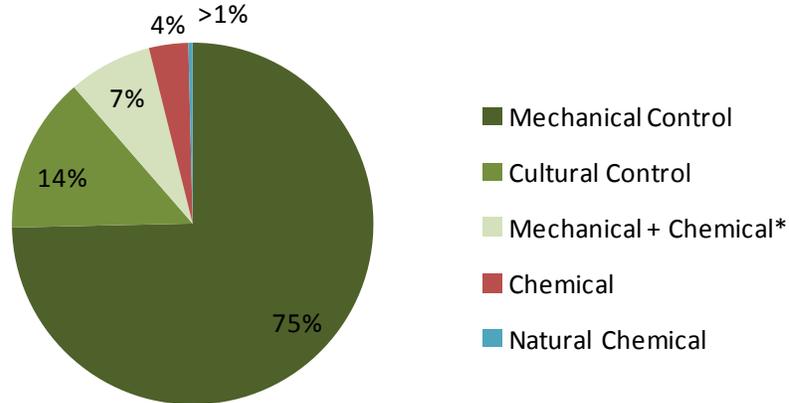
Taking into account the issues mentioned above, this data is still useful for providing an overview of how the city approaches pest

issues. The majority of staff IPM-related hours is spent on cultural and mechanical controls. Cultural controls help to create healthy environments that resist pests. Although these methods are time-consuming, it can eventually save time and resources by preventing high pest populations and can ultimately lead to the greatly reduced use of pesticides.

Pesticide use can vary greatly from year to year. Pesticide use may increase if an emergent pest requires immediate treatment. Large restoration efforts, such as removal of invasive trees and replanting native trees, can increase pesticide use above other years. The table on page 33 summarizes pesticide use for non-agricultural programs.

The Approved Pesticide List process is currently being updated and this will affect the particular chemicals that will be allowed and, in some cases, may change how they are used. In future annual reports, the impact of the revised process in relation to actual pesticide use will be discussed. This will help the city to continue making choices that will reduce the amount and/or toxicity of any pesticide products that are applied on city properties.

Methods Used for Pest Control for All Programs (Hours)



*Either cut-stump treatments on trees and shrubs or cutting and injecting herbicide into stems of knotweed. See the Horticulture and Natural Lands sections for details.

Program Update

Over the last year, the city’s IPM program has been assessed by the IPM Institute of North America, the Pesticide Research Institute and Osborne Organics. The majority of the recommendations addressed internal organization improvements that can be made to more successfully implement the IPM policy across all departments and workgroups. Another key recommendation addressed the need to update and revise the city’s pesticide screening process.

During 2012, the city will update the process for screening pesticides. A plan will also be developed to fully implement the IPM policy and its guidelines across all city work groups. Programs from across the city that use IPM will work together to reduce duplication of efforts and to make progress to further the goals of the IPM policy and continue working towards pesticide reduction.

The city will seek public input for the improvements to the IPM program and encourage individuals and businesses to adopt pest management practices that reduce the exposure of the community and environment to toxic chemicals.

Citywide Pesticide Use for Non-Agricultural IPM Programs in 2011

Key: Synthetic Product Natural Product

All quantities are pounds of active ingredient or gallons of concentrate

Active Ingredient	Product Name	Type of Pesticide	Target Pest	Total
Aminopyralid	Milestone	Herbicide	Broadleaf weeds	4.03 pounds
Chlorothalonil*	Instrata	Fungicide	Snow mold in golf greens	6.0 pounds
Chlorsulfuron	Telar DF	Herbicide	Broadleaf weeds	0.053 pounds
Clopyralid	Transline	Herbicide	Broadleaf weeds	3.69 pounds
Fludioxonil*	Instrata	Fungicide	Snow mold in golf greens	0.2 pounds
Glyphosate	Rodeo	Herbicide	Broadleaf and grassy weeds Invasive shrubs and trees	159.59 pounds
Imazapic	Plateau	Herbicide	Broadleaf weeds	0.006 pounds
Imidacloprid	Merit	Insecticide	Scale insects on trees	0.475 gallons
Mutsulfuron methyl	Escort	Herbicide	Broadleaf weeds	0.024 pounds
Propiconazole*	Instrata	Fungicide	Snow mold in golf greens	0.9 pounds
Benzydlethyl Methyl Ammonium Saccharide, Thymol	Ropel	Repellent (voles)	Voles (repellent)	11.5 gallons
Triclopyr	Garlon 4	Herbicide	Invasive trees and shrubs	24.56 pounds
20% Vinegar	Horticultural Vinegar	Herbicide	Weeds	0.75 gallons
Acetic Acid and Citric acid	Alldown	Herbicide	Broadleaf weeds	1.25 gallons
Iron (FeHEDTA)	Fiesta	Herbicide	Broadleaf weeds in turf	0.43 gallons
Castor oil	Moleout Liquid	Repellent (voles)	Voles (repellent)	3 gallons
Castor oil	Moleout granules	Repellent (voles)	Voles (repellent)	15 pounds
d-limonene	Nature's Avenger	Herbicide	Broadleaf weeds	38.5 gallons
Clove oil Citric Acid	Perfectly Natural	Herbicide	Weeds	1.0 gallons

*One of three active ingredients in one product, Instrata