



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

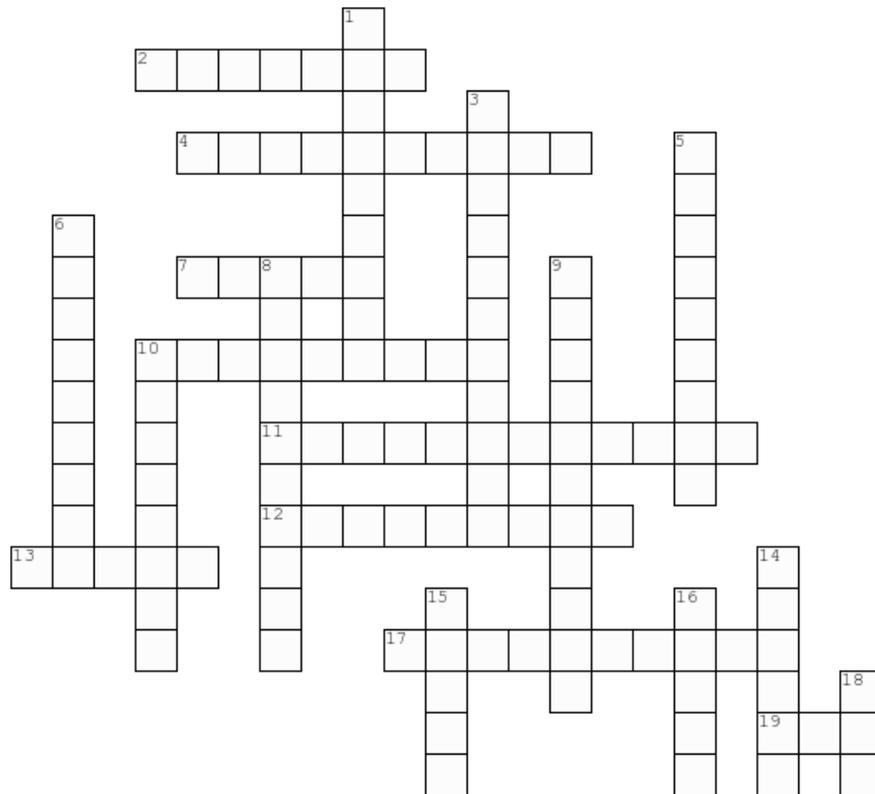
The Colorado Master Gardener Program
The Colorado Gardener Certificate
Program

Worksheet and Homework
Distance Education Edition

CMG/CGC Program - Homework and Worksheets

Topic	What's in this packet
THE COLORADO MASTER GARDNER PROGRAM	WS (Crossword)
IPM/PHC/DIAGNOSTIC PROCESS	
	Natria Pesticide Label for worksheet
	Reading Pesticide Labels WS
	Diagnosis Practice WS
BOTANY	
	Leaf Characteristics WS
	Plant Structures WS
	Plant Processes #1 – Photosynthesis/Transpiration WS
	Plant Processes #2 – Respiration WS
	Plant Processes #3 – Hormones WS
	Botany HW
ENTOMOLOGY	
	Entomology HW
PATHOLOGY	
	Pathology HW
	Pathology WS
LAWN CARE - TURF	
	Lawn Care HW
	Turf Diagnostics - WS
THE SCIENCE OF PLANTING TREES	
	Tree Planting WS (crossword)
TREE CARE	
	Tree Care WS (crossword)
SOILS, AMENDMENTS AND FERTILIZERS	
	Optional HW
	Soils Texture and Free Lime WS
WEED MANAGMENT	
	Weed Management HW
PRUNING	
	Pruning HW
MOUNTAIN GARDENING	
	Course Outline and Handouts

Colorado Master Gardener Program



Created with TheTeachersCorner.net [Crossword Puzzle Generator](#)

Across

- 2.** Pesticide CMGs can apply while volunteering
- 4.** Volunteer hours required of CMGs
- 7.** Interferes with listening
- 10.** Purpose of Extension programs
- 11.** When to use title 'Colorado Master Gardener'
- 12.** University system founded in 1860's
- 13.** Partner in Extension system besides federal and county
- 17.** Title of CMG trainee
- 19.** Initials of on-line reporting system

Down

- 1.** CSU materials with information on a topic
- 3.** Whom to refer legal questions
- 5.** Cannot be handled by volunteers
- 6.** Protects authors
- 8.** One of the grounds for dismissal
- 9.** Written CMG training materials
- 10.** Master Gardener role
- 14.** Continuing ed hours required of CMGs
- 15.** We do this more slowly than we hear
- 16.** Volunteer hours required for apprentices
- 18.** Initials of Colorado's land grant university



CMGGardenNotes#103A

Reading Pesticide Labels Worksheet

Find the answers to the questions on the label provided.

1. What are the active ingredients?
2. Can I apply this product to lilacs? The plant has powdery mildew and aphids.
3. I've applied this to my cabbage crop. How long do I have to wait after the application to eat it?
4. What is the mode of action for this product?
5. Will this product harm freshwater clams?
6. What action do I take if I accidentally spill this product on my shirt sleeve?
7. How do I dispose of the empty container?
8. How should I store this product?
9. Can I use this product in my greenhouse where I grow culinary herbs for sale?



CMG GardenNotes #108

Lab Worksheet: Diagnosis Practice

The objective of this exercise is to give you practice diagnosing tree insects and diseases.

For this activity, refer to *Insects and Diseases of Woody Plants in Colorado*. On pages 295 to 314 is a **Diagnostic Key to... Woody Plant Disorders**. Answer the following questions by using the key and reference pages cited.

Plant 1

1. Plant ID: Douglas fir
2. Describe signs and symptoms:
 - a. In severely stressed to recently killed trees, you find piles of sawdust and fiber accumulating beneath them. Wide galleries, just under the bark, are filled with fibrous material. You also find adult beetles that are about an inch long, brownish-gray with white specks and very long antennae.
 - b. What is the most likely (probable) insect causing the sawdust and fibrous material?



Plant 2

1. Plant ID: Aspen
2. Describe signs and symptoms:
 - a. In the spring, leaves are being eaten by caterpillars. They have a bright blue stripe on their side and yellow, keyhole shaped spots on their back. Your neighbor thought they were tent caterpillars, but you can't find any tents.
 - b. What are the possible insects that could be causing the problem?
 - c. Which insect do you think is causing the damage?



Plant 3

1. Plant ID: Crabapple
2. Describe signs and symptoms:
 - a. Four crabapple trees were lost to what a gardener believes is "fire blight". The trees were planted in an irrigated lawn area three years ago, but never really grew well. The first spring (just after planting) the trees bloomed, but new growth was minimal. The second year, the trees looked "blighted" with smaller pale leaves and no new growth. By the third season, the trees progressively declined, having no blossoms, tiny pale leaves and no twig growth. Most leaves dropped by mid-summer. In fall as the homeowner removed the dead trees, he discovered a large discolored area on the trunks just below ground level. He would like to replace the trees with fire blight resistant cultivars so he won't have this problem again.
 - b. What are the possible causes of this problem?
 - c. What is the probable (likely) cause?



Andrej Kunca, National Forest Centre – Slovakia,





CMG Garden Notes #150

Leaf Characteristics Worksheet

Describe the following characteristics for each numbered leaf sample using GN #134

Leaf 1 Note: leaf shape is variable Bur oak	Leaf Arrangement	Leaf Margin	Leaf Base	Intentionally blank
Leaf 2 Redbud	Leaf Shape	Leaf Margin	Leaf Venation	Intentionally blank
Leaf 3 Norway Maple	Leaf Arrangement	Leaf Margin	Leaf Venation	Intentionally blank

Leaf 4 This sample contains an entire leaf Note: minute sharp tip on each leaflet Indigo	Leaf Arrangement	Leaflet Shape	Leaflet Margin	Intentionally blank
Leaf 5 This sample contains an entire leaf Horsechestnut	Leaf Arrangement	Leaflet Shape	Leaflet Margin	Intentionally blank



CMG GardenNotes #151

Work Sheet: Plant Structures

The objective of this work sheet is to give students experience systematically looking at plant parts and connecting what they see with print information.

1. Flower parts

a. Locate and draw the parts of the inflorescence

1. Anthers
2. Calyx
3. Corolla
4. Filament
5. Ovary
6. Pedicel
7. Petals
8. Pistil
9. Receptacle
10. Sepals
11. Stamen
12. Stigma
13. Style

2. Identify the type of flower

Flower	Inflorescence Type	Fruit	Inflorescence Type
a Allium		d Achillea	
b Sunflower		e Poppy	
c Foxglove		f Calla Lily	

3. Identify the type of fruit

Fruit	Fruit Type	Fruit	Fruit Type
a Apple		b Strawberry	

4. Annual Growth

Examine young branches and twigs, looking for the annual growth rings (terminal bud scars). Based on the *terminal bud scars*, measure the annual growth for the past three years to the nearest inch. Note: The annual growth rings are easy to read on some species and more difficult on other species.

Tree 1	Tree 2
New growth (season 1) _____	New growth (season 1) _____
Previous season (season 2) _____	Previous growth (season 2) _____
Three years back (season 3) _____	Three years back (season 3) _____



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CMG GardenNotes #152

Work Sheet: Plant Processes #1

Photosynthesis/Transpiration

Situation/Symptoms

A homeowner calls about a tree in their yard that leafed out fine this spring. By late June, however, the leaves began to wilt, dry up and are now falling. They just moved into the home last fall and don't know how the landscape was maintained prior to that. Other trees in the yard are showing similar symptoms. There has been prolonged drought in the area for the past two years.

Question 1: Why are the leaves drying? Why were they fine this spring?

Question 2: What plant process has been interrupted?



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CMG GardenNotes #153

Work Sheet: Plant Processes #2

Respiration

Situation/Symptoms

A homeowner planted a shade tree two years ago in a landscape with heavy clay soils. The tree has never thrived and is now showing dieback mostly in the lower canopy. They asked the advice of their neighbor, a Colorado Master Gardener, who noticed that the tree had been planted about 6 inches too deep and the homeowner has been overwatering trying to bring the tree back.

Question: What is causing the dieback and what plant process is being interrupted?



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CMG GardenNotes #154

Work Sheet: Plant Processes #3

Growth Regulators/Hormones

Situation/Symptoms

A homeowner planted a 2 inch caliper shade tree three years ago but it still hasn't really taken off the way it should. They believe that they did everything right when planting the tree including pruning some of the top of the tree to balance out the compromised root system. Does the tree need more fertilizer?

Question: Why hasn't the tree come out of transplant shock and put on more top growth and how are hormones affecting the tree's growth?



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CMG GardenNotes #155

Homework: Botany

Answer the following questions

1. Why is it important to use scientific names for plants rather than just common names?
2. Why is it important for the gardener to understand the importance of plant families?
3. How can high temperatures affect the flavor of a melon?
4. How can late spring frosts affect plant growth and development?
5. How do the seven degrees of shade relate to plant placement in the landscape? Is *Impatiens walleriana* a good choice for a site with morning shade with afternoon sun? Why or why not?



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CMG Garden Notes #318

Homework: Entomology

1. How do you know if a creature in your garden is an insect?
2. What makes an insect “beneficial”?
3. Why can aphid populations increase so rapidly?
4. It is July. You have correctly diagnosed a large spider mite infestation on a customer’s raspberry plants. What is the most important management strategy you can recommend to the customer?
5. Why do gardeners often report that ladybugs “disappear” shortly after releasing them in the garden?



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CMG Garden Notes #332

Homework: Plant Pathology

1. What 4 components must be present for biotic disease to develop?
.
2. Another name for the living cause of disease_____
3. Another name for the non-living cause of disease_____
4. List 3 ways to manage powdery mildew on a shrub.
5. A customer brings you a foot-long branch of an aspen tree. The leaves on the branch tips are dark brown and wilted; the branch tip is bent over. Could this be fire blight? Why or why not?
6. List 2 general management strategies for Cytospora canker disease on an aspen.

7. How are leaf scorch and winter desiccation similar in terms of how they develop? In symptom expression?

8. Give two characteristics of healthy roots.

9. A ten-foot row of low-growing junipers is planted between the west facing side of a building and a sidewalk on a college campus. By mid-winter, the sidewalk side of the junipers begins to turn completely brown. What symptom supports this being an abiotic diagnosis? State a possible cause of the juniper symptoms.



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CMG GardenNotes #333

Plant Pathology Worksheet Packet

Symptoms vs. Signs - Activity 1

Lilac Leaves

Mrs. Johnson hires ABC Landscape Company to take care of her lawn. They mow and spray for weeds. On a recent visit in August, ABC applied a weed killer to the lawn. A week later, Ms. Johnson notices the leaves on her lilac are turning white. She is certain that the weed killer ABC sprayed on the lawn must have caused this damage because the problem appeared so soon after the treatment.

She brings in a sample of the leaves for you to look at to verify her assumption. Given the information we have covered so far in class:

A. What will you look for first? Describe them.

(Hint: chlorosis, necrosis, wilting and stunting are examples)

B. What will you look for next? Describe them if found.

(Hint: spores and fruiting structures are examples)

Plant Pathology Worksheet Packet

Symptoms vs. Signs - Activity 2

(Currant or Hawthorn leaves)

Well, Mrs. Johnson has another sample to show you. She is still certain that ABC Landscape must have damaged plants in her landscape. Now she shows you some currant (or hawthorn) leaves.

The leaves developed these spots about the same time the lilac problem appeared.

Given the information we have covered so far in class:

A. What will you look for first?

(Hint: chlorosis, necrosis, wilting and stunting are examples)

B. What will you look for next?

(Hint: spores and fruiting structures are examples)

C. Describe the symptoms:

D. Are there signs? Describe them if you find them.

CMG Introductory Plant Pathology

Activity 3 Plant Diagnosis Practice

Note: Use the cottonwood twig samples for this exercise.

Carrie purchased a home this past winter. As trees began to leaf out, she noticed that several scattered branches on a young cottonwood tree did not leaf out. In fact, the branches appear to be dead. She cut a small branch to bring to you and noticed that there are some kind of bumps on them. She wants to know how to control the pest causing the bumps.

Plant: Cottonwood

1. Describe the symptoms.
2. Describe signs if you see them.
3. What are the possible causes?
4. What is your diagnosis?
5. How can she manage the problem?

Plant Pathology Worksheet Packet

Abiotic vs. Biotic- Activity 5

Given the information we have covered so far in class and your examination of the leaf samples:

Determine if the damage on the samples is abiotic or biotic and state *why*.

Plant	Abiotic or Biotic?
-------	--------------------

Johnson Lilac

Johnson Currant (Hawthorn)

Roberts Linden (Aspen)



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CMG GardenNotes #570

Homework: Turf Management

1. The following could be an email or phone conversation that you are likely to have with a client when serving your volunteer time in your respective Extension offices. How would you engage this client? What questions might you ask her? What kind of recommendations/suggestions would you make to answer this client's questions about her lawn?

From: Tara [REDACTED]
Sent: Tuesday, August 04, 2012 9:35 PM
To: Koski,Anthony
Subject: turf

Dear Tony,

Hi, I got your name from one of my friends, Wes. He has the most beautiful lawn that I have ever seen. I have been trying for 5 years to get my lawn beautiful, to no avail. I don't think actually I know, that I have no idea what to do and when. Would you be able to assist me or put me in contact with someone who could? I live in Highlands Ranch. Thank you so much,

Tara [REDACTED]
[REDACTED]@yahoo.com

2. Understanding that the recommended height for mowing most lawns in Colorado (bluegrass, fescue, buffalograss) is 2.5- 3.5 inches, that you should never remove more than 1/3 of the grass height in a single mowing, and that it is recommended that clippings be returned to the lawn - here is a common question on mowing:

I went on vacation (or it has been raining... or my mower needed repairing) and my lawn hasn't been mowed for 2 weeks. The grass is very tall and even falling over. What should I do?

3. You often read and hear that lawns should be watered "deeply and infrequently". What does this mean? Explain this concept to someone who has moved to Colorado from a part of the country where lawns are rarely, if ever, irrigated- understanding that people want something a little more concrete than "deeply and infrequently" (like...How many days every week? How long to run the sprinklers each time the lawn needs watering?).

- What does "deep, infrequent" watering accomplish?
- Can a lawn be watered TOO "deeply"?
- Can a lawn be watered TOO "infrequently"?



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CMG Garden Notes #571

Worksheet: Turf Diagnostics

1. When diagnosing over the phone or by email, it is essential to get photos (including wide-angle of as much of the lawn as possible) and all information on how the lawn is being managed (how they are watering, mowing, fertilizing). The potential cause of the problem is often related in some way to how the lawn is being managed. What might be happening with this lawn? Read the email carefully – there are valuable clues here! Do you need more information from the client?

From: [REDACTED]
Date: Tue, Oct 20, 2015 at 2:40 PM
Subject: RE: Grass Samples

Here are pictures of the yellow grass. We water nearly every day for about 50 minutes. I have 5 zones spread across .8 of an acre with 5 heads per zone that spray some 20 feet in 355 degree circles. I keep the grass 3 inches or better most of the time.

I added some Poudre Valley Co-op's Green-N-Grow fertilizer on the grass in late spring & it started to yellow up. When it turned yellowish I thought I may have added too much but it never really got better. Any ideas?
Thanks, Lindsey



2. An email with some photos from the resident of an HOA.

This is in [REDACTED] HOA at 17th and Francis. Our contract service provider says it is blight aggravated by the wheels of the mowing machine which caused the strips. What is your analysis? Is the grass dead? Should we ask the lawn contractor to replace the sod? And what can we do differently next time to prevent? It has been very dry and hot, a record early so early in the year. What will July and August hold? Why should it be just in certain places. There are about 4 bad places similar to this. I'll appreciate your help.



3. This is an email from a colleague who was stumped. A number of potential causes had been eliminated. There are some good, useful clues here. Are there any other questions to ask the client? What else could be looked at to ascertain the cause of the mysterious brown spots?

From: [REDACTED]
Sent: Friday, September 18, 2015 6:09 PM
To: Koski,Anthony <Tony.Koski@ColoState.EDU>
Subject: Lawn Brown spots

Hi Tony

Attached photo shows a pattern of recent browning (“the last 3 weeks”) in KBG front lawn; unfenced. There is well over 1000 sq ft of turf area affected in this same pattern.

When I looked at it, I was able to eliminate grubs, NRS, dog urine, and cranberry girdlers as possible causes. This “looks like” dog urine injury but there would have to be 150 dogs that use this front lawn to the exclusion of all neighboring lawns.

- The soil is a clay loam, moist at an inch under brown spots but dry at soil surface
- Irrigation 3X/week, early morning hours
- Exposure is full day-long sun , on a hot SSW-facing slope.
- Browened blades pull up/off easily, leaving roots behind in the soil.
- Thatch layer is no more than ¼ inch anywhere checked.
- Rooting depth seems limited to about 1.5 inches.

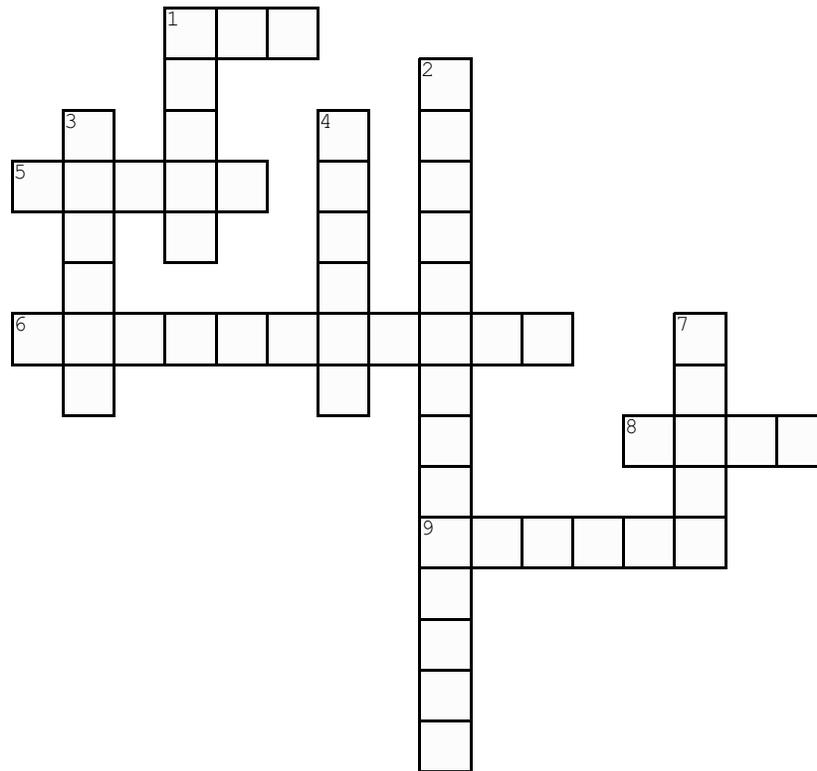
- Core cultivation is “every September” but not yet done this year.
- Some blade shredding from dull mower blade.

Can you help me with some ideas on possible causes? Their HOA is pressuring them to “fix” this.



The Science of Planting Trees

Complete the crossword below



Created with TheTeachersCorner.net [Crossword Puzzle Generator](#)

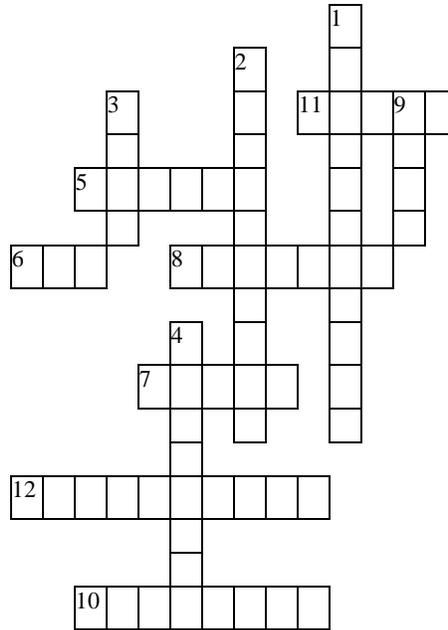
Across

1. Minimum number of structural roots that should be found in the top 1-3 inches of a rootball
5. Helps settle soil in planting hole
6. Potential problem if tree is planted too shallow
8. The soil under a root ball should be this
9. Do this to girdling roots compressing against the trunk

Down

1. Planting hole should be this much times the rootball diameter
2. Major problem caused by planting trees too deep
3. Ideal shape of a planting hole
4. Remove this because it decomposes very slowly
7. Remove this to avoid girdling problems

Tree Care Worksheet



Across

5 The best staking strap is made from:

CANVAS

6 Tree stakes are removed after this many growing seasons **ONE**

7 Helps retain soil moisture under trees **MULCH**

8 Adventitious shoots rising from roots are known as: **SUCKERS**

10 Roots wrapped around other parts of a tree are called _ roots **GIRDLING**

11 Hot or windy weather can cause herbicides to: **DRIFT**

12 Soil ___ can lead to low soil oxygen levels **COMPACTION**

Down

1 Tool to help you determine when to water **SCREWDRIVER**

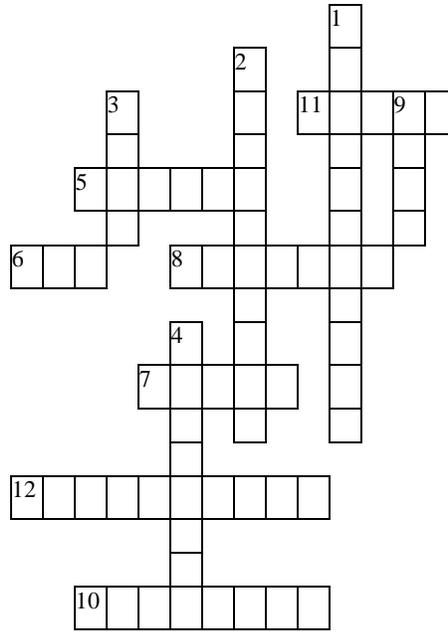
2 Vertical crack in trunk or stem of a tree **FROSTCRACK**

3 Done to young thin- barked trees to protect them in winter **WRAP**

4 Also known as southwest injury **SUNSCALD**

9 These roots are the primary sites of water/mineral absorption **ABSORPTIVE**

Tree Care Worksheet



Across

5 The best staking strap is made from:

CANVAS

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Down

1 Tool to help you determine when to water **SCREWDRIVER**

2 Vertical crack in trunk or stem of a tree **FROSTCRACK**

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9 These roots are the primary sites of water/mineral absorption **ABSORPTIVE**

8. Answer the following questions about one of the soils on the property.

Address		
What is the name of the soil(s) at this address?		
What is the generic slope at this address?		
From Map Unit Setting	Elevation	
	Mean annual precipitation	
	Mean annual air temperature	
	Frost-free period	
From Properties and Qualities	Depth to restrictive feature	
	Drainage class	
	Depth of water table	
	Frequency of flooding	
	Frequency of ponding	
	Calcium carbonate content	
	Maximum salinity	
	Available water capacity	
From Typical profile , give depths of various soil textures.		



CMG GardenNotes #252

Worksheet: Soil Texture and Free Lime Lab

1. Soil texture by feel

Identifying the soil samples to coarse (sandy), medium or fine (clayey).

[Reference: *The Science of Gardening*, page 89]

Soil Sample	Describe the feel: <ul style="list-style-type: none">○ Gritty = sand○ Silk smooth = silt○ Sticky = clay	How long will it ribbon out?	What is the soil texture? <ul style="list-style-type: none">○ Ribbons <1",<ul style="list-style-type: none">▪ Feels gritty = coarse texture (sandy soil)▪ Not gritty = medium texture (high in silt)○ Ribbons 1-2 inches<ul style="list-style-type: none">▪ Feels gritty = medium texture▪ Not gritty = fine texture○ Ribbons >2" = fine texture clayey soil
1			
2			
3			
Your soil			

2. Soil Texture by Measurement

Using the jar method, what is the soil textural class for a sample with the following amounts of sand, silt, and clay? [Reference: *The Science of Gardening*, page 87-88]

- How long do you shake the bottle of soil?
- When do you measure the sand, silt and clay levels?

Sand _____ Silt _____ Clay _____

- Determine the soil texture for the following sample:

		Depth of layer	Percent	Soil Textural Class <small>(from <i>Soil Textural Triangle</i>, page 87)</small>	Will this soil behave as a sandy or clayey soil?
Sample 1	Sand	3.0"			
	Silt	0.5"			
	Clay	1.5"			
	Total	5.0"			
Sample 2	Sand	3.5"			
	Silt	1"			
	Clay	0.5"			
	Total	5"			

3. Free Lime Test

On your soil sample, do a vinegar test for free lime (calcium carbonate). [Reference: *The Science of Gardening*, page 159 and 166-167]

- Did it fizz (have high calcium carbonate)? Yes No
- What does this indicate about your soil being prone to iron chlorosis? Can you lower the pH?



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CMG GardenNotes #356

Homework: Weed Management in the Home Landscape

1. You get a call from a client who just moved to Colorado late last fall. Their new home comes with a couple of large raised bed vegetable gardens. They noticed last fall that the beds had become overgrown with weeds. One of them they recognize as bindweed – but they aren't sure what the others are? Being new to veggie gardening, they are looking for advice on how best to manage the weeds in these beds come spring when they begin learning about vegetable gardening in Colorado. Provide them some SCIENCE-BASED recommendation on how to effectively manage the weeds in these raised beds – providing all options (chemical, as well as non-chemical).

3. A client brings you a sample of this weed growing in their lawn. Their questions are simple:
 - Why do I have it...where did it come from?
 - Why does it keep coming back when I pull it?
 - How do I get rid of it?



Remember: provide them with science-based information and options for management of this weed.



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CMG GardenNotes #618

Homework: Pruning

1. Describe the following terms:
 - a) Branch bark ridge -

 - b) Branch collar -

 - c) Reaction zone -

 - d) Branch defense zone –

2. Define and draw the following pruning methods:
 - a. Structural / subordinate pruning -

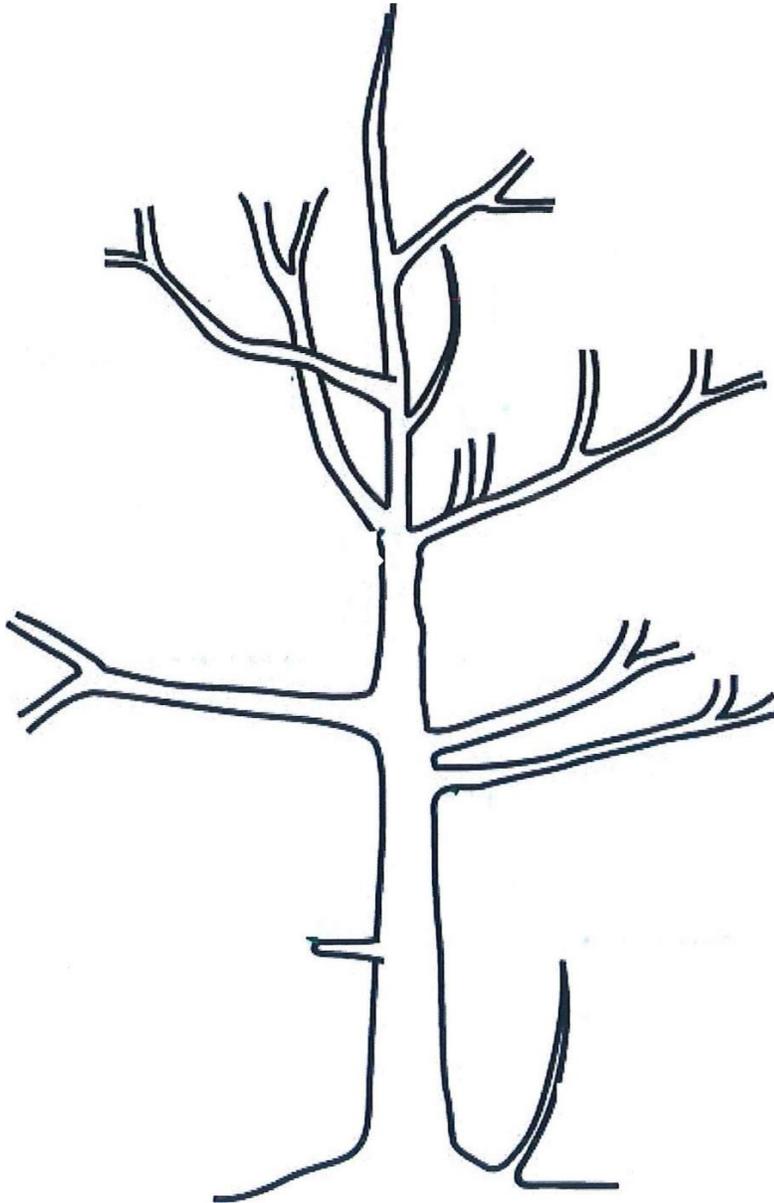
 - b. Cleaning –

 - c. Thinning –

 - d. Raising –

 - e. Reduction -

3. Describe, in your own words, the three-cut pruning technique. Why is this important?
4. Evaluate the tree below and draw where you would make your pruning cuts.





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CMG GardenNotes #590a

Mountain Gardening

9:30- 10:30 Mountain gardening overview

10:30 – 10:45 break

10:45-12:00 Mountain garden overview, continued

1:00- 2:00 Wildlife and the mountain gardener

2:00- 2:10 break

2:10 -2:45 Native herbaceous perennials for the mountains

2:45- 4:00 Non-native herbaceous perennials for the mountains

Fact sheets:

- 7.244 [Colorado Mountain Gardening Basics](#)
- 7.406 [Flowers for Mountain Communities](#)
- 7.413 [Ground Covers and Rock Garden Plants for Mountain Communities](#)
- 7.423 [Trees and shrubs for Mountain Communities](#)
- 7.242 [Native herbaceous perennials for Colorado Landscapes](#)
- 6.215 [Burrowing animals: Determining species by burrows & damage](#)
- 6.515 [Managing pocket gophers](#)
- 6.505 [Managing Wyoming squirrels](#)
- 6.520 [Preventing Deer Damage](#)
- 6.507 [Managing Voles in Colorado](#)
- 6.305 [Firewise landscape materials](#)
- 7.248 [Vegetable Gardening in the mountains](#)

From the Colorado State Forest Service:

- Creating Wildfire-defensible zones http://static.colostate.edu/client-files/csfs/pdfs/FIRE2012_1_DspaceQuickGuide.pdf

Gilpin Mountain Gardening Website:

<http://www.extension.colostate.edu/gilpin/hort/hort.shtml>

Mountain gardening blog

<http://coloradomountaingardener.blogspot.com/>

Places to visit

- Betty Ford Alpine Garden, Vail
- Yampa River Botanic Park, Steamboat Springs

Mountain gardening

Irene Shonle, CSU Extension Gilpin County

Many mountain gardeners think hardiness is the only factor in choosing a plant.
--It is important, but not the only consideration

Hardiness zones

- Based on the average minimum temperature in a region
- Extreme low temperatures not covered
- The USDA Hardiness Zone Map was revised in 2012.

Other Hardiness factors

- genetics (source of plant material),
- rapid temperature changes,
- moisture,
- wind exposure,
- sun exposure
- snow cover
- carbohydrate reserve (root system).

Hardiness zone maps should not entirely dictate plant choice

- May not be as important for perennials
- Not all plants fully tested
- Take your “zone” with a grain of salt – if you really want a plant, try it at least three times (in different microclimates) before giving up

Short growing season

- For every 1000’ gain in elevation, the temperature drops by 3.5° F. This means that often there are less than 90 frost-free days in the mountains.

Growing degree days and late bloomers

- Late blooming plants, or plants that require a lot of heat, may not bloom even if they are hardy enough.
- The development of a plant will occur only when the temperature exceeds a specific base temperature for a certain number of days. Each type of plant is adapted to grow best over its own specific base temperature, called T_{base} . (Be aware that even cultivars of the same plant species sometimes can have

different T_{base} .) 50° F is often the T_{base} used for warm season vegetables, but peas and lettuce will continue to develop at 40° F, so their T_{base} is 40° F.

- Here is how to calculate growing degree units: get the average temperature for the day (maximum and minimum temperatures added together and divided by two) and subtract a minimum base temperature (usually 50° F) . This gives you the growing degree units.

$$\frac{\text{Max Temp.} + \text{Min. Temp.}}{2} - T_{\text{base}} = \text{Daily GDU}$$

- $(75+45/2)-50 = 10 \text{ GDU/day} \times 90 \text{ days} = 900 \text{ GDUs/summer}$
 - o Ultra-early “Siberian” or “Arctic” tomatoes require 1100 GDUs to the first ripe fruit
 - o Echinacea may take up to 1000 GDUs
- This explains why it can be difficult to grow warm season crops or late-bloomers
- Also explains how warmer microclimates can support plants that don’t work in cooler ones
-

Other climatic considerations

- Valleys are cooler than hills
- At night, cool air drains to low spots. Valley floors may be over 10 degrees F cooler than surrounding gardens on hillsides above the valley floor

Aspect is crucial

- What you can plant on a south facing slope is very different than a north facing slope
- Gardeners at the same elevation on different sides of the valley have very different growing climates

Learn to create and exploit microclimates

South side of house for less hardy plants/plants that need heat

East side – protected from wind, moister, cooler afternoons

Wind

- Gusts common in mountains
- Can desiccate plants
- Can cause uneven snow layer
- Can blow away mulch
- Make windbreaks porous
- A windbreak density of 40 to 60 percent provides the greatest downwind area of protection
- Low pressure behind a dense windbreak creates turbulence and reduces protection downwind

Eddies around houses can capture snow and create snow-protected microclimate
If you create or have an existing windbreak, take advantage:

Microclimates: moisture

- Moisture is also a factor in plant choice/placement

Soil and pH vary widely in the mountains

- You can't blindly apply "standard" Front Range assumptions (alkaline, clay) to the mountains.
- Must test to know for sure.

Soil Review

- The "textbook" soil is composed of 45 percent mineral, 25 percent air, 25 percent water, and 5 percent organic matter.
- A healthy garden must have a soil that provides good drainage and aeration.
- Organic matter holds at least 10 times more water and nutrients than sand.

Mountain Soil-Decomposed granite

- Good drainage, but low water and nutrient holding capacity.
- Add organic matter (unless you're planting natives)
- And next year, add more!
- Compost best amendment, or alfalfa pellets

Mountain soils- Clay

- Less common
- Drainage poor, nutrient/water retention high.
- Add organic matter

Mountain soils - Loam

- Often under aspens
- Rare, but great if you have it!
- Good drainage and water/nutrient retention
- Probably don't have to do anything!

Alternatives to amendments

- Plant native plants that are used to lean soils
- Plant non-natives that are well adapted and like lean soils

Type of tree can influence soil, moisture

- Little to no vegetation under dense conifers
- Clearing trees promotes herbaceous growth
-

Pine needle duff

- Remove before planting
- Can inhibit growth

- Can be somewhat hydrophobic
- Can prevent seeds from reaching soil

Clearing trees also provides defensible space (From the Colorado State Forest Service:

- Creating Wildfire-defensible zones http://static.colostate.edu/client-files/csfs/pdfs/FIRE2012_1_DspaceQuickGuide.pdf

Zone 1 an area of 15 feet around the structure in which all flammable vegetation is removed. This 15 feet is measured from the outside edge of the home's eaves and any attached structures, such as decks.

- Zone 2 is an area of fuel reduction. It is a transitional area between Zones 1 and 3. The size of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space should extend at least 75 to 125 feet from the structure.

Zone 1

- Plant nothing within 3 to 5 feet of the structure.
- If the house has noncombustible siding, widely spaced foundation plantings are acceptable. Be sure there are no areas of continuous grass adjacent to plantings in this area.
- Frequently prune and maintain plants -remove dead branches, stems and leaves.
- Ideally, remove all trees from Zone 1 to reduce fire hazards. If you do keep a tree, consider it part of the structure and extend the distance of the entire defensible space accordingly. Isolate the tree from any other surrounding trees.

Zone 2

- Thin trees and large shrubs so there is at least 10 feet between crowns. Crown separation is measured from the furthest branch of one tree to the nearest branch on the next tree.
- On steep slopes, allow more space between tree crowns.
- Remove all ladder fuels from under these remaining trees. Carefully prune trees to a height of at least 10 feet.

Firewise landscape materials

- Grow close to the ground
- Have a low sap or resin content
- Do not shed and accumulate dead branches, needles, leaves, or debris
- Are easily maintained and pruned

Dealing with slope

- Retaining walls can be a beautiful way to hold back a slope

- Consult with your building dept. to determine whether a structural engineer needs to review your plan
- Slow down water if possible!

Water rights & Planting with the Precipitation

Colorado Water rights

Prior appropriation water law: first in time, first in right

Water is bought & sold like real estate, but separate from it – living by a river or pond doesn't mean you can use it

State Well Regulations for Household-Use Only Wells:

Most private wells drilled on or after May 8, 1972 on properties less than 35 acres are permitted for household-use only. Water can be used *only* inside the home. Water cannot be used to irrigate gardens, windbreaks, livestock, or any other outside use

The theory behind this is that household use only “uses” 10% of the water, and the rest returns to recharge the water cycle.

Excessive use can draw down the water table in the fractured rock aquifers

Even if your well is permitted for outdoor watering, you might want to protect it in drought times.

If you are on city water, there may be watering restrictions during drought.

We depend on precipitation to recharge our groundwater and reservoirs

Some part of Colorado almost always in drought

Even rain water harvesting probably problematic: rainwater harvesting may hurt senior water rights

Most stream systems have been over-appropriated, meaning that at some or all times of the year, a call for water even by a senior appropriator is not satisfied.

What about that 2009 rainwater bill (SB 80)?

SB-80 allows limited collection and use of precipitation for landowners, only if ALL of the criteria below (note especially the last one) are met:

The property on which the collection takes place is residential property.

The landowner uses a well, or is legally entitled to a well, for the water supply.

The well is permitted for domestic uses according to specific statutes

There is no water supply available in the area from a municipality or water district.

The rainwater is collected only from the roof.

The water is used only for those uses that are allowed by, and identified on, the well permit.

Good news! HB16-1005 (2016)

Under House Bill 16-1005, rain barrels can only be installed at single-family households and multi-family households with four (4) or fewer units. A maximum of two (2) rain barrels can be used at each household and the combined storage of the 2 rain barrels cannot exceed 110 gallons. Rain barrels can only be used to capture rainwater from rooftop downspouts and the captured rainwater must be used on the same property from which the rainwater was captured, for only outdoor purposes, including to water outdoor lawns, plants and/or gardens. Rain barrel water cannot be used for drinking or other indoor water uses.

For more information on ground water and your right to use it, contact:
Ground Water Information at the Colorado Division of Water Resources at
(303) 866-3587 9:00 a.m.-4:00 p.m.
Information is also available online at
water.state.co.us/groundwater/groundwater.asp.

Creative suggestions to work with the laws

Direct downspouts to garden

- Plants that prefer a bit of extra moisture will benefit from the extra water
- Similar gardens are called “rain gardens” in Midwest and East
- Idea developed to prevent city runoff, but can be adapted for here
- Diffuser head can work similarly, helps slow the flow
- No downspout?
- Plant under drip line
- (This can also be a place to hold plants until you can plant them)

Create swales and berms to slow water

Book: *Rainwater Harvesting for Drylands and Beyond, Volume 1, 2nd ed.: Guiding Principles to Welcome Rain into Your Life and Landscape* By *Brad Lancaster*

Haul in water to fill cisterns

Principles of Planting with the Precipitation

- Plant early – take advantage of late snows
- Plants must be hardened off or dormant

Plant during the monsoons – let nature water for you!

- Use only drought-tolerant plants
- Use natives or adapted xeric plants
- Use bulbs for early color – Spring blooming bulbs avoid drought

- Plant mid-size plants

- Smaller plants will die more easily from water fluctuations
- Do not plant plants with excessive top-growth for root size – they will transpire too much
- Harden them off to mountain climate
- When possible, plant in the evening, or on cloudy days
 - Plants won't be heat stressed
- Make sure to mulch!!!

Another option -- sowing wildflowers and grasses from seed

Sow wildflower seeds and grasses in the fall

This is when they are naturally sown by the plants

Winter is cool and wet

Seeds need cool stratification to break dormancy



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CMG GardenNotes #590b

Wildlife and the Gardener

Irene Shonle CSU Extension in Gilpin County

Observe presence and/or damage

How bad is it?

Confined to one/a few plants, one area of the home, one garden bed?

Is it short term? (A few leaves vs killing an established tree)

Can you just live with it?

If you can't live with it..

Next best choice is to exclude

This is the only long-term solution

Combination of making your yard less attractive and actively excluding

What attracts animals to your property?

Food

Plant

Animal prey

Other

Water

Shelter

Others members of the species

Bird feeders

Attractive plants

Young, small

Just planted from the nursery

Over fertilized

Non-native (but not exclusively)

Less palatable plants

Very aromatic plants

Bitter taste

Prickles and spines

Tough, leathery leaves

Toxic plants

Milky sap

Many plant, seed and bulb distributors list plant species as either deer or rabbit resistant

May limit the number of choices you have

Know the law

If wildlife is causing damage to crops, real or personal property, or livestock - a person (or any employee or agent of the landowner) may hunt, trap, or take the following wildlife on lands owned or leased by the person without securing a license to do so: Black-billed magpies, common crows, starlings, English or house sparrows, common pigeons, coyotes, bobcats, red foxes, raccoons, jackrabbits, badgers, marmots, prairie dogs, pocket gophers, Richardson's ground squirrels, rock squirrels, thirteen-lined ground squirrel, porcupines, crayfish, tiger salamanders, muskrats, beavers, exotic wildlife, and common snapping turtles. tree squirrels, cottontail rabbits, marmots, porcupines, bats, mice (except Preble's meadow jumping mouse), opossums, voles, rats, and ground squirrels.

Any person may kill skunks or rattlesnakes when necessary to protect life or property.

WHICH WILDLIFE SPECIES CAN I RELOCATE WITHOUT A PERMIT?

Tree squirrels, cottontail rabbits and raccoons can be relocated without a permit, If: The Division has been notified in advance.

The relocation site is appropriate habitat for the species.

Permission has been obtained from the landowner or managing agency

The relocation must occur within 10 miles of the capture site.

Control methods for pocket gophers

Barriers (small areas)

Wire mesh (1/4") tacked to bottom of raised bed

Ineffective: sonice devices, repellants and fumigants

Shooting pocket gophers is impractical because they seldom wander above ground.

Trapping

Traps can be set in the main tunnel or in a lateral, preferably near the freshest mounds.

Check traps twice daily since gophers often visit the traps within a few hours. If a trap is not visited within 48 hours, move it to a new location.

Trapping usually is most successful in the spring and fall when gophers are actively building mounds.

Pocket gopher toxicants

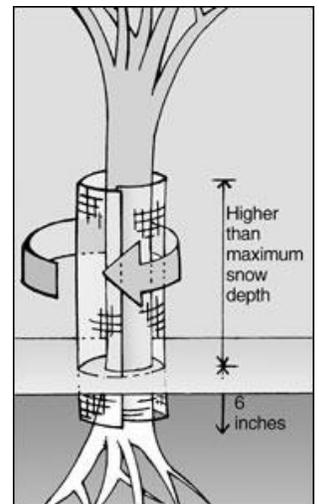
zinc phosphide (2 percent active ingredient)

Often sold as "poison peanuts"

strychnine (0.25 to 0.5 percent active ingredient), (usually restricted use)

chlorophacinone (Rozol) (0.005 percent active ingredient), (usually restricted use)

diphacinone (Eaton's Answer)(0.005 percent active ingredient)



Control Methods for Voles

Tree protectors

Barriers for garden beds

Dig a hole around the area you want to protect, 3” wide x 8” deep

Cut sheet metal or hardware cloth 15” wide and equal in length

Fold piece of material with a 2” foot, place in the trench, bury and pack the soil

Control vegetation

Cultivation, mowing, burning, herbicides

Repellents somewhat effective at high concentrations:

- blood meal, capsaicin, castor oil, coyote urine, and thiram)
- Most other compounds ineffective

Trapping

Mouse traps – set perpendicular to runways

Bait with rolled oats or peanut butter

Shooting (where permitted)

Dogs/cats

Rodenticides for Control of Voles – last resort (possible poisoning of non-target species)

2% zinc phosphide baits (Bell Labs, Chempar, Hopkins, USDA/APHIS)

Restricted use (must have applicator’s license)

Ramik, strychnine, anti-coagulants are illegal

Fumigants - likely not effective

Control of Wyoming ground squirrel

Shooting – legal, other squirrels may move into vacated areas

Trapping with wire-mesh cage, wooden rat snap-traps, or modified gopher traps.

Bait with rolled oats, peanut butter, fruit such as apples, or grain

Poison grain bait -most practical method for controlling large numbers

Most effective in early spring, or late June/ early July.

Two percent zinc phosphide is the only legal grain bait in Colorado.

- **RESTRICTED USE** – must have applicator license (non-target poisoning)

Fumigants are registered but complicated and problematic to use, transport (Hazmat)

Control methods for rabbits and ground squirrels

Exclusion Tree

protectors

Repellents

- Can be taste-based (contact) or odor based (area)
- There are new ones all the time - ask a local center or gardener what works best for your area or situation
- Not all brands will work for your situation, READ THE LABEL!
- Some brands wash off with precipitation, try to find one with oils that stick to plant leaves
- Success will vary over time and place

- Capsaicin, putrescent egg solids and garlic have been shown to be the most effective

Habitat alteration

- Remove brush pile habitat
- Rabbits/ground squirrels love to hide under low decks, porches
Block off access to take away “rabbit hotel”

Trapping (need permission from landowner to relocate)

- Wire cage traps - cover sides
- Place near cover
- Bait
Winter - ear corn, apples, clover, alfalfa
Summer - apples, carrots, cabbage

Methods not to use

- Electromagnetic, ultrasonic devices
- Toxicants - illegal
- Fumigants – illegal

Deer and Elk

Repellents

	<u>Deer</u>	<u>Elk</u>
• Hot Sauce (100x)	High	V. high
• Deer Away (BGR)	High	High
• Chicken eggs (1:4)	High	Medium
• Coyote urine	High	High
• Habanero peppers	Medium	
• Hot Sauce (10x)	Medium	
• Tabasco Sauce (1:1)	Medium	
• Thiram, Hinder	Medium	Medium
• Soap	Low-med.	
• Ro-pel, Ani-spray	Failure	Failure
• Hot Sauce (1x)	Failure	Failure

Exclusion methods for deer and elk

Tree Protectors

Electric Wire Fences

- Triple-galvanized, high-tensile 13.5 gauge
- Carry a current of 35 milliamps and 3,000 to 4,500 volts
- Can be 5,7, or 9 wire

One-wire peanut-butter baited fence

Wireless baited electric station

8' Tall non-electric fences

Double fence – deer cannot jump high and wide at the same time (4 feet high, 4 feet wide)

Deer and Elk Repellents

Research-based **egg /hot pepper repellant** (also works on rabbits)

- 1-2 beaten raw eggs
- One or more chopped Habanero pepper or hottest pepper you can find
- 4-5 cloves garlic (optional: rabbits)
- 1 quart or less water
- Shake well or blend.
- Strain with cheesecloth into sprayer
- Let it “ripen” a bit – putrescent egg solids most effective
- Spray on plants you wish to protect.
 - Rinse sprayer with clean water to avoid gumming.
 - Reapply after each rain
- Store leftovers outside out of the sun.

Repellent-impregnated cotton rope barrier

- Visual barrier plus an odor repellent
- Attach cotton cord or rope at a height of about 30 inches to 3- to 4-foot posts around the perimeter of the beds
- Spray an odor-based repellent directly onto the cotton rope or on strips of cotton cloth tied to the rope at 3- to 4-foot intervals

Soap has medium-low effectiveness, and human hair does not show effectiveness.

Dogs, pyrotechnics, and strobe lights have been shown to only have a temporary effect. Motion-activated water sprays work longer, but may still be temporary.



CMG GardenNotes #590c

Rabbit/Ground Squirrel/Deer Resistant Plants

In general, animals are discouraged by:

- ~ *Very aromatic plants*
- ~ *Prickles and spines*
- ~ *Tough, leathery leaves*
- ~ *Toxic plants*
- ~ *Milky sap*

No list is foolproof --a hungry animal will eat just about anything, including poisonous plants.

Surround the more delectable plants with deterrent plants.

Newly transplanted plants are more likely to be eaten – especially those just bought from nurseries, but even those recently moved within a garden. Bigger plants are more able to withstand nibbling.

Cultural controls such as removing brush piles or other protective cover where rabbits and ground squirrels hide and nest may help. Provide open areas in the landscape – small mammals tend to avoid open spaces that make them vulnerable to predators.

Many odor repellents are ineffective with rabbits, so read labels carefully before buying them. Something that works for deer may not work with rabbits. Some products are labeled for both. What works in one person's yard may not work in another person's yard.

Fencing with chicken wire fencing, hardware cloth or flexible netting at least two feet high, buried 4-8 inches under is fairly effective against rabbits. Deer can be prevented with fencing at least 8 feet high. Raised beds with hardware cloth (1/4" squares or less) tacked to the bottom can keep pocket gophers out of gardens. Encircle trees and shrubs with hardware cloth (buried an inch or two under the ground) to prevent voles from girdling the trees.

CRITTER RESISTANT PERENNIALS AND BULBS

Alliums, *Allium spp.*
Sagebrushes, *Artemisia frigida* and *ludoviciana*
Basket of Gold, *Aurinia saxatilis*
Bee balm, *Monarda spp.*
Black Eyed Susan, *Rudbeckia hirta*
Blanketflower, *Gaillardia spp.*
Bleeding Heart, *Dicentra spectabilis*
Blue Flax, *Linum lewisii*
Clustered bellflower, *Campanula glomerata*
Catmints, *Nepeta spp.*
Chives, *Allium schoenoprasum*
Cleome, *Cleome serrulata*
Columbine (marginal) *Aquilegia spp.* (especially bad when newly planted!)
Golden smoke, *Corydalis aurea*
Creeping Oregon Grape Holly, *Mahonia repens*
Creeping Baby's Breath, *Gypsophila repens*
Daffodils, *Narcissus spp.*
Delphinium, *Delphinium spp.*
Dianthus, *Dianthus spp.*
Dragon's head *Dracocephalon spp.*
Engelmann Ivy, *Parthenocissus quinquefolia engelmannii*
Golden Banner, *Thermopsis divaricarpa*
Goldenrod, *Solidago spp.*
Hardy Geraniums, *Geranium spp.*
Hummingbird Flower, *Zauschneria garrettii*
Iceland Poppy, *Papaver nudicaule*
Irises
Jacob's Ladder, *Polemonium aeruleum*
Kinnikinnick, *Arctostaphylos uva-ursi*
Lily of the Valley, *Convallaria maialis*
Locoweed, *Oxytropis spp.*
Lupine, *Lupinus spp.*
May Night Salvia, *Salvia sylvestris* x 'Mainacht'
Mexican Hat, *Ratibida columnifera*
Monkshood, *Aconitum spp.*
Oriental poppy, *Papaver orientale*
Pearly everlasting, *Anaphalis margaritacea*
Penstemon, *Penstemon spp.*
Pigsqueak, *Bergenia spp.*
Poppies, *Papaver spp.*
Prince's Plume, *Stanelya spp.*
Purple Flowering Sage, *Salvia nemorosa*
Pussytoes, *Antennaria spp.*
Sage, *Artemisia spp.*
Sea Pink, *Armeria maritima*
Showy Daisy, *Erigeron spp.*
Snow-in-Summer, *Cerastium tomentosum*
Soapwort, *Saponaria ocymoides*
Stone Crop, *Sedum spp.*
Sulphur Flower, *Erigeron umbellatum*

Tansy aster, *Macaeranthera tanacetifolia*

Thyme, *Thymus spp.*

Veronica, *Veronica spp.*

Yarrow, *Achillea spp.*

ORNAMENTAL GRASSES

Blue Fescue, *Festuca glauca*

Blue Avena Oat Grass, *Helictrotrichon sempervirens*

DECIDUOUS SHRUBS

Alpine Currant, *Ribes alpinum*

Apache Plume, *Fallugia paradoxa*

Boulder Raspberry, *Rubus deliciosus*

Curly Leaf Mountain Mahogany, *Cercocarpus ledifolius*

Cotoneaster, *Cotoneaster lucidus*

Gambel Oak, *Quercus gambelii*

Potentilla, *Potentilla spp.*

Rabbitbrush, *Chrysothamnus nauseosus*

Snowberry, *Symphoricarpos albus*

Tall Western Sage, *Artemisia tridentate*

Three Leaf Sumac, *Rhus trilobata*

Golden Currant, *Ribes aureum*



CMG GardenNotes #590d

Native Herbaceous Plants for the Mountains

(for more complete information, see fact sheet 7.242, Native Herbaceous Perennials)

Nodding onion – *Allium cernuum*
Pearly everlasting -*Anaphalis margaritacea*
Windflower- *Anemone multifida*
Pussytoes- *Antennaria* sp.
Colorado columbine- *Aquilegia caerulea*
Golden columbine - *Aquilegia chrysantha*
Sages – *Artemisia ludoviciana* and *A. frigida*
Harebells- *Campanula rotundifolia*
Indian paintbrush – *Castilleja* spp.
Showy daisy - *Erigeron speciosus*
Rocky Mountain bee plant - *Cleome serrulata*
Showy daisy – *Erigeron speciosus*
Sulphur flower - *Eriogonum umbellatum*
Wallflower - *Erysimum capitatum*
Blanketflower - *Gaillardia aristata*
Wild Geraniums - *Geranium viscosissimum* and *caespitosum*
Prairie smoke - *Geum/Erythrocoma triflorum*
Scarlet gilia/Fairy trumpet - *Ipomopsis aggregata*
Blue flag - *Iris missouriensis*
Blue flax - *Linum lewisii*
Silver lupine - *Lupinus argenteus*
White tufted evening primrose - *Oenothera caespitosa*
Pasque flower - *Pulsatilla patens*
Penstemons – *P. barbatus*, *P. virens*, *P. secundiflorus*, *P. strictus*, and others
Prairie coneflower -*Ratibida columnifera*
Black eyed Susan - *Rudbeckia hirta*
Golden banner - *Thermopsis divaricarpa*



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CMG GardenNotes #590e

Best Non-native Herbaceous Plants for Colorado Mountain Communities

Perennial Flowers

Yarrow -*Achillea* spp.
Monkshood – *Aconitum*
Chives – *Allium schoenoprasum*
Bugloss - *Brunnera macrophylla*
Columbine spp – *Aquilegia* hybrids
Clustered bellflower-*Campanula glomerata*
Mountain bluet- *Centaurea montana*
Jupiter’s beard- *Centranthus ruber*
Crambe- *Crambe cordifolia*
Dianthus species
Blanketflower – *Gaillardia* spp.
Hardy geraniums –*Geranium* spp.
Coral bells – *Heuchera* spp.
Delphinium spp.
Bleeding heart- *Dicentra spectabilis*
Dragon’s head - *Dracocephalon nutans*
Globe thistle-*Echinops* spp.
Sea holly-*Eryngium alpinum*
Iris – *Iris germanica*
Maltese cross- *Lychnis chalcedonica*
Lupine – *Lupinus perennis* or *L. polyphyllus*
Catmint-*Nepeta* spp.
Iceland poppy-*Papaver nudicale*
Oriental poppy-*Papaver orientale*
Penstemon hybrids
Peony – *Paeonia* spp.
Salvias - *Salvia nemerosa*
Scabiosa/Pincushion plant -*Scabiosa caucasica* and *lucida*
Sedum-*Sedum spectabile*
Painted daisy-*Tanacetum coccineum*
Snow daisy – *Tanacetum niveum*
Veronica Crater Lake Blue – *Veronica austriaca* ‘Crater Lake Blue’

Plant Select Plants that work at higher altitudes

Alpine willowherb- *Epilobium fleischeri*
Corsican violet-*Viola cornuta*
Dianthus “First Love”
COLORADO GOLD™ *Gazania linearis* COLORADO GOLD™

SNOW ANGEL™ Coral Bells- *Heuchera sanguinea* SNOW ANGEL™
Remembrance Columbine – *Aquilegia* ‘Remembrance’
‘Prairie jewel’ penstemon - *Penstemon grandiflorus* ‘Prairie jewel’
Turkish veronica -*Veronica liwanensis*
Cashmere sage – *Phlomis cashmeriana*

Annual Flowers

Snapdragons- *Antirrhinum* spp
California poppy- *Eschscholzia californica*
Gazanias – *Gazania* sp.
Sweet pea -*Lathyrus odorata*
Lobelia – *Lobelia erinus*
Geraniums -*Pelargonium* spp.
Annual alyssum - *Lobularia maritima*
Stock- *Mathiola* spp.
Breadseed poppy-*Papaver somniferum*
Shirley poppy- *Papaver rhoeas*
California bluebells -*Phacelia campanularia*
Larkspur – *Delphinium ajacis*
Pansies -*Viola* spp.
Mountain garland- *Clarkia elegans*
Nasturtiums – *Tropaeolum majus*
Honeywort – *Cerinthe major*

Ornamental grasses

Blue avena grass-*Helictotrichon sempervirens*
June grass *Koeleria macrantha*
Blue fescue - *Festuca ovina* var. *glauca*

Best bulbs

Daffodils
Grape hyacinths

Groundcovers and rock garden plants

Prickly Dianthus- *Acantholimon* spp.
Basket-of-gold- *Alyssum (Aurinia) saxatile*
Alpine rockcress -*Arabis alpina*
Sea thrift -*Armeria maritima*
Snow-in-summer- *Cerastium tomentosum*
Bellflowers -*Campanula* spp-- most do well – look for hardiness
Creeping baby’s breath- *Gypsophila repens*
Candytuft-*Iberis* spp.
Deadnettle -*Lamium maculatum*
Edelweiss -*Leontopodium alpinum*

Horehound-*Marrubium rotundifolium*
Pineleaf penstemon- *Penstemon pinifolius*
Creeping phlox-*Phlox subulata*
Himalayan Border Jewel-*Persicaria affinis*
Rock soapwort -*Saponaria ocymoides*
Saxifrages
Stonecrop -*Sedum* spp.
Hen and Chicks,-*Sempervivum* sp.
Thyme-*Thymus* spp.
Wooly veronica – *Veronica pectinata*