



Photo: ASI

SECTION V:

*Getting More
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CHAPTER 18: Additional Resources for Targeted Grazing

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ADDITIONAL RESOURCES



Scientific Articles and Reports:

- DiTomaso, J.M. 2000. **Invasive Weeds In Rangelands: Species, Impacts and Management.** *Weed Science* 48:255-265.
<http://wssa.allenpress.com/pdfserv/i0043-1745-048-02-0255.pdf>
- Frost, R.A. and K.L. Launchbaugh. 2003. **Prescription Grazing for Rangeland Weed Management - A New Look at an Old Tool.** *Rangelands* 25: 43-47.
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- Hart, S.P. 2001. **Recent Perspectives in Using Goats for Vegetation Management in the USA.** *Journal of Dairy Science* 84 (E. Suppl):E170-E176.
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- Luginbuhl, J.M., J.T. Green, J.P. Mueller, and M.H. Poore. 1996. **Meat Goats in Land and Forage Management.** In: *Proceedings of the Southeast Regional Meat Goat Production Symposium* "Meat Goat Production in the Southeast—Today and Tomorrow." February 21-24, 1996. Florida A&M University, Tallahassee.
www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGLand.htm
- Luginbuhl, J.M., J.T. Green, M.H. Poore, and J.P. Mueller. 1996. **Use of Goats as Biological Agents for the Control of Unwanted Vegetation.** Presented at the International Workshop "Use of Trees in Animal Production Systems." Indio Hatuey Pasture and Forage Experimental Station, Matanzas. November 26-29, 1996.
www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGVeget.htm
- Olson, B.E. and J.R. Lacey. 1994. **Sheep: A Method for Controlling Rangeland Weeds.** *Sheep and Goat Research Journal* 10:105-112.
www.cnr.uidaho.edu/rx-grazing/readings/Olson_Lacey_Sheep_Res_1994.pdf
- Olson, B.E. 1999. **Grazing and Weeds.** p. 85-96 In: R.I. Sheley and J.K. Petroff, eds. *Biology and Management of Noxious Rangeland Weeds.* Corvallis, OR. Oregon State University Press.
- Olson, B.E. 1999. **Manipulating Diet Selection to Control Weeds.** In: K.L. Launchbaugh, K.D. Sanders, and J.C. Mosley, eds. *Grazing Behavior of Livestock and Wildlife.* Idaho Forest, Wildlife & Range Exp. Sta. Bull. #70 Univ. of Idaho, Moscow, ID.
www.cnrhome.uidaho.edu/default.aspx?pid=74888
- Popay, I. and R. Field. 1996. **Grazing Animals as Weed Control Agents.** *Weed Technology* 10:217-231.
- Severson, K.E. and P.J. Urness. 1994. **Livestock Grazing: A Tool to Improve Wildlife Habitat.** In: M. Vavra, W.A. Laycock, and R.D. Pieper, eds. *Ecological Implications of Livestock Herbivory in the West.* Denver, CO: Society for Range Management. p 232-249.



Photo: Ray Holes, Prescriptive Grazing Services, Idaho



Photo: ASI

Organizations and Information on the Web:

- *The University of Idaho* hosts a *Prescription Grazing for Vegetation Management* site that contains links to many articles regarding prescribed grazing, animal behavior, animal production, and noxious and invasive weeds. Many great articles can be found at this site, an excellent source of scientific and popular press articles. www.cnr.uidaho.edu/rx-grazing
- *The Western Rangelands Partnership* is a group of rangeland extension educators and library information specialists who gather information about rangeland ecology and management and publish it on this excellent searchable website. www.rangelandswest.org
- *BEHAVE* is an organization of scientists and practitioners dedicated to Behavioral Education for Human, Animal, Vegetation, and Ecosystem management. The BEHAVE website features fact sheets, research findings, announcements of seminars, workshops and field days, and information on ordering materials produced by the BEHAVE consortium. www.behave.net
- *ATTRA* (Appropriate Technology Transfer to Rural Areas) is a national sustainable agriculture information service that serves farmers and educators who need information about sustainable practices. Contact the technical specialists at ATTRA by calling (800) 346-9140 or access their website. Specialists can search for information, provide references to people with experience, and offer guidance on finding helpful materials. www.attra.ncat.org
- *The Center for Invasive Plant Management* has a website that includes articles about ecological management, resources, and educational events (including workshops and courses); also lists funding sources. www.weedcenter.org

- **Livestock for Landscapes** provides information and training for using livestock as landscape management tools. This site includes a community and provider network, workshops and consultation, training cows to eat weeds, using goats to reduce fire hazards, resources, and links. www.livestockforlandscapes.com
- The **Maryland Small Ruminant Page** is an outstanding source of sheep and goat information. Articles can be found on general weed information, weed identification, noxious/invasive weeds, weed control, along with dozens of articles about controlling weeds with sheep and goat grazing. www.sheepandgoat.com/weed.html
- **Langston University** in Oklahoma hosts the E. (Kika) de la Garza American Institute for Goat Research, which has an interesting website with information about using goats for fire management and brush control. Click on “library” and then look at the Field Day Proceedings, especially those for 2004, 2002, and 2000. See also the web-based training module 15, “Goats for Vegetation Management,” by Steve Hart. www2.luresext.edu
- The **Natural Resources Conservation Service** national website is searchable and contains information that can help land managers. Contacting state and local NRCS personnel is a great move, as they can assist with soil, water quality, stocking rate, fencing, and many other components of range and pasture management. www.nrcs.usda.gov
- The **USDA Cooperative State Research, Education, and Extension Service** provides a wealth of information regarding grazing, weeds, and livestock care and feeding. It links to area county extension offices, where extension agents/educators are available to answer questions on a variety of topics. www.csrees.usda.gov
- The **National Plants Database** includes information about more than 43,000 plants, including noxious and invasive plants listed for each state. It provides pictures to aid in identification. www.plants.usda.gov
- The **National Invasive Species Council** hosts a comprehensive database pertaining to federal and state activities with invasive species. The site contains specific species profiles, their impacts, and the federal government’s response. The site links to other agencies and organizations dealing with invasive species issues. www.invasivespeciesinfo.gov
- The **Society for Range Management** is a professional society dedicated to supporting people who work with rangelands and have a commitment to their sustainable use. SRM hosts a website with publications, links to other websites, calendar of events, videos that can be checked out for a small fee, and much more. The Rangeland Ecology and Management journal (formerly the Journal of Range Management) and the magazine Rangelands are both published by SRM and are referenced on their website. www.rangelands.org
- The **American Sheep Industry Association** represents the interests of sheep and goat producers located throughout the United States, from farm flocks to range operations. ASI hosts a website of information and publications related to sheep production. The Sheep and Goat Research Journal, published by ASI, can be accessed at their site. www.sheepusa.org
- The **Montana Sheep Institute** conducts and provides research on using sheep for weed control. Their website includes a list of recent research and a photo gallery. www.sheepinstitute.montana.edu

CD-ROMs, DVDs, Videos

- **Multi-Species Grazing and Leafy Spurge**

TEAM Leafy Spurge. 2002.
USDA-ARS Northern Plains
Agriculture Research Laboratory
1500 North Central Avenue
Sidney, MT 59270
406-433-2020

www.team.ars.usda.gov

This CD provides a variety of useful information about using grazing as an effective, affordable, and sustainable leafy spurge management tool. It contains economic reports, the Multi-Species Grazing and Leafy Spurge manual, a PowerPoint® presentation, posters, photos, an extensive bibliography, and more. A great resource.

- **GOATS! For Firesafe Homes in Wildland Areas**

Kathy Voth
6850 West County Road 24
Loveland, CO 80538

www.livestockforlandscapes.com

This CD/Handbook is designed to provide fire managers, communities, and livestock owners information on using goats to reduce fire danger. It includes expected results and the “hows” of managing animals, choosing treatment sites, developing contracts for services, estimating costs, and starting projects. This is a great CD with some excellent videos.

- **Healing the Land Through Multi-Species Grazing**

Washington State University Extension. 2004.
VT0119 (also available as DVD0119). Call the Bulletin Office at (509) 335-2857 or 800-723-1763; or write to: Bulletin Office, Washington State University, P.O. Box 645912, Pullman, WA, 99164-5912 USA. Can also be ordered online:

<http://cru84.cahe.wsu.edu/cgi-bin/pubs/VT0119.html>

This video is about the use of multi-species grazing (cattle, sheep, goats) as a tool in an integrated approach for the control of noxious weeds. It depicts the activities of a two-year regional project funded by the USDA Western Sustainable Agriculture Research and Education Professional Development Program. Thirty participants from four states (Washington, Idaho, Oregon, and California) took part in this project.

Finding More

- **SARE Project Reports and Contacts**

Sustainable Agriculture Research and Education (SARE) program is a funding source for farmers, researchers, and educators. SARE has funded numerous projects related to using sheep or goats to manage vegetation. Visiting the SARE site and learning about those projects can provide useful information and contacts. Go to www.sare.org and then “project reports” and then “search database” and search using terms to limit the results. For example, to find out if there are projects using sheep to graze in orchards, use “sheep and trees” for the terms. The site allows for limiting results to only farmer/rancher projects or only a particular region. In addition to the project reports, SARE offers some publications. Search the main site to find stories and publications that are pertinent; “sheep and goats and weeds” or “sheep and trees” will provide a good start.

- **USDA CRIS System**

All research sponsored or conducted by the USDA is required to be documented in the Current Research Information System (CRIS), a unit of the Cooperative State Research, Education, and Extension Service (CSREES). The CRIS database currently includes information covering over 95% of all publicly supported agricultural and forestry research. To learn about pertinent research projects, go to <http://cris.csrees.usda.gov> and click on “search CRIS now.” The screen will show project titles and investigators; clicking on “more” provides a project summary, including all progress reports and lists of publications detailing this research.

- **AGRICOLA From the National Agricultural Library**

For scientific articles related to prescribed grazing, the most comprehensive database of published works related to agriculture is maintained by the National Agricultural Library. The database can be searched by key word, title, or author to locate relevant articles. Searching is made easy by the electronic catalog called AGRICOLA available on the web at <http://agricola.nal.usda.gov>

- **Sheep and Goat Research Journal**

From the American Sheep Industry; go to www.sheepusa.org and click on “Research Journal.” Then click on the title and to find several issues online, including the 1994 Special Issue: The Role of Sheep Grazing in Natural Resource Management. Also available through libraries.

- **Small Ruminant Research**

Publishes original, basic, and applied research articles, technical notes, and review articles on research relating to goats and sheep (and deer, camelids, and camels). This is the journal of the International Goat Association (www.iga-goatworld.org), and access to full-text articles online is available to association members. Copies of the journal are also available in libraries and on the web at www.iga-goatworld.org/srr/index.htm

- **Rangeland Ecology and Management** (formerly the Journal of Range Management)

Published by the Society for Range Management (www.rangelands.org). Issues can be found online at www.srmjournals.org and can also be received through subscription. Membership in the Society for Range Management is open to anyone engaged or interested in any aspect of the study, management, or use of rangelands. The Society offers publications and training opportunities and meetings. This journal is peer-reviewed and geared to scholars.

- **Rangelands**

*Also published by the Society for Range Management and available online or through subscription. Go to www.srmjournals.org to access this magazine, which features scientific articles, book reviews, and society news, as well as youth, technology, and policy departments. Information is scientifically correct and presented in a user-friendly, non-technical format. **Rangelands** is intended for educators, students, rangeland owners and managers, researchers, and policy leaders. Archived volumes of **Rangelands** from 1978 through 1998 are available at: <http://rangelands.library.arizona.edu/rangelands/>*

GLOSSARY

- Aestivate:** To become dormant during the summer or dry season.
- Alkaloids:** Nitrogen-containing plant compounds that can have several toxic effects on grazing animals. These compounds can be poisonous to animals, causing birth defects, loss of muscle control, or death.
- Apical Meristem:** The growth point on a plant at the tip of a shoot that causes the shoot to grow longer and can suppress growth of other stems on the plant. When the apical meristem is removed, the stem stops growing, but other stems on the plant may be stimulated to grow.
- Axillary Bud:** The growth point on a plant located at the junction of the stem and the leaf. New stems or bunches of grasses, shrubs, and trees emerge from axillary buds.
- Basal Area:** The area at the base of a plant that extends into the soil.
- Biological Control (or biocontrol):** The practice of introducing natural predators and parasites to harm an undesirable plant or animal. In the case of weed management, biocontrol usually involves introducing an insect or infectious organism, like a disease or rust, to suppress the growth or reproduction of the weed.
- Biomass:** The total weight of aboveground leaves, stems, flowers, and seeds of plants in an area. This term could include living or dead plant material depending on how it is defined by the user.
- Body Condition Score:** A value assigned to describe how thin or fat an animal is based on observation and feeling for fat deposits over the spine. Sheep and goats are generally evaluated on a 1- to 5-point scale from emaciated to obese while cattle are generally evaluated on a 9-point scale.
- Bolting:** The period of a plant's development when it begins to expand its stem to produce flowers and seeds.
- Broadleaf Plants:** Plants that generally have wide leaves and solid stems. These include forbs, shrubs, and most trees but not grasses, conifers or other plants with needles or grass-like leaves.
- Browsers:** Livestock and wildlife that feed on stems, twigs, buds, and leaves of shrubs and trees.
- Canopy Cover:** The percentage of ground area in a plot with plant leaves and stems above it. This would account for the area of the ground that cannot be seen looking from above the vegetation.
- Clonal Plants:** Plants that reproduce by underground or aboveground runners to create a group of genetically identical plants called a clone.
- Cool-Season Plants:** Plants that grow most actively in the spring and fall and generally produce seeds in late spring or early summer, then go dormant when it becomes hot and dry. These plants have a type of photosynthesis that uses a so-called "C3" pathway.
- Decadent Plant:** A plant that is dead or dying.
- Decumbent Plant:** A plant growth form where stems and leaves grow close to the ground.
- Defoliation:** The removal or loss of leaves and stems from plants.
- Detoxification:** Digestive and metabolic processes that render poisonous compounds harmless.
- Exotic Species:** A plant, animal, or microbe that is not native or endemic to an area.
- Fallow:** Farmland not planted with crops and that is kept free of weeds for a year or more to preserve and store soil moisture and nutrients for the next year's crop.
- Fine Fuels:** Dry and dormant plants with small stems (less than 1/4 inch) that readily ignite and burn quickly in dry conditions. Fine fuels include grasses, broadleaf forbs, and small shrubs.
- Firebreak:** An area cleared of vegetation that could otherwise readily ignite and spread fire. Firebreaks are often created around houses as a zone to stop or slow a spreading fire.
- Forbs:** Plants other than grasses, grass-like plants, or shrubs and trees that die back to the ground every year and are not woody. Many wildflowers and weeds are forbs.
- Fuel Load:** The amount of combustible material in an area, generally including dry and dormant vegetation that will readily burn.
- Fuel Continuity:** How evenly or patchily combustible material or fire fuel is arranged in an area.
- Grasses:** Non-woody plants that have long narrow leaves with veins that run parallel to the leaf edge. Grasses have stems that are hollow with nodes or swellings where leaves originate.
- Grazers:** Livestock or wildlife that consume mostly grasses.

Green Bridge: An area of green vegetation growth that creates a refuge or movement corridor for insects traveling between crop fields.

Green Strip: A narrow band of vegetation planted late. Maturing plants are grown or grazed to delay maturation and stay green when surrounding vegetation becomes dormant and combustible thereby creating a strip to stop or slow the spread of wildfire.

Guardian Animals: Donkeys, llamas, mules, and several breeds of dogs that are selected, bred, and raised to live with and protect livestock from predators.

Herbaceous Plants: Non-woody plants that die back to the ground at the end of every growing season. The roots may stay alive and produce stems in the next year.

Herbivory: The process of animals eating plants (i.e., herbivores) in an ecosystem.

High-Tensile Fencing: Fences created with wires that don't expand when pulled; the wire is strung tightly to resist animal movement through the fence.

Integrated Pest Management (or IPM): An approach to managing pest problems including insects and weeds. A key to IPM is the strategic combined use of chemical, biological, and cultural practices to suppress a pest or pests below some acceptable level of infestation.

Intermediate Feeders: Grazing and browsing animals, including goats, that will eat a variety of grasses, forbs, or shrubs depending on what is nutritious and palatable at the time.

Invasive Species: Plants, animals, or microbes that have moved into an area and reproduced so aggressively that they replace or suppress the species that naturally occurred on the area.

Ladder Fuels: Shrubs and small trees that create a layer of combustible vegetation between the ground and the tree crowns, allowing wildfires to spread into the upper tree canopy.

Lignified: Plant stems that are made hard like wood as the result of the deposition of lignin in the cell walls.

Monitoring: A repeated assessment of land and vegetation conditions over months or years to determine if land management objectives are being met.

Monoculture: A natural or cultivated area where a single plant dominates the plant community.

Morphology: The form or structure of an animal, plant, or microbe.

Multi-Species Grazing: Grazing more than one type of livestock (i.e., cattle, sheep, goat, or horses) on the same unit of land. The grazing can occur at the same time or at different times and still be considered multi-species grazing.

Native Species: Plants, animals, fungi, and microorganisms that are endemic and occur naturally in a given area or region.

Noxious Weeds: A subset of weeds that are designated by weed control organizations or agencies as legally requiring treatment whenever they are encountered.

Orchard Floor: The soil and vegetation between the rows of trees or vines and under the canopy of an orchard crop.

Ovipositing: The laying of eggs, especially referring to insects laying eggs.

Palatability: How desirable or appealing a specific plant is to an herbivore. Highly palatable plants are sought and readily consumed.

Phenology: The timing of growth and reproduction throughout the year or growing season.

Photo Points: Permanent locations from which to take photographs to monitor site conditions over time.

Photosynthesis: The chemical process in plants by which sunlight is captured to convert carbon dioxide and water into sugar compounds and subsequently starches and other plant carbohydrates.

Phytochemicals: Refers to any plant compound, though is generally used to describe plant compounds that can be toxic when eaten by herbivores.

Post-Ingestive Feedback: The sensory feedback gained by an animal after eating a plant. The feedback can be negative, such as nausea, or positive, such as an energy boost or hunger suppression.

Predation: When an animal (i.e., predator) hunts and kills another animal.

Prescribed Grazing: The controlled harvest of vegetation with grazing or browsing animals managed with the intent to achieve management objectives. The term can refer simply to planned grazing or to a very specific time and amount of grazing by a specific species.

Prescribed Fire: The use of a controlled burn in a given area to achieve a desired result or to satisfy a management plan.

Rest Rotation Grazing System: A planned grazing system that allows for a full year of rest from grazing for pastures on a rotating basis. This system requires at least three pastures and one herd. The rotation sequence for each pasture is usually to defer (fall graze), then rest (no graze), then spring graze.

Rhizomes: An underground scaly root-like stem that extends away from the base of a plant and gives rise to new plants.

Secondary Compounds: Plant compounds that appear to play no role in the growth and reproduction of the plant (i.e., primary compounds), but can be repulsive to herbivores and play an important role to protect the plant from grazing or browsing. Secondary compounds include alkaloids, tannins, and terpenes.

Seed Set: The stage in a plant's life, after flowering, when it produces seeds.

Senescence: The aging and dying of leaves at the end of the growing season.

Shrubs: Woody plants with several stems, rather than a central trunk, and a relatively low growth habit compared to trees.

Silviculture: The art and science of growing trees.

Slash: Residue such as limbs or bark from trees or shrubs left on the ground after storms, forest harvesting, or management practices.

Stem Internode: The area on a plant stem between two nodes. (Nodes are swollen areas where leaves and branches are attached.)

Stocking Rate: The number of animals, usually livestock, that graze a given area of land for a specified period of time. Generally expressed in animal unit months per acre.

Stubble Height: The height of stems or leaves that remain after a grazing period.

Tannins: Naturally occurring plant compounds found mostly in shrubs and forbs that reduce forage value by forming insoluble complexes with proteins when eaten.

Targeted Grazing: The application of livestock grazing at a specified season, duration and intensity to accomplish specific vegetation management goals. The term "targeted" refers to the specific plant or landscape that is the aim of controlled grazing practices.

Terminal Bud: The bud, or growth point, located at the end of the plant shoot or twig.

Terpenes (including monoterpenes): Organic compounds found in many trees and shrubs that kill rumen microbes and cause damage to the grazing animal when eaten. Several of these compounds are also called "essential oils" because they have an odor or "essence" giving plants like pines, juniper, or sagebrush their distinctive odor.

Transects: Measures in plots or on points along lines that can quantify plant cover, density, or abundance.

Understory Vegetation: The grasses, forbs, or shrubs growing on the ground surface under the canopy of trees.

Urban/Wildland Interface: The zone where houses and other human structures meet or intermingle with undeveloped rangelands and forest wildlands

Utilization: The proportion or degree of current year's forage production that is consumed or destroyed by herbivores (including insects).

Warm-Season Plants: Plant that grow most actively in the warmest season of the year. These plants have a so-called "C4" type of photosynthesis that allows them to grow throughout the summer and produce flowers and seeds in late summer or early fall.

Wether: A castrated male sheep or goat. Equivalent to the term "steer" for cattle.



LIST OF PLANTS

Mentioned in the Handbook

Common and scientific names of plants listed in the text. The reference for scientific names is the U.S. Department of Agriculture PLANTS Database (www.plants.usda.gov/).

Common Name

Alfalfa
 Barley
 Bentgrass
 Birdsfoot Trefoil
 Blackbrush
 Bluebunch Wheatgrass
 Bottlebrush Squirreltail
 Burdock
 Canada Reedgrass
 Canada Thistle
 Cheatgrass
 Crested Wheatgrass
 Deerbrush
 Douglas Fir
 Fireweed
 Goatsrue
 Houndstongue
 Idaho Fescue
 Japanese Brome
 Johnsongrass
 Juniper
 Kentucky Bluegrass
 Kudzu
 Leafy Spurge
 Lodgepole Pine
 Lupine
 Medusahead
 Mesquite
 Mountain Mahogany
 Multiflora Rose
 Oak Brush
 Orchardgrass
 Oxeye Daisy
 Pacific Silver Fir
 Perennial Pepperweed
 Perennial Ryegrass
 Pinion Pine
 Ponderosa Pine
 Radiata Pine
 Red Alder
 Red Fescue
 Redberry Juniper

Scientific Name

Medicago sativa
Hordeum spp.
Agrostis spp.
Lotus corniculatus
Coleogyne ramosissima
Pseudoroegneria spicata
Elymus elymoides
Arctium minus
Calamagrostis canadensis
Cirsium arvense
Bromus tectorum
Agropyron cristatum
Ceanothus integerrimus
Pseudotsuga menziesii
Chamerion angustifolium
Galega officinalis
Cynoglossum officinale
Festuca idahoensis
Bromus arvensis
Sorghum halepense
Juniperus spp.
Poa pratensis
Pueraria montana
Euphorbia esula
Pinus contorta
Lupinus spp.
Taeniatherum caput-medusae
Prosopis glandulosa
Cercocarpus montanus
Rosa multiflora
Quercus gambelii
Dactylis glomerata
Leucanthemum vulgare
Abies amabilis
Lepidium latifolium
Lolium perenne
Pinus monophylla
Pinus ponderosa
Pinus radiata
Alnus rubra
Festuca rubra
Juniperus coahuilensis

Common Name

Reed Canarygrass
Rough Fescue
Sagebrush
Salmonberry
Saltcedar
Sandberg Bluegrass
Scotch Thistle
Serviceberry
Silver Sagebrush
Slash Pine
Snowberry
Soft Chess
Spotted Knapweed
Subterranean Clover
Sugar Pine
Tansy Ragwort
Thimbleberry
Timothy
Toadflax (or Dalmation Toadflax)
Vetch
Vine Maple
Western Hemlock
Western Larch
Western Red Cedar
Western White Pine
Wheat
Wheatgrass
White Clover
Whitetop (or Hoary Cress)
Wild Oat
Yellow Starthistle

Scientific Name

Phalaris arundinacea
Festuca campestris
Artemisia spp.
Rubus spectabilis
Tamarix ramosissima
Poa secunda
Onopordum acanthium
Amelanchier alnifolia
Artemisia cana
Pinus elliotii
Symphoricarpos spp.
Bromus hordeaceus
Centaurea stoebe
Trifolium subterraneum
Pinus lambertiana
Senecio jacobaea
Rubus parviflorus
Phleum pratense
Linaria dalmatICA
Vicia spp.
Acer circinatum
Tsuga heterophylla
Larix occidentalis
Thuja plicata
Pinus monticola
Triticum aestivum
Agropyron spp.
Trifolium repens
Lepidium draba (formerly Cardaria draba)
Avena fatua
Centaurea solstitialis