

CURRICULUM FOR LANDSCAPE WEEDS—OUTLINE

TIME REQUIRED: 4 hours

NUMBER OF SESSIONS: One per year

SUGGESTED CLASS SIZE: Up to 20 participants

Objectives

- 1) Identify weeds and learn their life cycles and growth habits.
- 2) Use indoor and outdoor class exercises to (a) practice monitoring techniques and data recording, (b) evaluate site conditions, (c) determine optimal management time, (d) learn management alternatives, and (e) handle various turf management tools and equipment.

Lecture and Discussion

A. What's a weed?, pages 3–5

Introduce objectives and lesson plan. Class defines *weed* and reviews definitions, names some school settings where they consider plants to be weeds.

B. Weed identification, classification, & management, pages 6–8

Identify weed specimens, the type of plant (grass or broadleaf), and how long it takes to complete its life cycle (annual, biennial, or perennial), and when they flower and set seed. Use this information to determine optimal management time to prevent weeds from spreading and dispersing seeds.

C. Tools and methods, pages 9–10

View slides of monitoring techniques and types of management. Discuss weed treatment options and mulches. Discuss and examine tools on the display table and their role in an IPM program.

Exercises

D. Field Exercise 1, page 11

Estimating Extent of Weed Infestations

Each team records the following information in three designated areas: most abundant species, type, stage, height, amount (percent of designated area), and potential problem.

E. Field Exercise 2, page 12

Evaluating Soil Surface Conditions: Mulch, Compaction, Moisture

Each team evaluates mulch depth, compaction, and moisture in different locations.

F. Sample Weed Monitoring Form, page 13

Using information from the first two exercises, class completes this form to summarize weed monitoring information and recommended management alternatives. Discuss the exercises and decisions made when filling out the form.

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School IPM Curriculum—Landscape Weeds

References

- Ali, A.D. and Clyde Elmore. 1989. *Turfgrass Pests*. Cooperative Extension. University of California Division of Agriculture and Natural Resources (Pub. 4053) Oakland, Calif. 121 pp.
- Dreistadt, S.H., J.K. Clark and M.L. Flint. 1994. *Pests of Landscape Trees and Shrubs*. UC DANR. (Pub. 3359). Oakland, Calif. 327 pp.
- Fischer, B. 1989. *The Grower's Weed Identification Handbook*. UC DANR. (Pub. 4030) Oakland, Calif. 311 pp.
- Flint, M.L. and P. Gouveia. 2001. *IPM in Practice: Principles and Methods of Integrated Pest Management*. UC DANR. (Pub. 3418). Oakland, Calif. 296 pp.
- Whitson, T. 2000. *Weeds of the West, 9th ed.* Western Society of Weed Science and University of Wyoming. Jackson, Wyo. 630 pp.
- Wilen, C.A. and C.L. Elmore. 2001. *Weed Management in Landscapes*. UC IPM Pest Management Guidelines. UC DANR. (Pub. 7441). Oakland, Calif. 6 pp.
<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7441.html>
- Also refer to *Curriculum for Turf Weeds*.

Materials

Books

- Turfgrass Pests* (one for each team of two participants)
-

Visual aids

- Slides of landscape weeds
 - Slides of monitoring and of management alternatives (cultural, physical, biological, and chemical)
 - Weed identification posters or print photos of regionally common weeds from the UC IPM Weed Photo Gallery, http://www.ipm.ucdavis.edu/PMG/weeds_common.html
-

Supplies

- Quart-size ziplock style baggies (for weed specimens)
-

Specimens

- Mulch (several types)
 - Weeds (several different species collected from training site if possible—one or two specimens for each team of two participants)
-

Tools and equipment

- Weed-suppressive cloth
 - Hoes, dandelion fork, weed popper, weed scrapers, hula hoe
 - Soil probes
 - Propane waffle iron for weed management
 - Propane torch kit for weed management
-

Products

Display a variety of herbicide alternatives commonly used at the training site and several that may have more limited uses, e.g., herbicides exempt from registration.

CURRICULUM FOR LANDSCAPE WEEDS—LESSON PLAN

A. What's a weed?

Ask class to define weed

When do plants become bad or good—weeds or beneficials? It's really situational; it might have to do with personal preferences, aesthetics, or health and safety. **Weeds are plants in the wrong place. A weed is a plant that does more harm than good and has a habit of encroaching where it is not wanted.**

Weeds can cause serious problems around school facilities because some

- Provide a harborage for pests such as insects, rats, and mice (e.g., English ivy);
- Interfere with normal building use and maintenance and may detract from the building's appearance;
- Grow in cracks of pavement and contribute to the breakdown of paving materials;
- Restrict air circulation, light and other factors needed to keep pest problems from occurring;
- Are fire hazards and violate fire codes when they dry up (e.g., grasses);
- Bother people with allergies during pollen production (e.g., grasses, knotweed); and
- Are poisonous to people (e.g., poison oak).

Plants become weeds under some circumstances. Use these criteria to determine weed potential:

- Is the plant native to the area or exotic?
- Does the plant displace native, or otherwise desirable, vegetation?
- Is the plant aggressive, competitive, and readily spread?
- Is the plant a host of pests or plant diseases?
- Does the plant have a restrictive height in terms of line-of-sight?
- Does the plant's excessive growth create a fire hazard?

Suggestions for classroom activities

- Have class name some settings or situations where they consider plants to be weeds on school grounds.
- Show about five slides of weeds in school settings (**Note: These are photos you've taken yourself, or downloaded from the internet with permission.**)
- Discuss other types of weed problems in schools.

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Common weed problems in landscaped areas

- **Unaesthetic plants**—The way they look is objectionable to some. Examples include plants around school perimeters in minimally landscaped areas.
- **Unmanaged plants creating hazards**—Examples include sidewalk, driveway, and walkway crack plants, plants near playing fields which have thorns or sharp, prickly surfaces such as yellow starthistle.
- **Fire hazards**—In non-irrigated areas, dry plants more than three inches in height may be fire hazards if not managed. Mainly near perimeter fences.

→ Have class list environmental or habitat factors that cause weed problems.

Examples of environmental or habitat factors that may cause weed problems

- Disturbed soil—soil becomes compacted or flooded, reducing oxygen and room to discharge carbon dioxide. Plants die, unless they are specially adapted to live with reduced oxygen and weeds move in.
- Seed dispersal by wind, equipment, vehicles, foot traffic (see box below for more information about dispersal)
- Desirable vegetation does not compete well
- Changing environmental conditions favoring weed species; e.g., increased irrigation
- Changing site conditions caused by campus expansion; e.g., building a new athletic field in a previously weedy area
- Close proximity to weedy field(s)
- Changing practices on neighboring properties; e.g., less weed management
- Inappropriate selection and propagation of weedy ornamentals; e.g., English ivy, which easily becomes invasive

Dispersal and movement

Weeds disperse in a variety of ways. Weed seeds may be blown around in wind, washed away in water, or transported by animals that have fed on them. Human activities are an important means of dispersal. Weed seeds and other reproductive structures are carried onto school property on contaminated equipment, in soil, and by attaching to clothing. Because school grounds are disturbed sites, the ability of weeds to establish in new areas is increased.

B. Weed identification, classification, & management

Is it a weed?

The art and science of categorizing a plant as a weed will be approached using the look–see–feel method in our workshop, as follows:

First, you have to be able to identify the weed. Figure out if the plant you are looking at is a *monocotyledon* or *monocot* (usually the grass family). *Mono* refers to one set of cotyledons (the first two leaves produced by the plant), also known as seed leaves. Veins are usually parallel to the leaf—think grasses, palms, and lilies.

Or is the weed a *dicotyledon* or *dicot*? (Dicots are also known as broadleaf plants, although mature representatives sometimes have narrow leaves.) Dicots have two leaves when they first sprout. Veins are usually perpendicular to the leaf. However, if you have a mature plant, it's easy to recognize whether it has broad or narrow leaves. Other plant parts to examine closely are flowers, seeds, leaves, stems and roots. Ideally, figuring out the plant family is the best way to begin.

Once you think you have a plant identified, you'll want to know whether it's an *annual*, *biennial*, or *perennial*. You can find this information in books or on the internet. Also see the Table on pages 28–29 in Ali and Elmore (1989), which is listed below.

Annual = one year to complete life cycle
Biennial = two years to complete life cycle
Perennial = more than two years to complete life cycle

Weed Identification Resources

Books

Ali, A.D. and Clyde Elmore. 1989. *Turfgrass Pests*. Cooperative Extension. University of California Division of Agriculture and Natural Resources. (Pub. 4053) Oakland, Calif. 121 pp.

Fischer, B. 1989. *The Grower's Weed Identification Handbook*. University of California, Division of Agriculture and Natural Resources. (Pub. 4030) Oakland, Calif. 311 pp.

Whitson, T. 2000. *Weeds of the West, 9th ed.* Western Society of Weed Science and University of Wyoming. Jackson, Wyo. 630 pp.

Also refer to *Curriculum for Turf Weeds*.

Web sites

- UC IPM: http://www.ipm.ucdavis.edu/PMG/weeds_common.html
- Iowa State: <http://www.weeds.iastate.edu/weed-id/weedid.htm>
- FMC Corp.: <http://ag.fmc.com/ag/weedbug/>

School IPM Curriculum—Landscape Weeds

Getting samples identified

If there are local weed samples you cannot identify, take them to your local county agricultural commissioner or UC Cooperative Extension office. Phone numbers and locations of both are in the county pages of your telephone directory.

Be sure to protect fresh samples sent by mail from damage. To prevent rotting, do not place fresh plant material in ziplock or sealed plastic bags. Samples pressed and dried can be sent in an envelope between two stiff pieces of cardboard. Please include all relevant plant information such as habitat, size of original plant (if sending only a partial specimen), location, elevation, and plant characteristics that are not easily discernible from the sample (i.e., root type, flower color).

Classroom Exercise: Weed identification and classification

Display a selection of ten weed specimens collected from various locations around the school. Divide the class into teams of two, assigning each team a weed specimen. Ask each team to name its mystery weed, then classify the weed as an **annual**, **biennial**, or **perennial**; **broadleaf** or **grass**.

Together, the class should next complete the Table 1 on the next page for all specimens. Make references available for each team, specifically the table from Ali, A.D., and C.L. Elmore (1989), *Characteristics of Turfgrass Weeds, and Their Annual Periods of Growth and Control*.

Allow time to finish this exercise. Go through the samples and identify them together. Then, using the Ali & Elmore table, go through and figure out when you have windows of opportunity to manage these weeds.

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Table I. Weed Identification and Classification Worksheet

Name the weed and decide the type of plant and how long it takes to complete its life cycle

Name	Grass	Broadleaf	Annual	Perennial	Biennial	Month(s) of flower & seed production	Month(s) of seed germination
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

School IPM Curriculum—Landscape Weeds

Determining Optimal Timing for Management

Below is a list of weeds classified by life cycle (annual, perennial, biennial); type of growth (grass, broadleaf, or woody); and when the plants grow, flower, and set seed in coastal and some inland parts of California. This information will help to devise a management plan.

Table 2. List of weeds classified by life cycle

	Name	Plant Family	Growing Season	Flower & Seed Production
Annual Broadleaf	California bur clover	Fabaceae	winter	Mar.–June
	bristly oxtongue	Asteraceae	summer	Apr.–Dec.
	cheeseweed (<i>Malva</i>)	Asteraceae	summer	Mar.–Oct.
	vetch (9 species)	Fabaceae	summer	Apr.–June
	mustard (black)	Brassicaceae	winter	Feb.–June
	yellow starthistle	Asteraceae	summer	June–Dec.
	Annual Grass	annual bluegrass	} Poaceae	winter
crabgrass		summer		Jan.–Sept.
wild oats		winter		Mar.–June
Italian ryegrass		summer		June–Aug.
Biennial Broadleaf	bristly oxtongue	Asteraceae	summer	Apr.–Dec.
	cheeseweed (<i>Malva</i>)	Malvaceae	summer	Mar.–Oct.
	narrowleaf plantain	Plantaginaceae	cool	Apr.–Aug.
	vetch	Fabaceae	spring–summer	Apr.–June
Perennial Broadleaf	Herbaceous (non-woody) Perennials			
	sweet alyssum	Brassicaceae	all year	most of year
	broadleaf plantain	Plantaginaceae	spring–fall	Apr.–Sept.
	dandelion	Asteraceae	all year	all year
	puncturevine	Zygophyllaceae	summer	Aug.–Oct.
	milkweed (4 species)	Asclepiadaceae	summer–fall (warm)	varies by species
	narrowleaf plantain	Plantaginaceae	spring–summer (cool)	Apr.–Aug.
	oxalis	Oxalidaceae	winter–spring (cool)	Nov.–May
	vetch (one species)	Fabaceae	spring–summer	Apr.–June
	white clover	Fabaceae	all year	Apr.–Dec.
	Woody Perennials			
	blackberry	Rosaceae	spring–fall	Apr.–July
	poison oak	Anacardiaceae	spring–summer (warm)	Apr.–May
Perennial Grass	Grassy Perennials			
	bermudagrass	} Poaceae	spring–fall	June–Oct.
	dallisgrass		summer–fall (warm)	June–Oct.
	beardless ryegrass		spring–early winter	May–June
	kikiyugrass		summer–fall (warm)	Mar.–Oct.

C. IPM Tools and Methods

Not only do you have to determine optimal timing to manage landscape weeds, but you must also know which tools to use and practices to consider.

Conventional and IPM programs—what’s the difference?

Conventional Spray Program (= bare soil maintenance)

A typical conventional spray program often features 2–3 herbicide treatments per year.

IPM Program

An IPM program often features the following components:

- Identify weed species, quantify population levels and define tolerance.
- Monitor on a quarterly basis, and before and after each treatment.
- Use biological, physical, and mechanical practices first. Incorporate landscape redesign into decisions.
- Use herbicides as a last resort.

Biological control = the use of natural enemies of a weed to reduce its population

- Competitive plantings
 - Goats—good for open spaces, large areas, fire hazards, poison oak
- Weed-eating insects—e.g., for managing yellow starthistle (California Department of Food & Agriculture releases for free), some other weeds

Physical and Mechanical = direct action; tools that directly disrupt or kill weeds

- Cultivation
 - Propane torch or waffle iron
- Hand pulling
 - Cement
- Mulch (See Appendix)
 - Caulk
- Weed-suppressive cloth
- Mowing—Cut off flower heads when possible to prevent seed formation and spread
- Mow bands and strips—leave an area free of plants or turf around fences and fencelines

Cultural = Modifying growing techniques to reduce weeds and favor beneficials

- Irrigation
 - Drainage
- Fertilization
 - Change attitudes—Tolerate some weed growth
- Choosing the right plant

Chemical = herbicides—poisons designed and sold to kill weeds

- Least-hazardous alternatives: Least-toxic registered or exempt products with active ingredients such as clove oil*, 2-phenethyl propionate*, sodium lauryl sulfate*, fatty acids, acetic acid (vinegar), citric acid* and garlic* (* = exempt from registration)

Classroom Summary Exercise

Table 3. IPM Practices for Weeds (see list on previous page for help with answers)

SITE	WEED	PROBLEM	TREATMENT	OPTIMAL TIME
Non-irrigated fenceline	Italian thistle <i>(example)</i>	Aesthetic Spreading into adjacent areas	Mow ¹ Clove oil ^{1,2} Mow bands ¹	} Spring ³
Irrigated tree or shrub planting	white clover			
Irrigated fenceline	mustard			
Asphalt playground	spotted spurge			
Concrete walkway	silver knotweed			
Running track	yellow starthistle			
Non-irrigated mixed planting	wild oats			
Non-irrigated fenceline	bristly oxtongue			
Irrigated mixed planting	oxalis			

¹ In this example, combining these three treatments may result in optimal management.

² Exempt material under the Healthy Schools Act—use does not require notification or posting.

³ Treat in spring before flowers develop and stems become woody.

D. Field Exercise 1

Estimating Extent of Weed Infestation

PURPOSE: To evaluate the extent of weed infestation in landscaped areas.

PROCEDURE: Each team of 2–3 throws a hula hoop or a similar object into a landscaped area (e.g., flower bed) to mark off three different sections. Finish one section before starting a new one. For the second section, list a weed species different from the first, and likewise for the third. Allow 20 minutes for completion.

BIGGER PICTURE: Identifying and monitoring the weeds in your landscape will help you develop weed management alternatives.

Identify the most abundant weed species (See *Turfgrass Pests* for help with species identification.)

1. _____ 2. _____ 3. _____

Type of Weed

1. p Broadleaf p Grass p Annual p Perennial
 2. p Broadleaf p Grass p Annual p Perennial
 3. p Broadleaf p Grass p Annual p Perennial

Stage

1. Germinating First leaves Real leaves Vegetative growth No growth
 Flowering Dispersing seed
2. Germinating First leaves Real leaves Vegetative growth No growth
 Flowering Dispersing seed
3. Germinating First leaves Real leaves Vegetative growth No growth
 Flowering Dispersing seed

Height

1. p 0–3" p 4–7" p 8–12" p 13–15" p 16–19" p 20–24"
 2. p 0–3" p 4–7" p 8–12" p 13–15" p 16–19" p 20–24"
 3. p 0–3" p 4–7" p 8–12" p 13–15" p 16–19" p 20–24"

Amount of Coverage by Weeds (Note: thresholds vary for different species)

1. 0–5% 6–15% 16–25% 17–50% 51–75% 76–100%
 2. 0–5% 6–15% 16–25% 17–50% 51–75% 76–100%
 3. 0–5% 6–15% 16–25% 17–50% 51–75% 76–100%

Potential Problems—Why it’s important to manage the weed species

1. Tripping Attracts trash Harborage for other pests Fire Aesthetic
 Spreading into adjacent areas Other _____
2. Tripping Attracts trash Harborage for other pests Fire Aesthetic
 Spreading into adjacent areas Other _____
3. Tripping Attracts trash Harborage for other pests Fire Aesthetic
 Spreading into adjacent areas Other _____

E. Field Exercise 2

Evaluating Soil and Mulch Conditions: Depth, Compaction, & Moisture

PURPOSE: To evaluate the influence of soil and mulch conditions.

PROCEDURE: Each team evaluates mulch depth, compaction of soil, and moisture in five separate landscaped locations. These locations can be weedy or weed free. Allow 20 minutes for completion.

BIGGER PICTURE: This exercise will help you assess the thickness of your mulch layer and whether soil compaction is a problem. Many mulch types improve the water-holding capacity of soil. The lack of mulch in an area combined with compacted soil will increase the chances of weed growth.

Samples

Mulch depth: 1 _____ 2 _____ 3 _____ 4 _____ 5 _____

Soil compaction: 1 _____ 2 _____ 3 _____ 4 _____ 5 _____

- A. None—probes easily, little resistance
- B. Some—some resistance, but little pressure needed
- C. Noticeable—resistance noticeable, difficult to sample
- D. Extreme—cannot penetrate or sample

Evaluating Moisture of Mulch and Soil

Sample	Location	Depth	Moisture content			
1		0"–3"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
		4"–6"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
2		0"–3"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
		4"–6"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
3		0"–3"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
		4"–6"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
4		0"–3"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
		4"–6"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
5		0"–3"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet
		4"–6"	<input type="checkbox"/> Dry	<input type="checkbox"/> Moist	<input type="checkbox"/> Wet	<input type="checkbox"/> Very wet

Remember: When soil becomes compacted or flooded, oxygen available to desirable plants is reduced and there is little room to discharge carbon dioxide. Plants die, unless they are specially adapted to live with reduced oxygen. Weeds, which are often happy under these conditions, move in.

F. Weed Management Summary

Sample Weed Monitoring Form

PROCEDURE: Use information from the first two exercises to complete this form. Summarize weed monitoring information and recommend management alternatives. Discuss the exercises and decisions made when filling out the form.

WHY MONITOR? HOW OFTEN? Don't let weeds get away from you! Manage them before they get woody, or flower and set seed. Ideally, you should monitor every week to two weeks during the growing season.

Date inspected: _____ Form prepared by: _____

Location: _____

Area monitored	Weed species	Infestation level
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Recommended solutions: Pursue alternative practices before using herbicides. The order of preference is as follows:

- Hoe and or remove by hand—all weeds that exceed 18" in height
- Monitor and adjust irrigation
- Modify habitat—such as enlarging or reducing size or type of planting
- Weed flamer—for use in winter and spring, especially for cracks
- Hot water—non-selective especially effective for non-weedy species
- Mulch—especially for non-turf situations
- Chemical applications—consider using herbicidal products that are exempt from notification and posting under the Healthy Schools Act

Specific recommendations

WEED INFESTATION LEVELS:

Category 1: 1–5%

Category 2: 5–10%

Category 3: 15% or more

PRIORITY WEEDS—Within each category, make a special note of persistent weeds that are not well tolerated at the site. These weeds may demand continuous management, and will be listed as priority weeds. Examples include nutsedge, field bindweed, bermudagrass (in certain situations), and kikuyu grass.

Mulch

Use the following references and tables to evaluate suitable mulches for landscaped areas. Note that any mulch that is throwable—bark, for instance—is probably unsuitable to use around a school.

References

Dreistadt, S.H., J.K. Clark and M.L. Flint. 1994. *Pests of Landscape Trees and Shrubs*. UC DANR. (Pub. 3359). Oakland, Calif. 327 pp.

See **Mulches**, pages 231–235, especially tables 7–4 and 7–5, organic and inorganic mulches.

Flint, M.L. and P. Gouveia. 2001. *IPM in Practice: Principles and Methods of Integrated Pest Management*. UC DANR. (Pub. 3418). Oakland, Calif. 296 pp.

See **Mulches**, pages 122–123, especially Table 5–12, Mulching materials commonly used in landscape situations.

Some Materials Used for Mulch

Table A1. Longevity of Mulch Materials for Weed Management*

Material	Optimum depth	Longevity
Cocoa bean hulls	2 inches	3 months
Compost	4 inches	3 months
Green yard waste	4 inches	6 months
Hortopaper®	Thin sheet	3 months
Oat straw	4 inches	6 months
Rice straw	4 inches	12 months
Wood chips, cedar chips	3–4 inches	12 months
Wood chips, eucalyptus	4 inches	12 months
Wood chips, fir bark, ¼"	4 inches	3 months
Wood chips, mixed	6 inches	12 months
Woven fabrics	Thin sheet	3–8 years

*Longevity depends on exposure to sun, climatic factors, weed species, age of material, and depth.

Table A2. Cost of Different Mulch Materials*

Material	Type	Price/yd ³ (low to high volume)
Wood chips	Green from dump	\$2-\$4
	Brown from dump	\$9-\$11
	From wood farm	\$18
	Cedar bark	\$25
	Cedar mulch	\$32
	Shredded bark	\$28
	Redwood mulch, medium	\$29
	Chipped bark	\$40
	Fir bark, ¼" clean	\$42
Composts	Early compost (green waste)	\$3-\$5
	Late compost (green waste)	\$6-\$12
	Eco Compost	\$18-\$21
	Chicken compost	\$36
Other materials	Cocoa bean hulls	\$36
	Class II base rock	\$35
	Landscape fabric	\$81

* These are approximate prices for 2003 and may vary locally.