

Preventing the Spread of Invasive Plants:



Best Management Practices for Land Managers

3rd Edition

California Invasive Plant Council

©2012 California Invasive Plant Council
Available at www.cal-ipc.org

Cite this report as: Cal-IPC. 2012. Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd ed.). Cal-IPC Publication 2012-03. California Invasive Plant Council, Berkeley, CA. Available at www.cal-ipc.org.

This report was funded through the American Recovery and Reinvestment Act, with funding provided by the USDA Forest Service, State and Private Forestry, through the California Department of Agriculture as well as direct funding from the USDA Forest Service, State and Private Forestry.

In accordance with federal law and U.S. Department of Agriculture policy, the California Invasive Plant Council is prohibited from discriminating on the basis of race, color, national origin, sex, age or disability. (Not all prohibited bases apply to all programs).

To file a complaint of discrimination: write USDA, Director, Office of Civil Rights, Room 326- W, Whitten Building, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Technical Advisory Team

In 2011, the California Invasive Plant Council formed a technical advisory team comprising land management experts in the state. The technical advisory team guided the development of a set of voluntary invasive plant prevention best management practices (BMPs) for land management.

David Bakke USDA Forest Service	Jim Dempsey California State Parks	Sarah Godfrey Big Sur Land Trust	Deborah Nelson USDA Forest Service
Giselle Block US Fish and Wildlife Service	Garrett Dickman National Park Service	Jay Goldsmith National Park Service	Mona Robison California State Parks
Diana Brink US Bureau of Land Management	Susan Ellis California Department of Fish and Game	Martin Hutten National Park Service	Joel Trumbo California Department of Fish and Game
Karen Buhr California Association of Resource Conservation Districts	Rena Escobedo USDA Forest Service	Tim Hyland California State Parks	Wendy West University of California, Cooperative Extension
Joanna Clines USDA Forest Service	Mark Frey The Presidio Trust	Diane Ikeda USDA Forest Service	
	Holly Gellerman California Department of Fish and Game	Mike Kelly San Diego Conservation Resources Network	

Technical Advisory Team for Fire and Fuel Management

In 2012, the California Invasive Plant Council formed a technical advisory team comprising fire and land management experts in the state. The technical advisory team guided the development of a set of voluntary invasive plant prevention best management practices (BMPs) for fire and fuel management.

Matthew Bahm National Park Service	Karen Buhr California Association of Resource Conservation Districts	Erv Gasser National Park Service	Diane Ikeda USDA Forest Service
David Bakke USDA Forest Service	Joanna Clines USDA Forest Service	Jay Goldsmith National Park Service	Jon Keeley US Geological Survey
Steve Bakken California State Parks	Athena Demetry National Park Service	Kevin Guerrero California Department of Forestry and Fire Protection	Rob Klinger US Geological Survey
Lou Ballard US Fish and Wildlife Service	Garrett Dickman National Park Service	Lisa Hoover USDA Forest Service	Susan Kocher University of California Cooperative Extension
Paige Boyer USDA Forest Service	Ralph Domanski California Emergency Management Agency	Martin Hutten National Park Service	Cheryl Miller Hills Emergency Forum
Dianna Brink Bureau of Land Management	Becca Fenwick University of California Natural Reserve System	Tim Hyland California State Parks	Kelly Moroney US Fish and Wildlife Service
Philip Brownsey USDA Forest Service			

(continued)

Technical Advisory Team for Fire and Fuel Management *(continued)*

Miriam Morrill
US Fish and Wildlife Service

Debra Nelson
USDA Forest Service

Julie Nelson
USDA Forest Service

Craig Ostergaard
California Forest Pest Council

Carol Rice
Wildland Resource Management

Mona Robison
California State Parks

Courtney Rowe
USDA Forest Service

Bob Rynearson
California Forest Pest Council

Forest Schafer
North Lake Tahoe Fire Protection District

Rich Schwab
National Park Service

Brenda Seabert
California Department of Forestry and Fire Protection

David Shy
California Department of Forestry and Fire Protection

Nelson Siefkin
National Park Service

Joel Silverman
Midpeninsula Regional Open Space District

Bobbi Simpson
National Park Service

Tom Smith
California Department of Forestry and Fire Protection

Jim Suero
California State Parks

Neil Sugihara
USDA Forest Service

John Swanson
East Bay Regional Park District

Aileen Theile
East Bay Regional Park District

Art Torrez
USDA Forest Service

Kathy Van Zuuk
USDA Forest Service

Wendy West
University of California Cooperative Extension

Robin Wills
National Park Service

John Winder
California Department of Forestry and Fire Protection

Kim Zagaris
California Emergency Management Agency

Reviewers

Mike Hebrard
California Department of Forestry and Fire Protection

Scott Hill
East Bay Municipal Utility District

Dee McDonough
Diablo Fire Safe Council

Christopher Rowney
California Department of Forestry and Fire Protection

Duane Shintaku
California Department of Forestry and Fire Protection

Lynn Webb
California Department of Forestry and Fire Protection

USDA Forest Service Pacific Southwest Region Fire Program Reviewers:

Shelly Allen
Van Arroyo
Kit Bailey
Michael Beasley
Robert Bell
Gary Biehl
Steve Burns
Curtis Coots
Arlen Cravens
Pete Duncan
Timothy Dunfee
Anthony Escobar
Rob Griffith
Lorene Guffey
Edward Guzman

James Hall
Jim Harris
Jeff Iler
Carlton Joseph
Jay Kurth
Robert Laeng
Shawna Legarza
Trudie Mahoney
David McMaster
Joe Millar
Steve Millert
Michael Minton
Marc Nelson
Lance Noxon
Steve Parr
Jeanne Pincha-Tulley
Jeff Power
Joe Reyes
Allan Setzer
Brent Skaggs
Susie Stingley
Donn Thane
Willie Thompson
John Truett
Randy Unkovich
Marva Willey

Cal-IPC Staff

Alice Chung
Training Project Manager

Heather DeQuincy
Outreach Program Manager

Jen Stern
Training Program Manager

Arpita Sinha
Training Program Specialist

Doug Johnson
Executive Director

Carol Bardoff
Training Program Assistant

Contents

Section I: Background

Introduction	1
Prioritizing BMP Implementation	5
Pre-Activity Assessment Outline	6
List of Best Management Practices	7

Section II: BMP Chapters

1. Planning BMPs	9
2. Project Materials BMPs	15
3. Travel BMPs	19
4. Tool, Equipment and Vehicle Cleaning BMPs	21
5. Clothing, Boots, and Gear Cleaning BMPs	23
6. Waste Disposal BMPs	25
7. Soil Disturbance BMPs	27
8. Vegetation Management BMPs	29
9. Revegetation and Landscaping BMPs	31
10. Fire and Fuel Management BMPs	35
10.1 Fire Management Planning BMPs	37
10.2 Fuel Management BMPs	40
10.3 Fire Suppression BMPs	44
10.4 Post-Fire Activity BMPs	47

Section III: Checklists

Checklist Introduction	51
Key to BMP Chapter Acronyms	52
A. Site Assessment, Field Mapping & Monitoring	53
B. Routine Vegetation Management	54
C. New Project – Planning	56
D. New Project – Implementation	57
E. Inspection & Cleaning	59

Section IV: Appendices

General Resources	61
Prevention Resources	62
Fire and Fuel Management Resources	63
Glossary	64
References	69



Introduction

Purpose Statement

The goal of this manual is to present voluntary guidelines that help those managing wildlands in California to prevent the accidental spread of terrestrial invasive plants.

Invasive Plants

Federal Executive Order 13112 defines an invasive species as an alien (non-native) species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. While the majority of non-native plants do not pose a threat to natural or human systems, the Cal-IPC Invasive Plant Inventory identifies 200 species, approximately 3% of the plant species growing in the wild in California, as invasive (Cal-IPC 2006). These plants have the capacity to alter native ecosystems, with potential detrimental implications for wildlife communities, fire regimes, water flow, and nutrient cycling.

Background

Invasive plants can degrade the ecological integrity of wildlands, and land managers employ a range of tactics to reduce this damage. Controlling already established invasive plant infestations is important. However, stopping the introduction and spread of new invasive plant infestations is the most cost-effective approach to reducing this damage. Prevention is a key aspect of invasive plant management that deserves more attention.

Revegetate or mulch disturbed areas to prevent invasive plants from establishing. Photo: David Chang, Santa Barbara County Agricultural Commissioner

Land managers must have a good understanding of ways to avoid accidentally spreading invasive plants through their work. Such work often involves travel from one worksite to another. Tools, equipment, vehicles, animals, clothing, boots, and project materials moved between worksites can become potential vectors for the spread of invasive plants. Generally speaking, soil and vegetation disturbance, including construction and maintenance activities, can also create suitable conditions for the establishment of invasive plants.

This manual was developed by a technical advisory team made up of land management experts in the state, organized by the nonprofit California Invasive Plant Council (Cal-IPC) and funded by the USDA Forest Service, State & Private Forestry. The team reviewed existing resources to develop an accessible overview of key prevention measures that can be used by all land managers. References to source documents, some of which include extensive detail, can be found in the References section at the end of this manual.

Terminology

In this manual, we occasionally use the term “weed” to mean “invasive plant”, such as when referring to “weed-free straw” for erosion control. We also use the general term invasive plant “spread” to mean introduction of invasive plants to a new area, establishment of new invasive plant populations, or spread of existing invasive plant populations. The Glossary at the end of the manual lists terms used in this text.

Best Management Practices (BMPs)

Best Management Practices are methods or techniques found to be the most effective and practical in achieving an objective, such as preventing or reducing invasive plant spread, while making optimal use of resources.

Prevention BMPs that reduce invasive plant spread can help:

- Reduce future maintenance needs and cost
- Reduce fire hazards
- Reduce herbicide use
- Enhance access and safety
- Limit liability for the governing agency or lessee
- Maintain good public relations
- Protect existing wildlife habitat, native plant populations, beneficial insects, as well as threatened and endangered species.

Target Audience

This manual was developed for those managing wildlands, and includes guidelines for those involved in wildland fire management. The manual can be used in a number of ways. For instance, land managers can use the material in the manual to conduct trainings for work crews. The manual can help land managers by providing language for contractor specifications for work on their land. Managers can also use the manual to develop educational materials for the public.

Scope

The primary focus of this manual is preventing the spread of terrestrial invasive plants. Therefore this manual does not focus on invasive plant control methods; however, control measures are discussed insofar as they relate to prevention. For example, mowing as a control method is not discussed, but because timing of mowing relates directly to potential for invasive plant spread, this aspect is included. Invasive aquatic plants are outside the scope of this manual.

Implementation of BMPs

Effective implementation of prevention BMPs requires a process of continuous learning. These voluntary BMPs were developed with the understanding that each situation and entity has different needs, constraints and resources. The applicability and effectiveness of BMPs will vary with existing land uses, degree of human

disturbance, the objectives of the land owners, and the resources available for management activities. For example, programmatic planning BMPs may be less applicable to smaller restoration groups, as these BMPs are more suited for large agencies. A discussion of Prioritizing BMP Implementation appears later in this section on page 5 of this draft to help determine which BMPs to emphasize depending on situational factors. Some BMPs may be able to be implemented with existing resources, while others may only be possible pending allocation of additional resources.

Conducting a thorough pre-activity assessment will help to identify which tasks can spread invasive plants (See Pre-Activity Assessment Outline on page 6 of this draft). Many of these BMPs may overlap with existing practices or standard mitigations, such as those for Storm Water Pollution Prevention, clean air regulations, pest quarantines, or rare species protections.

Using This Manual

This manual provides BMPs to aid in preventing the introduction and spread of invasive plants. Its recommendations are voluntary; each organization can choose how to best incorporate and phase this information into their operations.

Section I includes overview information on what BMPs are, why they are important, and how to best implement them. This section also provides recommendations for BMP prioritization.

Section II provides detail on a wide range of topic-specific BMPs for preventing the spread of invasive plants. Each BMP is appropriate for particular situations; users can select those that are suitable for their use.

The BMPs described in Section II are structured as follows:

BMP Statement: Prevention BMP statements, in bold font, describe practices that can prevent the introduction and spread of invasive plants.

Considerations:

- a. BMP Considerations are listed below the BMP Statement\
- b. BMP Considerations give more information about why the BMP is important, and may include details, suggestions, examples, and issues to consider when applying the BMP.

Section III presents ready-to-use checklists which contain only the BMP statements to provide a quick and portable reference for field activities. The checklists are divided into five categories:

- Site Assessment, Field Mapping and Monitoring
- Routine Vegetation Management
- New Project – Planning
- New Project – Implementation
- Inspection and Cleaning

These checklists can be used as templates and be modified based on your needs.

Section IV has additional resources and information, a glossary, and other references.

Definition and Categorization of Activities

Definition and categorization of activities may vary among agencies and organizations. For this reason, the definition and scope of each activity and how it may spread invasive plants is described in the introduction of each chapter. When using this manual, consider your activity's scope and potential impact as it relates to the potential to introduce or spread invasive plants. Refer to BMPs in related chapters to customize your prevention practices.

Overall Prevention Principles

Take time to plan. Proper planning can reduce future maintenance costs by reducing the potential for invasive plant introduction and spread. A good first step is to conduct a pre-activity assessment of the work area to determine which activities could spread weeds and which BMPs are applicable.

Stop movement of invasive plant materials and seeds. The movement of workers, materials and equipment can carry weeds between sites. This manual identifies potential vectors of spread and how to eliminate them or reduce their effects.

Reduce soil and vegetation disturbance. Disturbance can allow invasive plants to colonize a new area. When disturbance is unavoidable, managers should conduct follow-up monitoring to ensure early detection of any invasive plants that may have been introduced.

Maintain desired plant communities. A healthy plant community with native and desirable species provides resistance to invasive plant establishment.

Practice early detection and rapid response (EDRR). Early detection and eradication of small populations helps prevent the spread of invasive plants and significantly reduces weed management costs. Regular monitoring increases the chances of success.

Prioritizing BMP Implementation

The prevention BMPs in this manual are developed with the understanding that each situation and entity has different needs and resources. This outline can help you select which areas and species to prioritize when integrating BMPs into management activities.

1. Management costs. Prioritize:

- Areas where future control costs will be high if invasive plants become established
- Areas where fire risk is high
- BMPs with approaches that are measurable in cost and effectiveness

2. Ecological value of habitats. Prioritize:

- Areas with threatened or endangered species and habitat
- Areas of high ecological or conservation value
- Areas where invasive plants have not invaded

3. Context of the area being managed. Prioritize:

- Wildland and natural areas
- Areas with new construction or disturbance
- Areas containing water bodies
- Areas with important scenic or recreational resources
- Areas where adjacent land owners are cooperative
- Areas where wildland interfaces with urban areas
- Wildland areas frequented by vehicles, equipment and foot traffic

4. Treatment of invasive species. Prioritize:

- Species known or suspected to be invasive but still in small numbers
- Species that can alter ecosystem processes
- Species with the potential to alter fire regimes
- Species that occur in areas of high conservation value
- Species with the potential to require high management costs
- Species that are likely to be controlled successfully
- Species determined to be of regional concern as identified through regional partnerships

Pre-Activity Assessment Outline

This assessment outline can help you proactively address activities that have the potential to spread invasive plants. A site assessment and a description of planned activities will need to be completed as part of this pre-activity assessment.

1. Conduct a site assessment to ascertain:

- A list of invasive plant species found in route to and within worksites. Include exact locations and densities, and the species' dispersal mechanisms.
- A list of priority areas for implementing prevention BMPs. Refer to Prioritizing BMP Implementation on the previous page for guidance on prioritization.

2. Describe each activity (e.g. roadside mowing, facility inspection, access road grading and maintenance, and pole/tower repair) to ascertain:

- Location(s) of the activity
- Location(s) of access routes
- Timing for the activity
- Tools and equipment to used
- Materials to be moved, imported or exported
- Expected alteration of existing vegetation and soil

3. List the sequence of tasks that are included in the activity. Identify which tasks can be altered to reduce the likelihood of invasive plant spread based on:

Task location

- a. Is there a location for this task with less potential to spread invasive plants?
- b. Can access routes be changed to avoid traveling through invasive plant populations?
- c. If materials are being moved, is there a better location for materials to be stored?

Task timing

- a. Can the task be performed in a different time (earlier/later in the season) or in a different sequence (e.g. spraying after mowing)?
- b. Can invasive plant populations be treated before project tasks commence to reduce the spread of invasive plant parts and seeds?

Task method

- a. Is there a different method of performing the task that can reduce the risk of spread?
- b. Could using different tools/equipment/materials reduce the risk of spread?
- c. Are weed-free materials available?

4. Select BMPs from the following chapters to address the potential introduction and spread of invasive plants.

List of Best Management Practices

Chapter 1: Planning BMPs

Programmatic Planning

- PL1: Adopt official policy to prevent invasive plant introduction and spread.
- PL2: Include invasive plant risk evaluation as a component of initial project planning.
- PL3: Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.
- PL4: Coordinate invasive plant prevention efforts with adjacent property owners and local agencies.
- PL5: Develop monitoring plans for BMP implementation and effectiveness.

Activity Planning

- PL6: Provide prevention training to staff, contractors and volunteers prior to starting work.
- PL7: Conduct a site assessment for invasive plant infestations before carrying out field activities.
- PL8: Schedule activities to minimize potential for introduction and spread of invasive plants.
- PL9: Integrate cleaning BMPs into planning for land management activities.
- PL10: Prepare worksite to limit the introduction and spread of invasive plants.
- PL11: Monitor the site for invasive plants after land management activities.

Chapter 2: Project Material BMPs

- PM1: Use a weed-free source for project materials.
- PM2: Prevent invasive plant contamination of project materials when stockpiling and during transport.

Chapter 3: Travel BMPs

- TR1: Plan travel to reduce the risk of invasive plant spread.
- TR2: Integrate cleaning activities into travel planning.

Chapter 4: Tool, Equipment and Vehicle Cleaning BMPs

- TE1: Designate cleaning areas for tools, equipment, and vehicles.
- TE2: Inspect tools, equipment, and vehicles before entering and leaving the worksite.
- TE3: Clean soils and plant materials from tools, equipment, and vehicles before entering and leaving the worksite.
- TE4: Clean pack, grazing and support animals.

Chapter 5: Clothing, Boots and Gear Cleaning BMPs

- CB1: Wear clothing, boots and gear that do not retain soil and plant material.
- CB2: Designate cleaning areas for clothing, boots and gear.
- CB3: Clean clothing, footwear and gear before leaving the worksite.

Chapter 6: Waste Disposal BMPs

- WD1: Designate waste disposal areas for invasive plant materials.
- WD2: Render invasive plant material nonviable when keeping it on-site.
- WD3: When disposing of invasive plant material off-site, contain it during transport.

(continued)

List of Best Management Practices *(continued)*

Chapter 7: Soil Disturbance BMPs

- SD1: Minimize soil disturbance.
- SD2: Implement erosion control practices.
- SD3: Manage existing topsoil and duff material to reduce contamination by invasive plants.

Chapter 8: Vegetation Management BMPs

- VM1: Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.
- VM2: Manage vegetation with methods favorable to desirable vegetation.
- VM3: Retain existing desirable vegetation and canopy.

Chapter 9: Revegetation and Landscaping BMPs

- RL1: Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.
- RL2: Acquire plant materials locally. Verify that species used are not invasive.
- RL3: Revegetate and/or mulch disturbed soils as soon as possible to reduce likelihood of invasive plant establishment.

Chapter 10: Fire and Fuel Management BMPs

Fire Management Planning BMPs

- FP1: Consider wildfire implications when setting overall priorities for invasive plant management programs.
- FP2: Integrate invasive plant prevention into fire management plans.
- FP3: Provide training in preventing the spread of invasive plants.

- FP4: Plan to utilize weed-free materials for post-fire activities.

Fuel Management BMPs

- FM1: Incorporate invasive plant considerations when developing fuel management programs.
- FM2: Maintain active management of invasive plants on fuel management sites.
- FM3: Reduce disturbance when implementing fuel management activities.
- FM4: Incorporate invasive plant considerations when using prescribed fire.

Fire Suppression BMPs

- FS1: Develop operational procedures related to fire suppression to reduce the spread of invasive plants.
- FS2: Locate indirect fire lines to reduce additional disturbance and invasive plant spread where feasible.
- FS3: Locate fire activity areas in locations free of invasive plants where feasible.
- FS4: Clean vehicles, equipment, clothing and gear before arriving and leaving fire activity areas.
- FS5: Use water sources free of invasive plants for fire suppression when feasible.

Post-Fire Activities BMPs

- PF1: Manage access to burned areas.
- PF2: Use weed-free materials for post-fire activities.
- PF3: Cover and rehabilitate soil disturbed by suppression activity.
- PF4: Develop and implement post-fire integrated invasive plant management prescriptions.
- PF5: Revegetate burned areas to reduce the spread of invasive plants.



Chapter 1: Planning BMPs

Integrating prevention BMPs into land management can significantly minimize the introduction and spread of invasive plants. Effective planning reduces costs and enhances project success. This chapter addresses how and when to integrate prevention BMPs into planning and management, and highlights the importance of communication among staff, adjacent property owners and local agencies.

Identifying invasive plant risks early in the planning process helps organizations develop strategies to prioritize prevention measures, allocate resources, and incorporate prevention costs into budgets throughout the project life cycle. Additionally, tracking the costs and results of implementing prevention BMPs will provide references for future projects.

Planning includes developing schedules, budgets, and strategies as well as identifying critical control points for carrying out prevention BMPs. Identifying

Map invasive plants before starting work to designate work routes and detect invasive plant infestations early. Photo: Arpita Sinha, Cal-IPC

and mapping invasive plants at worksites is critical for evaluating threats. This helps determine high-risk spots for potential establishment and spread, and helps land managers select appropriate prevention practices.

This chapter includes two sections on planning: programmatic planning and activity planning.

Programmatic Planning BMPs are critical because they lay the framework for prevention BMPs to be integrated into all activity planning and land management. **Activity Planning BMPs** focus on limiting the introduction and spread of invasive plants during each stage of land management. These BMPs start on page 11.

PROGRAMMATIC PLANNING BMPs:

PL1: Adopt official policy to prevent invasive plant introduction and spread.

- a. Adopt an environmental stewardship policy that encourages preventing the introduction and spread of invasive plants.
- b. Increase organization/agency-wide awareness of invasive plant impacts.

- c. Consider using multi-disciplinary teams to address site-specific invasive plant prevention and control challenges.
- d. Identify funding, priorities, and personnel assignments for invasive plant prevention. Consider having a dedicated invasive plant contact person.
- d. Develop incentive programs among staff and volunteers to encourage invasive plant detection and reporting.
- e. Include invasive plant prevention measures as part of contract notes and specifications.

PL2: Include invasive plant risk evaluation as a component of initial project planning.

- a. Integrate invasive plant identification and risk analysis as a part of NEPA/CEQA processes.
- b. Evaluate invasive plant spread risks and the long-term maintenance consequences with natural resource managers. Determine project alternatives and management needs based on a pre-activity assessment. See Pre-Activity Assessment Outline on page 6.
- c. Incorporate invasive plant prevention measures into project layout, design, and project decisions.
- d. Develop mitigation plans for areas where avoidance of invasive plants is not possible.
- e. Designate known invasive plant occurrences in maintenance plans and any associated contracts.

PL3: Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.

- a. Include BMP costs in all budgets, estimates and bid packages. Include costs for prevention training for staff and contractors, cleaning routines for clothing, tools, equipment and vehicles, and site preparation and monitoring.
- b. Track cost and results of implementing BMPs as a reference for future project planning and cost estimates.
- c. Integrate cleaning routines into all land management activities. For detailed cleaning protocol see Checklist E on page 49.

- f. Develop plant lists and design guidelines for revegetation and landscaping that will optimize resistance to invasive plant establishment. For details see RL1 on page 31.
- g. Plan to minimize soil and vegetation disturbance during activities. For details see SD1 on page 27 and VM3 on page 30.
- h. When designing vegetation management projects, consider the life cycle and dispersal mechanisms of the invasive plant species within and/or adjacent to the worksite.
- i. Acquire documentation of invasive plants along roadways and address treatment strategies in the course of road maintenance activities.

PL4: Coordinate invasive plant prevention efforts with adjacent property owners and local agencies.

- a. Coordinate prevention efforts with adjacent property owners to ensure their activities will minimize the introduction or spread of invasive plants into the worksite or neighboring properties.
- b. Coordinate with local and state agencies to streamline record keeping systems of invasive plant infestations. Incorporate updates into appropriate databases such as CalWeedMapper (www.calweedmapper.calflora.org) and share with local and state agencies.
- c. Coordinate new research on invasive plant prevention and technology with Cal-IPC, agencies, and universities. Share findings with public and private partners.

PL5: Develop monitoring plans for BMP implementation and effectiveness.

- a. Establish a periodic monitoring program based on knowledge of high priority invasive plant life cycles (ideally three times a year and during growth periods).
- b. Identify and monitor sites that are susceptible to invasion, such as post construction areas and roadsides (from the edge of pavement extending a minimum of fifteen feet), pull outs, trailheads, campgrounds and parking lots.
- c. Define “zero tolerance” zones in critical habitats. Commit to keeping these areas free of invasive plants through frequent monitoring and control efforts.
- d. Track results of implementing BMPs as a reference for future project planning and cost estimates.
- e. Develop follow-up treatments as needed based on monitoring results.
- f. Consider modifying BMP implementation based on the following questions:
 - Were invasive plant populations reduced or adequately suppressed thus preventing spread?
 - Was the planned procedure used? If not, why did it vary from the original plan?
 - Were invasive plant prevention costs equal to, less than, or more than projected prevention costs?
 - What was the effect on the targeted invasive plant species?
 - Were there any side-effects on non-target organisms from implementing prevention measures?
 - Was available funding and manpower adequate?
 - Was personnel training adequate?

ACTIVITY PLANNING BMPs:

In addition to the following BMPs, also refer to related BMPs in:

- Chapter 2: Project Materials for procuring and managing erosion and project materials.

PL6: Provide prevention training to staff, contractors and volunteers prior to starting work.

- a. Provide pre-work training on invasive plants and prevention BMPs to staff, contractors and volunteers. Training should include:
 - Field identification of invasive plants in the work area
 - Reproductive biology of invasive plants
 - Ecological and economic impacts of invasive plants
 - Invasive plant prevention BMPs
 - Inspection and cleaning protocols for vehicles, tools, equipment, clothes and personal gear
 - When and how to record and report occurrences for invasive plants
 - How to use prevention resources (reporting websites, checklists, etc.)
 - How to treat materials infested with invasive plant propagules.



Train staff and contractors in prevention measures.

Photo: John Luker, California State Parks, Angeles District

- b. Provide additional training to staff and contractors managing project materials. Training should include:
 - How to acquire weed-free materials
 - Project material inspection protocols
 - c. Ensure staff and contractors understand provisions for invasive plant prevention throughout the project. Invasive plant considerations should be routinely addressed during pre-bid, pre-work and meetings, as appropriate.
 - d. Identify and train personnel responsible for inspection of cleaned tools, equipment and vehicles at facilities and worksites. Require an inspection form or checklist be used to document tools, equipment and vehicles are cleaned before leaving an infested worksite and are clean upon arrival at a clean/uninfested worksite.
 - e. Provide invasive plant identification guides, prevention BMPs, activity, and cleaning and inspection checklists (see Checklists on page 53) to staff, contractors, and volunteers. Provide these resources in other languages when appropriate. Also have these resources available at highly visible locations such as:
 - Access points
 - Field stations and work trailers
 - f. Educate all site users about preventing invasive plant spread.
 - Post invasive plant prevention messages using signs and posters at prominent locations such as visitor centers, campgrounds, trailheads. Provide informational materials to site users at visitor centers and events.
 - Install prevention equipment such as boot brushes and washing stations at trailheads.
- b. Scout for invasive plants at likely introduction sites such as roadsides, trailheads, campgrounds, staging areas, and other disturbed areas. Wet areas may also be especially susceptible.
 - c. Scout not only within the worksite but nearby as well.
 - d. Gauge the extent and intensity of scouting based on:
 - Threat of invasive plants to critical habitats
 - Size of the worksite
 - Type of activity (whether the activity disturbs ground or vegetation, and the degree of the disturbance)
 - Adjacent environment
 - e. Be especially aware of invasive plant species that are not widespread in the work area and can be controlled using early detection and rapid response. Flag areas infested with invasive plants that are not widespread in the work area. Either avoid disturbance in those areas, or identify and

PL7: Conduct a site assessment for invasive plant infestations before carrying out field activities.

- a. A site assessment for invasive plant infestations includes scouting for invasive plants found within the worksite (including the exact locations and densities), and determining priority areas for implementing prevention BMPs.



Photo: Martin Hutten, Yosemite National Park

Evaluate invasive plant risk as a part of project planning and environmental analysis.

isolate contaminated soils during construction or other disturbance. Isolated contaminated soils should be either placed back in the original location or disposed of appropriately to avoid spreading isolated populations of invasive plants throughout the worksite.

- f. Review internal documentation and consult local groups and online resources for information on existing and potential invasive plant infestations on and near worksites.
 - Weed Management Areas (WMAs), County Agricultural Commissioner offices, and Resource Conservation Districts are key local groups that have broad awareness of infestations in a given area. Cal-IPC currently maintains an online list of WMAs (www.cal-ipc.org/WMAs).
 - Cal-IPC works with a range of partners to map invasive plants across the state. Occurrence data for invasive plants can be found online at CalWeedMapper (www.calweedmapper.calflora.org), Calflora (calflora.org) and on the California Department of Fish & Game's BIOS viewer (www.bios.dfg.ca.gov).
 - Specimen data can also be found at the California Consortium of California Herbaria (<http://ucjeps.berkeley.edu/consortium/>), which houses data for over 20 California herbaria including the California Department of Food and Agriculture Weed Laboratory.
- g. Document invasive plant findings and communicate them to resource or facility managers.
- h. Incorporate findings into a database (e.g. www.calweedmapper.calflora.org) and project drawings or maps.
- i. Evaluate invasive plant risks. Determine invasive prevention and management needs at the onset of activity planning. Prioritize treatment of invasive plants based on guidelines in Prioritizing BMP Implementation on page 4.

PL8: Schedule activities to minimize potential for introduction and spread of invasive plants.

- a. Prioritize reducing invasive plant seed production along roadsides (edge to fifteen feet along roadway edge) to reduce seed movement by vehicles.
- b. Conduct work under conditions that minimize the risk of spread (e.g. frozen ground, snow cover, seed absence).
- c. Avoid working during rain events and high winds. Wet conditions make it easier for seeds to be picked up by a vehicle and spread miles down the road.
- d. Develop site-specific plans for controlling existing invasive plants before ground-disturbing activities begin.
 - Control invasive plants along access roads before moving equipment into the worksite.
 - Manage invasive plants three to five years prior to the planned disturbance to minimize invasive plant seeds in the soil, when feasible.
- e. For details on scheduling vegetation management see VM1 on page 29.

PL9: Integrate cleaning BMPs into planning for land management activities.

- a. Determine cleaning needs for tools, vehicles, equipment, clothing, boots and gear in conjunction with each activity and worksite. Include these cleaning needs in project plans, and make prior arrangements for any special needs identified. For details on cleaning see Chapters 4 and 5 on pages 21 and 23.
- b. Include cleaning costs in project budgets.
- c. Acquire necessary cleaning tools.
- d. Designate sites for cleaning vehicles, equipment, pack animals, clothing and gear.
- e. Identify cleaning facilities (such as car washes) near the worksite, in the event that cleaning on-site is not an option.
- f. Use inspection checklists to ensure comprehensive cleaning. See Checklist E on page 59.

PL10: Prepare worksite to limit the introduction and spread of invasive plants.

- a. Protect likely introduction sites such as pull-outs, trailheads, campgrounds, and parking lots from invasive plant introductions by paving, deep mulching, or planting a dominant non-invasive groundcover.
- b. Periodically inspect areas of concentrated use, such as staging areas, parking areas, trailheads, or campgrounds, and keep them free of invasive plants.
- c. Treat invasive plants at access roads and staging areas before using them.
- d. Control invasive plants in areas adjacent to worksites. This prevents seeds or other reproductive structures from moving into the worksite. If removing plants is not feasible, stopping seed set can be an effective way to reduce the potential for spreading the plant.
- e. Position activity boundaries to exclude areas infested with invasive plants. Activity boundaries include staging areas, timber harvest landings, skid trails, access roads and other temporary facilities. If this is not possible, control invasive plants in infested areas prior to their use.

PL11: After land management activities, monitor worksites for invasive plants.

- a. Carry out the established monitoring plan. Partner with local WMAs (www.cal-ipc.org/WMAs), agencies and organizations to help with monitoring when possible.
- b. Train staff to recognize and report invasive plants as part of ongoing monitoring.
- c. Monitor areas including:
 - On-site cleaning area
 - Waste disposal area
 - Areas where project materials are stored
 - Access routes, roads and other areas of concentrated use
 - Areas near salt licks, watering sites, loading/unloading areas and corrals for animals
- d. Monitor and maintain revegetation and landscaping to ensure long-term establishment of desired plant species.

- e. Monitor during multiple growing seasons, especially at times of germination and flowering, for a minimum of three years after project completion to ensure that any invasive plants are promptly detected and controlled. If three years is not sufficient to control invasive plants, monitoring and treatment should be continued until confident that invasion has been controlled.
- f. For on-going projects, continue to monitor until reasonably certain that invasive plants will not reappear. Plan for follow-up treatments based on presence of invasive plants.



Monitor worksite for invasive plant infestations after activities.

Photo: Martin Hutten, Yosemite National Park



Chapter 2: Project Materials BMPs

Project materials are common vectors of invasive plant introduction into new areas. Infested project materials that are imported to worksites can introduce invasive plant propagules and lead to new infestations. This chapter includes practices for minimizing the spread of invasive plants from project materials.

Effective project material management can prevent invasive plant spread at the source and minimize contamination during transport and stockpiling. Because project materials are often managed by different entities or departments during different project phases, developing a procedure for procuring, storing, and inspecting materials at critical control points will streamline materials management and minimize contamination. Additionally, developing

relationships with suppliers and requesting that they supply weed-free materials can help to increase demand and availability of these materials.

Project materials include:

- Erosion control materials (silt fences, fiber roll barriers, straw wattles, mulch and straw)
- Soil and aggregate (topsoil, fill, sand, and gravel)
- Landscape materials (plants, seed, sod, mulch, and soil amendments)
- Animal/livestock feed
- Water (for cleaning or irrigation)
- Construction/building materials

*Project materials contaminated with invasive plant seeds and parts and spread invasive plants. Use weed-free materials to prevent spreading invasive plants.
Photo: Martin Hutten, Yosemite National Park*

PM1: Use a weed-free source for project materials.

- a. Develop a procedure for procuring and storing weed-free materials and inspecting material sources. Cultivate relationships with suppliers to streamline sourcing of weed-free materials.
- b. Select materials based on the environmental needs of the worksite. Understand how weed-free materials are produced, whether the screening criteria is based on noxious weeds or wildland invasive plants. Weed-free materials may not be 100% weed-free, but using weed-free materials can reduce the probability of exposure to invasive plant parts and seeds.
 - Noxious weeds are agricultural weeds listed by the California Department of Food and Agriculture. www.cdffa.ca.gov/plant/ipc/weedinfo/winfo_list-pestrating.htm
 - California Invasive Plant Council's inventory lists wildland invasive plants. www.cal-ipc.org/ip/inventory/
- c. Determine the degree to which weed-free project materials are needed for each worksite. Materials from an infested site may be suitable for a worksite that is already infested with the same species. Excavated material from areas containing invasive plants may be reused within the limits of the infestation.
 - For example, materials from a yellow starthistle infested site could be reused in areas already infested by yellow starthistle, but not in areas free of yellow starthistle.
 - Unused excavated material contaminated with invasive plants should be stockpiled on an impervious surface and managed until all invasive plant material is non-viable. For details on managing stockpiled materials see PM2 on page 18.
- d. Use weed-free materials for erosion control and soil stabilization.
 - When available, use weed-free straw certified by a county agriculture department, coconut fiber, rice straw and/or native grass straw. These types of erosion control material have limited quantities of invasive plants or contain wetland species that may not survive in dry upland conditions. See Cal-IPC (www.cal-ipc.org/ip/prevention) for a Weed-Free Forage & Straw Supplier List.



Photo: Maria Knight, USDA Forest Service

Contaminated project materials, like this gravel pile, can spread invasive plants to worksites.

- e. Use weed-free sand and gravel.
 - Perform follow-up inspections at sites where erosion control materials have been used to ensure that any invasive plant introductions are caught early and treated.
 - Any fill material brought on-site should be clean, debris-free, and devoid of invasive plant parts or seeds. Do not borrow fill from weed-infested stockpiles, road shoulders or ditch lines.
 - Inspect aggregate material sources (including but not limited to surrounding ditches, topsoil piles, gravel/sand piles or pits). See Cal-IPC (www.cal-ipc.org/ip/prevention) for information about procuring weed-free sand and gravel.
- f. Use weed-free seed. Verify seed mix to ensure it does not contain invasive plants.
 - Use local seeding guidelines for your county to determine procedures and appropriate seed mixes.
 - A certified seed laboratory should test each lot according to Association of Seed Technologists and Analysts (AOSTA) standards (which include a statewide invasive plant list) and provide documentation of the seed inspection test. Check state, federal, and California Invasive Plant Council lists to see if any local weeds need to be added prior to testing. For more information on locating lists of invasive plants, see PM1d on page 16.

- Seed purchased commercially should have a label that states the following:
 - Species
 - Purity: Most seed should be no less than 75% pure and preferably over 85% pure. The rest is inert matter, weed seed, or other seed.
 - Weed seed content: The tag should state NO invasive plants are present. Only certified weed-free seed should be used. Note that seed is usually certified to be “noxious weed free”, referring to the California Department of Food and Agriculture noxious weed list, and may still contain seeds of wildland invasive plant species not included on the noxious weed list.
 - Germination of desired seed: Germination generally should not be less than 50% for most species, although some shrubs and forbs will have lower percentages.
- g. Keep and reuse on-site weed-free materials rather than importing new materials to limit contamination.
 - Stockpile topsoil along perimeter of project for later use rather than importing topsoil. For details on topsoil management, see SD3 on page 28.
 - Consider using mulch from non-invasive plant species chipped on site when feasible.
- h. Find local sources when off-site weed-free project materials are needed. Inspect project material suppliers as appropriate to determine if the source is weed-free. Weed-free materials may not be 100% weed-free, but using these materials can reduce the probability of exposure to invasive plant contamination.
- i. Designate and use weed-free water sources for each project.
 - Inspect water sources to prevent introduction of invasive plants or animals.
 - Designate weed free pathways to water sources.
- j. Provide weed-free feed for livestock and pack animals before and after project use to limit invasive plant seed transport via manure.
- k. If unable to obtain materials from a weed-free source:
 - Work with a local weed specialist to sterilize or treat materials and provide results of post-treatment inspection. Monitor application areas. For monitoring protocol see PL11 on page 14.
 - If soil sources are infested, treat the invasive plants, then strip the infested topsoil and stockpile the contaminated material for several years to further deplete the soil seed bank. Check regularly for re-emergence of invasive plants and treat as needed.
 - Inspect the area where material from weed-infested sources were used annually for at least three years after project completion to ensure that any invasive plants transported to the site are promptly detected and controlled. For monitoring protocol see PL11 on page 14.
- l. Inspect project materials, sources, and storage areas for invasive plants annually and prior to each use to ensure that no invasive plants have invaded since the last inspection. Record inspection results. Continue to monitor worksites for three year after project completion.
- m. When feasible, include penalties, performance standards, or withholding provisions in contract specifications by which a contractor is assessed monetary damages for importing invasive plants as a result of non-compliance with contract specifications.



These certified weed-free rice straw wattles are contained in plastic packaging to protect them from invasive plant establishment.

Photo: Mona Robison, California State Parks

PM2: Prevent invasive plant contamination of project materials when stockpiling and during transport.

- a. Move only weed-free materials into uninfested areas. Moving materials from one infested location to another within a particular zone may not cause contamination, but moving materials from infested to uninfested areas could lead to the introduction and spread of invasive plants.
- b. Clean transport vehicles before and after loading project materials.
- c. Encourage log yard and biomass plant operators to maintain weed-free yards, equipment parking areas, off-loading areas, and staging areas. This will reduce the likelihood of invasive plant spread from yard to worksite.
- d. During transport, cover exposed piles of materials with geotextile fabric or impermeable material to prevent contamination of weed-free materials or spread of infested materials.
- e. Cover exposed piles of project materials with impermeable material to protect materials from wind and rain, and reduce germination of invasive plants.
- f. Cover active and inactive soil stockpiles with soil stabilization material or a temporary cover:
 - Soil stabilization used on bare slopes can be used for stockpiled soils. Temporary soil stabilization materials include:
 - Hydroseed (tackifier, fiber or seed)
 - Erosion control blanket (jute mesh or netting)
 - Mulch
 - Soil binder
 - Geosynthetic fabric
 - Surrounded with a linear sediment barrier (e.g. fiber roll).
- g. For managing existing topsoil and duff materials see SD3 on page 28.
- h. Frequently monitor stockpiles, materials storage areas and borrow pits. Quickly treat new invasive plant populations prior to seed production.



Photo: Ramona Robison, California State Parks

Cover soil stockpiles to prevent invasive plant establishment. Monitor worksites for invasive plants following activities.



Chapter 3: Travel BMPs

Land managers traveling between worksites can become vectors for the spread of invasive plants. For instance, driving a truck along an infested road can pick up seeds and carry them to a worksite. This chapter includes practices for minimizing the introduction of invasive plants by equipment, vehicles, animals and people.

It is important to be aware of travel routes. While cleaning vehicles, equipment, pack animals, clothing and gear is essential; land managers' travel practices can reduce the amount of plant reproductive material that gets transported in the first place.

TR1: Plan travel to reduce the risk of invasive plant spread.

- a. Consider the scale of infestation at worksites and travel routes. Typically not all areas are infested to the same degree with the same plants; this may affect the type and degree of prevention measures implemented.
- b. Avoid driving off-road whenever possible.
- c. When driving off-road, avoid patches of invasive plants.
- d. Exclude areas infested with invasive plants from equipment travel corridors and staging areas.
- e. Avoid parking on the side of the road in areas infested with invasive plants.
- f. Prevent animals (pack and grazing) from entering areas infested with invasive plants.
- g. When traveling through infested areas cannot be avoided:

Vehicles traveling through areas infested with invasive plants can spread viable plant material. Photo: Peter Schuyler, ecological consultant

- Consider the sequence of operations. Arrange travel routes from uninfested areas to infested areas. Work first in uninfested areas when vehicles and equipment are free from invasive plant material.
 - Control invasive plants at access roads and staging areas before using them.
 - Clean your vehicle before leaving the infested area.
 - Travel under dry conditions when feasible. Traveling under wet conditions, particularly along unpaved roads, greatly elevates the risk of picking up invasive plant seeds and transporting them.
 - Restrict travel to those periods when spread of seed is least likely, such as just prior to flowering or late in the season when seeds have already dropped.
- h. Limit the number of roads traveled to minimize soil disturbance and the risk of unintentionally transporting invasive plant parts and seeds on equipment into uninfested areas.
 - i. Close or reroute public roads or trails in areas infested with invasive plants. Where appropriate, ask user groups to become actively involved to help control an infestation so the trail can be reopened.
 - j. Perform road maintenance such as road grading, brush clearing, and ditch cleaning from uninfested to infested areas. If possible, schedule such activities when seeds or propagules are least likely to be viable.

TR2: Integrate cleaning activities into travel planning.

- a. Include cleaning when planning travel time.
- b. Set up cleaning operations to be efficient and effective to have minimal impact on travel time.
- c. Remove soil and plant materials from tools, vehicles, equipment, clothing, boots and gear before entering and leaving a worksite.
- d. Refer to an inspection checklist to ensure comprehensive cleaning of vehicles, equipment, pack animals, clothing and gear. See Checklist E on page 59.
- e. Avoid traveling through areas infested with invasive plants when collecting water for dust abatement or cleaning.



Photo: Noa Rishie, California State Parks, Angeles District

Clean seeds and plant parts from vehicles before leaving worksites infested with invasive plants.



Chapter 4: Tool, Equipment and Vehicle Cleaning BMPs

Tools, equipment and vehicles used for land management activities are potential vectors for invasive plant spread. For example, a mower used at a site infested with yellow starthistle can trap seeds in the mower deck and deposit them at the next worksite. This chapter presents ways to prevent the spread of invasive plants by cleaning hand tools, power tools, construction equipment, vehicles, and pack and grazing animals. For a detailed cleaning protocol see Checklist E in the checklists section of this manual on page 59.

TE1: Designate cleaning areas for tools, equipment, and vehicles.

- a. Tools, equipment, and vehicles should be cleaned in areas that are:
 - Easily accessible for monitoring and control
 - Located away from waterways
 - Located away from areas of sensitive habitats or species

- Near areas already infested with invasive plants
- Contained with silt fences or soil berms
- Paved or have sealed surfaces to avoid re-accumulation of soil and plant material on cleaned vehicles and equipment

TE2: Inspect tools, equipment, and vehicles before entering and leaving the worksite.

- a. Consider the extent of infestation at worksites. Typically not all areas are infested to the same degree with the same plants, and this may affect the type and degree of inspection needed.
- b. Prior to entering an uninfested area, inspect vehicle and equipment undercarriages and tires for seeds or plant parts.
- c. Refer to an inspection checklist to ensure comprehensive inspection. See Checklist E on page 59.

*Clean tools, equipment, and vehicles to reduce the spread of invasive plants.
Photo: Martin Hutten, Yosemite National Park*

- d. Train staff, contractors and volunteers to inspect for seeds, seed heads, plant material, soil and mud.
- e. Procure appropriate equipment for inspections, such as flashlights, portable lighting if night-time inspections are necessary, and under-vehicle mirrors.
- f. Inspect areas where tools, equipment and vehicles are stored for invasive plants. Maintain these facilities as weed-free.
- g. Ensure that rental equipment is free of invasive plant material before accepting it.

TE3: Clean soils and plant materials from tools, equipment, and vehicles before entering and leaving the worksite.

- a. Clean tools, equipment, and vehicles if soil and plant materials are found during inspections.
- b. Remove soil, seeds and plant parts from tools, the undercarriage, tires, sideboards, tailgates, and grills of all vehicles and equipment. Wash tires and under carriage if the travel route is muddy. For detailed cleaning protocol see Checklist E on page 59. Cleaning methods are divided into two categories:
 - Cleaning without water:
 - Bristle brushes, brooms, scraper and other hand tools (to remove heavy accumulation of soil and debris prior to washing with other tools)
 - High pressure air devices
 - Vacuum cleaner
 - Hand removal
 - Cleaning with water:

Wash on a paved surface to avoid creating mud. Contain waste water and splash to prevent invasive plant parts and seed from spreading through runoff. Berms or silt fences installed along perimeters of work areas can aid in preventing the spread of contaminated materials outside the cleaning area.

- High pressure washers (preferably with 2,000-psi): wash once for six minutes or two to three times for three minutes for best results.
- Portable cleaning station with undercarriage washers and pressure hoses (useful during maintenance of multiple sites).

- c. Dispose of propagule-containing water from equipment washing at a waste management facility or incinerator; not a wastewater treatment plant.
- d. Clean carpet, rubber, nylon or plastic materials using:
 - A vacuum cleaner
 - A variety of brushes with bristles of varying length and texture.
- e. Frequently wash vehicles, especially after driving off-road or along roads bordered by a high density of invasive plants, and after traveling under wet conditions.
- f. Include cleaning as part of routine maintenance activities for tools, equipment and vehicles. This is in addition to regular cleaning on site.

TE4: Clean pack, grazing and support animals.

- a. Brush and clean animals — especially their hooves and legs — before leaving areas infested with invasive plants. For detailed cleaning protocol see Checklist E on page 59.
- b. Provide weed-free forage or pelletized feed for livestock (preferably for three days or more) before and after project use to limit invasive plant seed transport via manure.
- c. Consider using transitional pastures when moving livestock from invasive plant infested areas.
 - Allow animals to graze invasive plants only before they flower or set seed. If this is impossible, contain animals in a weed-free holding area (preferably for three days or more) before moving them into uninfested areas.



Contain waste water when washing vehicles to prevent spreading invasive plant parts.

Photo: Maria Knight, USDA Forest Service



Chapter 5: Clothing, Boots and Gear Cleaning BMPs

Land managers have the potential to be a vector of seed dispersal through what they wear and what they carry into the field. The tendency for a fabric to attract and hold seeds and other plant material varies significantly depending on its texture. This chapter presents prevention practices that can minimize the spread of invasive plant material via clothing, boots, and gear. For a detailed cleaning protocol see Checklist E on page 59.

CB1: Wear clothing, boots and gear that do not retain soil and plant material.

- a. Wear fabrics that do not retain invasive plant propagules:
 - Cotton duck (canvas),
 - Nylon
 - Leather
 - Fabrics such as Para-aramid Kevlar^{®1} and Meta-aramid Ripstop Nomex^{®2}
- b. Avoid brushed cotton, netting, Velcro, and bulky knits like wool and fleece
- c. Use special gear as appropriate:
 - Nylon gaiters to cover socks and laces
 - Leather laces on leather boots
 - Rubber boots
- d. Consider dedicating a pair of shoes or boots for use only in infested sites.

Wear fabric that does not retain plant material to reduce the spread of invasive plants. Photo: Martin Hutten, Yosemite National Park

1. DuPont[™] and Kevlar[®] are registered trademarks of DuPont
2. DuPont[™] and Nomex[®] are registered trademarks of DuPont

CB2: Designate cleaning areas for clothing, boots and gear.

- a. Select cleaning areas that are:
 - Easily accessible for monitoring and control
 - Located away from waterways
 - Located away from sensitive habitats or species
 - Near areas already infested with invasive plants



Photo: Jen Stern, Cal-IPC

Clean clothing, boots and gear to reduce the spread of invasive plants.

CB3: Clean clothing, boots and gear before leaving worksite.

- a. Carry appropriate equipment to help remove soil, seed, and plant parts. This may include wire brushes, small screwdrivers, boot brushes, extra water free of invasive species, and bags for plant material.
- b. Remove soil, mud, seeds, and any plant material from clothing, boots and gear before leaving a worksite infested with invasive plants.
- c. Clean clothing, boots and gear at the designated cleaning area or at location of exposure to invasive plant seeds or material. In some cases it may be appropriate to bag seeds and plant parts for off-site disposal.
- d. Inform coworkers about possible seeds or other propagules carried on their clothing, footwear and gear.
- e. For a detailed cleaning protocol see Checklist E on page 59.



Chapter 6: Waste Disposal BMPs

After removing invasive plants, land managers need to decide what to do with the resulting plant biomass. Our definition of waste includes invasive plant biomass, seeds and contaminated materials such as soil and mulch. These materials may spread invasive plants if they are left viable and uncovered or are transported without containment. This chapter presents guidelines for proper waste disposal to prevent the spread of viable plant material and seeds.

WD1: Designate waste disposal areas for invasive plant materials.

- a. Select disposal areas where viable invasive plant materials will be contained, buried or destroyed.
- b. Locate debris burn piles in areas that minimize the possibility of invasive plant establishment.
- c. Do not dispose of viable invasive plant material that has the ability to resprout or spread at a facility that produces mulch or chipped products.
- d. Do not dispose of soil, seeds, or plant material down a storm drain. This action may promote the spread of invasive plants downstream.
- e. Develop a monitoring plan for waste disposal areas, including burn piles, to prevent the introduction and spread of invasive plants.

Prevent invasive plant materials from contacting soil when disposing of materials on-site. Photo: Cindy Roessler, Midpeninsula Regional Open Space District

WD2: Render invasive plant material nonviable when keeping on-site.

- a. When composting invasive plants on site, consider the reproductive biology of the invasive plants:
 - Composting will render invasive plant material nonviable only if compost piles reach very high temperatures. Finished compost should be monitored for invasive plant emergence.
 - For large amounts of invasive plant material or for invasive plants with rigid stems, contain plant materials by placing them on asphalt or black plastic (4-mm-thickness minimum), covering with black plastic (4-mm-thickness minimum), and securing the edges with landscaping staples, large rocks or sand bags. Effectiveness of this method varies by plant species.
 - For smaller amounts of plant material or for plants with pliable stems, bag the material in heavy-duty (3-mm or thicker) garbage bags. Keep plant material bagged for at least one month. Effectiveness of this method varies by plant species.
 - Keep covered or bagged materials in the sun, preferably on a dark surface such as asphalt, to accelerate the decomposition process. Material is nonviable when partially decomposed, very slimy or brittle. Once material is nonviable, it can be disposed of in a landfill or brush pile.
 - Monitor the bagged or covered material to ensure the plants do not escape through rips, tears or seams in the plastic.
- b. When drying out invasive plants in piles:
 - Prevent cut surfaces of invasive plant stems from contacting soil, to avoid root growth and reestablishment.
 - Invasive plants with viable seeds or fruit attached should not be left on-site to dry out in an exposed manner.
- c. When burying invasive plants on-site:
 - Contain all invasive plant material in an excavated pit, cover with woven geotextile, and cover with a minimum of 3 feet of uncontaminated fill material. Effectiveness of this method varies by plant species.

- This method is best used on a worksite that already has disturbed soil.
- d. Burn plant material after obtaining necessary permits.
 - e. Monitor all disposal sites for emergence of new invasive plants. Locate disposal sites so that they are easy to monitor.

WD3: When disposing of invasive plant material off-site, contain it during transport.

- a. Contain invasive plant material in heavy-duty (3-mm or thicker, contractor quality plastic) garbage bags. Securely tie the bags and transport under tarps or in an enclosed truck to an appropriate disposal area.
- b. Clean vehicles after transporting invasive plant material. For detailed cleaning protocol see Checklist E on page 59.
- c. If invasive plant material has the ability to re-sprout or spread by seed, do not dispose of it at a facility that produces mulch or chip products. Contact your local solid waste authority for additional details.



Contain invasive plant material in heavy-duty garbage bags when disposing of materials off-site.

Photo: Courtesy of Mario Abreu, California Native Plant Society



Chapter 7: Soil Disturbance BMPs

Soil disturbance includes contouring, grubbing, logging, moving, removing, excavating and cutting. Soil disturbance destabilizes and exposes soil, which can impact water and air movement, biological activity, root growth and seedling emergence. Disturbed soil provides an opportunity for invasive plants to establish and spread, to compete with native species, and to colonize new areas.

Soil disturbance often occurs during:

- Road maintenance
- Timber harvesting
- Soil excavation
- Vegetation clearing
- Movement of vehicles and heavy equipment

Soil disturbance should be minimized to the extent practical. Disturbed soil should be stabilized and covered as soon as possible to prevent the germination and growth of invasive plants. If a worksite is infested with invasive plants, schedule treatment of these plants prior to ground disturbance to minimize spread of invasive plants into other uninfested areas. Project materials such as fill, aggregate and erosion control materials can also carry invasive plant seeds, which further increase the risk for infestation after soil disturbance.

In addition to the following BMPs, also refer to related BMPS in:

- Chapter 2: Project Materials for procuring and managing erosion and project materials.

SD1: Minimize soil disturbance.

- a. Retain soil and desirable vegetation in and around the activity area as much as possible to prevent the introduction and spread of invasive plants.

Minimize soil disturbance by selecting low impact equipment. Photo: Martin Hutten, Yosemite National Park

- b. Minimize ground disturbance, as increased bare ground creates suitable habitat for invasive plant germination.
 - c. Consider the impacts of different types of equipment. Choose equipment that minimizes soil disturbance.
 - d. Minimize the frequency of soil disturbance. If a site has to be cleared of vegetation regularly (such as brush clearing), consider paving or otherwise protecting the site with weed-free materials (gravel, mulch, decomposed granite), deep mulching or planting non-invasive groundcover, or sealing bare surface with soil stabilizer. For more information on soil stabilizers see PM2f on page 18.
 - e. Limit the number of roads and access points used to help minimize soil disturbance, and to limit the risk of unintentionally transporting invasive plants into uninfested areas.
- Identify on the plans where local topsoil and duff material, within the worksite, should be:
 - Removed or excavated
 - Stockpiled
 - Reapplied
 - b. When excavating local topsoil and removing duff material, minimize handling of the material to reduce detrimental impacts to soil microorganisms.
 - c. Stockpile local topsoil and duff material in windrows no taller than ten feet for local topsoil and five feet for duff. Implement temporary erosion control measures to reduce the likelihood of invasive plant establishment and loss of material. For erosion considerations see PM2 on page 18.
 - d. Seed local topsoil stockpiles that will remain in place for over six months with a fast-growing non-invasive native plant species to maintain soil microorganisms. Covering topsoil stockpiles with impermeable barriers such as plastic sheeting may destroy living soil microorganisms. For information on temporary cover materials see PM2f on page 18.
 - e. Monitor stockpiles of topsoil and duff material regularly as they are highly susceptible to invasion by invasive plants. Determine management needs based on presence of invasive plants.

SD2: Implement erosion control practices.

- a. Promptly revegetate and/or mulch disturbed soil after ground disturbing activities. This will stabilize soils and reduce the likelihood of invasive plant establishment. For more details on revegetation and erosion control see RL3 on page 33.
- b. Use weed-free mulch, logging slash, native plant seed or a native or non-persistent cover crop as temporary cover during the delay between soil disturbance and revegetation.
- c. Contain and manage water runoff, which may carry soil, seeds and plant material. Silt fences installed along perimeters of worksites can aid in preventing the spread of infested materials.

SD3: Manage existing topsoil and duff material to reduce contamination by invasive plants.

- a. Save local existing topsoil for reuse. Plan topsoil management prior to soil disturbance.
 - Develop topsoil management plans on all projects that include grading or earthwork unless the topsoil and duff material are determined to be contaminated with invasive plants.



Install wattles or erosion control mats to reduce soil erosion.

Photo: Cindy Roessler, Midpeninsula Open Space District



Chapter 8: Vegetation Management BMPs

Integrating prevention BMPs into vegetation management can greatly minimize the introduction and spread of invasive plants. For example, scheduling vegetation management activities prior to seed production can reduce the spread of invasive plants. Life cycles of both invasive and desirable plants should be considered when scheduling activities. Mowing invasive plants after seed production will promote seed dispersal and increase the size of infestations.

Vegetation management activities may include but are not limited to: mowing, manual clearing, trimming, mechanized clearing and trimming, herbicide application, prescribed grazing and burning.

VM1: Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.

- a. Consider the timing of invasive plant control efforts based on the plant's life cycle.
 - Schedule land-disturbing activities to occur prior to seed set to minimize spreading seeds. Keep in mind that seeds may be present in the soil.
 - Consider invasive plant reproductive biology and response to fire when planning prescribed burns.
 - Coordinate the timing of maintenance activities and invasive plant control activities. For example, delay mowing until two weeks after herbicide application and delay spraying after mowing until vegetative regrowth has occurred.

*Schedule mowing of invasive plants to minimize impact on desirable plants.
Photo: Noa Rische, California State Parks, Angeles District*

- Before excavating invasive plants from drainage ditches, treat the entire infestation to ensure that the plant parts will not spread to adjacent and downstream areas. Avoid side casting (piling excavated soil on either side of a trench when digging a drainage ditch) of accumulated road materials infested with invasive plants. Stockpile in one area that can be monitored.
- b. For more details on scheduling see PL8 on page 13.

VM2: Manage vegetation with methods favorable to desirable vegetation.

- a. Coordinate management of invasive plants and desirable plants.
 - Schedule mowing, clearing, trimming or grazing of desirable plants for after seed maturation, ensuring desirable plants grow unrestricted and produce seed.
 - Schedule management of invasive plants at early flowering stage (or well before seed development) to avoid spreading viable invasive plant seeds.
- b. Limit mowing and other mechanical control to the minimum needed to control invasive plants.
 - To reduce plant shock and root dieback of desirable plant species, mowing height should not be less than six inches. Mowing too low during the growing season will increase soil exposure to sun, soil temperatures and erosion risks, and encourage invasive plant growth.
- c. Identify conditions under which invasive plants should not be mowed to avoid spreading them. Some invasive plants have the ability to sprout from stem and root fragments. Mowing these plants should be avoided.

VM3: Retain existing desirable vegetation and canopy.

- a. Identify and protect desirable vegetation on site to increase competition with invasive plants. Desirable vegetation should be non-invasive and suitable for the conditions.
- b. Train personnel to identify invasive and non-invasive plants on-site. Provide identification guides to field staff.
- c. Minimize clearing large amounts of vegetation and creating canopy openings. Increased sunlight and bare ground creates suitable habitats for invasive plant germination.
- d. Consider the impacts of different types of equipment. Choose equipment that minimizes vegetation disturbance.



Flag native plants for avoidance before treating invasive plants.

Photo: Noa Hsieh, California State Parks, Angeles District



Chapter 9: Revegetation and Landscaping BMPs

Revegetation and landscaping work is often derived from different needs and carried out by different staff or contractors. Revegetation is the process of replanting and rebuilding the vegetated community on disturbed land. Landscaping modifies land to meet functional, aesthetic and regulatory requirements. Despite the differences, revegetation and landscaping share the fundamental goal of creating weed-resistant plant communities.

Creating weed-resistant plant communities requires planning and a thorough understanding of site ecology including: existing soil condition, hydrology, exposure, existing plant community and habitat, invasive plant risk assessment, human impact, and the surrounding environment.

Plant selection is critical to successful revegetation projects. Revegetation and landscaping with desirable non-invasive plants suitable for local conditions can create weed-resistant communities that prevent or slow the establishment, growth, and reproduction of invasive plants. The following prevention BMPs are for revegetation and landscaping projects. In addition to the following BMPs, also refer to related BMPs in:

- Chapter 2: Project Materials for procuring and managing erosion and project materials.

RL1: Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.

- a. Identify areas where revegetation or landscaping is needed to improve invasive plant resistance of plant communities. Determine the goal of vegetation coverage. Evaluate annually for three years to determine if vegetation establishment is successful.

Plant native or desirable non-invasive plants to optimize resistance to invasive plant establishment. Photo: Jack Broadbent, California Department of Transportation

- Develop weed-resistant plant communities in disturbed areas such as roadsides. Consider using plants that have low growth forms, require no mowing, establish well, and are well adapted to disturbance.
 - Revegetate or landscape with local native plants or appropriate non-invasive plants to prevent invasive plant introduction. Native species grown outside of the region may not establish well.
- b. Evaluate existing soil type, texture and health to determine vegetation selection, fertilization and maintenance needs.
- Improve unhealthy soil by adding healthy topsoil, compost, fertilizer and/or using aeration to incorporate oxygen into the soil.
 - Fertilization, if done improperly, can encourage weed growth and reduce the ability to establish native plants. Organic fertilizers are better suited for native plants because they release nitrogen at a very slow and stable rate.
 - Do not fertilize areas treated with compost as the compost will provide the plants with the necessary micro-nutrients to support healthy growth. Compost should be supplied by participants in the US Compost Council's Seal of Testing Assurance Program. A list of current STA program participants is available at: <http://compostingcouncil.org>.
 - If improving soil health is not possible, choose vegetation with low soil-nutrient requirements.
- c. Develop a plant palette that will occupy various planting zones/ecological niches in order to create a weed-resistant landscape.
- Select plants, with the aid of a revegetation/landscaping specialist, based on existing soil conditions, drainage patterns, amount of rainfall or irrigation available, exposure and adjacent environment.
 - Use native material to the greatest extent possible.
- d. Encourage passive regeneration of native plant cover where site conditions permit and where the risk of introducing invasive plants is low.
- e. Design irrigation systems with attention to irrigation timing, coverage and quantity to encourage the growth of desirable plants and discourage the growth of invasive plants. Too much water can stunt the growth of drought-tolerant plants and encourage undesirable invasive plants.
- RL2: Acquire plant materials locally. Verify that species used are not invasive.**
- a. Identify sources of native and appropriate nonnative plant materials. Specify and use weed-free locally appropriate seed mixes that will occupy various niches in order to create weed-resistant plant communities.
 - b. Check seed label for purity, composition, source and germination. Confirm consistency with specifications. For seed label details see PM1 on page 16.
 - c. Use local native ecotypes when feasible. Native species grown outside of the region may not establish well. Consider contract growing of local native plants.
 - d. When using local native species is not feasible and the risk of invasive plant infestation is high, use locally grown, non-invasive species proven to grow well locally.
 - e. Do not plant invasive plants. Verify plant lists do not contain invasive plant species by checking Cal-IPC's invasive plant inventory (www.cal-ipc.org/ip/inventory/weedlist) and the local Agricultural Commissioner's Office.
 - f. Confirm that only selected plant species are used in the planting, especially when naming inconsistencies are possible.
 - g. Have extra plant materials on hand. Plan for mortality of 20-30% percentage of container plants.

RL3: Revegetate and/or mulch disturbed soils as soon as possible to reduce likelihood of invasive plant establishment.

- a. Promptly revegetate and/or mulch disturbed areas, including new forest openings, with local native or non-invasive plants. For details on acquiring plant materials see RL2 on page 32.
- b. Use proper horticultural practices to promote healthy root and foliage growth that will aid in the vegetation's ability to withstand adverse conditions and to compete with invasive plant growth.
 - Avoid use of fertilizer in areas with high infestations of invasive plants where fertilizer may favor growth and spread of invasive plants over desirable species.
 - Consider using compost or organic slow release fertilizer when planting native species. Excessive nitrogen availability promotes the growth of weedy annual grasses, which can dry out the site and crowd out slow-growing perennials.
 - Consider soil inoculation to improve establishment success for planted species. Inoculation refers to the adding of "inoculants" which are mycorrhizal fungi that help with moisture retention and soil/root relationships in the first year of establishment.
- c. When revegetation is impossible, consider limited and judicious use of paving/hardscape or otherwise protecting the site using weed-free materials (gravel, logging slash, long-fiber mulch, decomposed granite), deep mulching or using a soil stabilizer. For more information on soil stabilizers see PM2f on page 18.
- d. When using mulch:
 - Use weed-free mulch. For information on weed-free mulch see PM1 on page 16.
 - Consider fire risk at the application site. Some long-fiber mulches such as shredded redwood bark (gorilla hair) are highly flammable.

- Apply mulch at the recommended thickness to suppress the establishment and growth of invasive plants. Ensure mulch remains on-site. Lighter mulches will blow away in areas prone to heavy wind; mulches can move if watering results in surface flow. Consider the use of tackifiers or biodegradable netting.
- Supplement with additional mulch to retain thickness and effectiveness after it begins to decompose.



Select plant materials from local sources. Verify that all plants selected are not invasive.

Photo: Jim Dempsey, California State Parks



Chapter 10: Fire and Fuel Management BMPs

Wildfire is a natural part of California ecosystems, and the structure and composition of most of California’s plant communities are dependent on the periodic occurrence of fire. However, it also has significant potential for creating conditions that aid the establishment or spread of invasive plants which can damage the state’s ecosystems. Disturbance created by wildfire suppression activities and pre-fire fuel treatments can also inadvertently contribute to the spread of invasive plants. This chapter addresses the many steps that can be taken to limit invasive plant establishment or spread. However, it must first be stated that **in wildfire suppression, protection of life is the foremost goal. Implementation of the prevention measures described in this manual should not interfere with this goal.** As stated in federal policy, “the safety of firefighters and the public is the first objective on all fire management activities, followed by the protection of property and minimizing impacts to natural and cultural resources.”

In addition to the prevention measures summarized in previous chapters, this chapter provides measures specific to wildfire management activities, with sections on: **1) fire management planning, 2) fuel management, 3) fire suppression, and 4) post-fire activities.** These prevention measures should be considered even for prescribed burns, since they can also inadvertently contribute to the spread of invasive plants.

Fires can result in reduced competition for light, water and nutrients; invasive plants are poised to take advantage of such conditions. In the worst cases, fire and invasive plants form a positive feedback loop where wildfire increases invasive plants, which then alter the fire regime in ways that favor further invasive plant spread (e.g. increasing fire frequency or intensity). An example is the shift seen in some locations in Southern California, where invasive annual grasses are replacing native chaparral. Such major changes in vegetation can also greatly impact

Invasive plants can spread following the disturbance of fire. Photo: Garrett Dickman, Yosemite National Park

hydrology, erosion, nutrient levels, and wildlife habitat. There is a strong tie between disturbance and invasive plant establishment and spread. Activities associated with fire and fuel management (for instance, cutting fuel breaks) can be a cause of disturbance, potentially facilitating the spread of invasive plants. Vehicles, personnel and materials (such as hay used for erosion control), can act as vectors for spreading invasive plant seeds. Fire managers working for land management organizations and agencies share the responsibility of managing public and private lands with other resource professionals and can play a key role in reducing the spread of invasive plants associated with fire management.

Preventing the spread of invasive plants by fire and fire-related management activities requires an assessment of land management goals and an understanding of how resident plant communities and species (both native and non-native) will respond to fire and the post-fire environment. Tools such as the Fire Effects Information System website (www.fs.fed.us/database/feis/) and the *A Manual of California Vegetation* and *Fire in California's Ecosystems* can help land managers learn the specific invasive plants of their region and how they are likely to interact with fire in California ecosystems. Additional resources are listed in the Fire and Fuel Management Resources on page 63.



Photo: S. Kocher, UC Cooperative Extension

Wildfire is a natural part of California ecosystems. The structure and composition of most California plant communities are dependent on the periodic occurrence of fire.



10.1 Fire Management Planning BMPs

Fire management activities include fuel management, fire suppression, and post-fire activities. A fire management plan provides the basis for communication, coordination, and project planning with partner agencies. Because fire, fire management, and invasive species all impact each other, natural resource managers should consider wildfire implications when designing invasive plant management programs, and consider invasive plant implications when designing wildfire management programs.

Because agencies conducting fire management activities do not always have jurisdictional authority over all of the properties that are relevant to fire management, it is important for all entities involved to work together in developing integrated fire and land management plans. Cooperative Agreements can be

an effective way to establish allowable techniques for each property and include property owners in planning efforts.

It is essential that land managers understand the relationship between fire, plant communities and invasive plants in order to effectively integrate fire management activities into overall land management planning. Awareness building and training on invasive plant prevention can be integrated into fire management planning without interfering with fire management priorities.

In addition to the following BMPs, also refer to related BMPs in:

- Chapter 1: Planning BMPs for integrating prevention BMPs into land and fire management activities.

Coordinate mapping efforts for invasive plant management with mapping efforts for wildfire management to the extent possible. Photo: Forest Schafer, North Lake Tahoe Fire Protection District

FP1: Consider wildfire implications when setting overall priorities for invasive plant management programs.

- a. Identify areas most susceptible to future wildfires and identify invasive plant populations within these areas. Evaluate the likely effects of wildfire on invasive plant populations and invasive plants on wildfires in these areas. Utilize this information in setting invasive plant management priorities with the intent to prevent future spread of existing populations.
 - To the extent feasible, coordinate mapping efforts for invasive plant management with mapping efforts for wildfire management.
 - For fire effect information for specific species, see the USDA Forest Service’s Fire Effect Information System (FEIS) website (www.fs.fed.us/database/feis/).
 - Identify priority areas for invasive plant management. Refer to the Prioritizing BMP Implementation on page 5.

Evaluate high-potential wildfire areas where prescribed burns can be used to benefit native plant communities and species while proactively reducing the threat of invasive plant spread following a wildfire in that area.

FP2: Integrate invasive plant prevention into fire management plans.

- a. Use an interdisciplinary team when developing fire management plans, in order to address preventing the spread of invasive plants. Include those versed in other disciplines, such as botanists, endangered species specialists, soil scientists, hydrologists, and GIS specialists.
- b. Include invasive plant prevention priorities identified in land management plans when developing fire management plans. These priorities should ideally be coordinated with existing local invasive weed committees and incorporated into an Integrated Pest Management (IPM) plan.
- c. Include actions to prevent invasive plant spread in all levels of fire and fuel planning documents where appropriate. For instance, integrate appropriate measures into:
 - Fire and fuel management plans



Photo: Athena Demetry, Sequoia and Kings Canyon National Parks

Fire crew staging at a low elevation site for mobilization to wildfire at higher elevation. Helibases, fire camp and staging areas infested with invasive plants can be a vector of spreading invasive plants.

- Suppression Repair Plans
 - Burned Area Emergency Response (BAER) plans
 - Burned Area Rehabilitation (BAR) plans
 - Wildland Fire Decision Support System (WFSS) protocol
 - Community Wildfire Protection Plans (CWPPs) for private lands in the Wildland-Urban Interface (WUI)
 - Minimum Impact Suppression Tactics (MIST).
- d. Ensure wildfire infrastructure areas (existing or planned) are invasive plant free.
 - Initiate the establishment of a network of helibases and potential fire camp and staging areas that can be maintained in an acceptably invasive plant-free condition. Identify potential cleaning stations for those entering and leaving these areas.
 - Identify water sources infested and uninfested with aquatic and terrestrial invasive plants. Map acceptable and contaminated water sources and ensure this information is available to resource advisors and fire personnel.
 - e. Integrate equipment cleaning BMPs into planning for fire management activities. See PL9 on page 13.
 - f. Encourage sound forestry and range management practices to maintain healthy, vigorous overstory vegetation (where appropriate), which generally tends to “shade out” invasive species. Healthy forest and rangeland is typically less susceptible to intense burning conditions in the event of wildfire.



Photo: Forest Schaefer, North Lake Tahoe Fire Protection District

Incorporate invasive plant information in existing fire and fuel management training.

- g. Ensure that the use of fire retardant is discussed within the fire management plan. Consider the impacts of fire retardant on soil fertility.

FP3: Provide training in preventing the spread of invasive plants.

- a. Include invasive plant awareness and prevention in existing fire and fuel management training.. Consider the best ways to provide information to Resource Advisors, Incident Management Teams, and agency leadership. Include information in regular trainings such as employee orientation and annual refresher courses.
- b. Include consideration of invasive plant risk factors and implementation of prevention practices in Resource Advisor duties on all Incident Management teams and Burned Area Emergency Response teams.

FP4: Plan to utilize weed-free materials for post-fire activities.

- a. See Chapter 2: Project Materials on page 15.
- b. Consider development of as-needed contracts for weed-free materials. For example, contracting for specialized weed-free materials can take weeks to months—a timeframe that exceeds most fire emergency rehabilitation and suppression repair projects. If contracts are in place prior to fire suppression, it is more likely that weed-free materials can be effectively acquired. As-needed contracts are commonly used in other fire management activities (e.g. water tankers, helicopters, fuel management crews).
- c. Consider stockpiling native and appropriate nonnative seed for use in post-fire activities. Like weed-free materials, the time needed for contracting and acquisition of seed can exceed the timeframe of most fire emergency rehabilitation and suppression repair projects.



Photo: S. Kocher, UC Cooperative Extension

Have weed-free materials ready for use in post-fire activities.



10.2 Fuel Management BMPs

Fuel management is designed to change future fire behavior, to contain fires, or to reverse negative ecosystem changes. Fire-adapted ecosystems, like those in California, will change in unnatural ways when fire is excluded. Fuel management can be used to counteract these changes so that fires are less destructive. Fuel management activities typically involve the thinning or removal of understory vegetation and the rearrangement or removal of surface fuels. Methods used in fuel management include prescribed fire, mechanical or hand thinning, mechanical mastication, machine piling, pile burning, and chipping. This work happens in both wildlands and the Wildland-Urban Interface (WUI), where property owners are often required to maintain significant safe space around structures.

Fuel management activities, themselves a type of disturbance, can potentially impact the introduction, establishment and spread of invasive plants. Vegetation clearing and soil disturbance can provide

openings for invasive plants. Thus it is important to include an assessment of this potential when designing fuel management activities. There is significant variability in impact depending on ecosystem. Fuel management that reduces disturbance while meeting overall fuel management objectives can reduce the risk of introduction or spread of invasive plants. It is important to consider both human-caused factors and environmental conditions that influence invasive plant spread when developing fuel management plans.

The best management system for maintaining native plant diversity is likely one that mimics natural disturbance processes (including the characteristic fire regime) of the frequency, intensity, and duration of fire with which native species evolved. When this is not possible (such as when the natural disturbance is stand-replacing fire and the area is in the WUI), managing for general resiliency to climate change, fire, and invasion may be the best option. The complex and diverse ecosystems in California may require a mosaic of diagnostic and prescriptive actions to effect best management results.

When planning fuel management activities, consider environmental conditions that influence invasive plant spread. Photo: Forest Schafer, North Lake Tahoe Fire Protection District

In addition to the following BMPs, also refer to related BMPs in:

- Chapter 8: Vegetation Management for general prevention measures.
- Chapter 6: Waste Disposal for managing invasive plant disposal on-site and off-site.

FM1: Incorporate invasive plant considerations when developing fuel management plans.

- a. Use an interdisciplinary team when developing fuel management plans, in order to address preventing the spread of invasive plants. Include those versed in other disciplines, such as botanists, endangered species specialists, soil scientists, hydrologists, and GIS specialists that are knowledgeable about invasive plants and native plant life histories. This may necessitate partnering with other agencies or organizations.
- b. Survey for invasive plants to create baseline data for fuel treatments. Make sure survey data from local and state resource agencies is available and integrated.
- c. Have a set of clear target conditions for vegetation and fuel. When developing these target conditions, consider both the effects of fuel treatments on invasive plants and native plants, and the effects of invasive plants on fuel treatments.
- d. Assess both human-caused factors and environmental conditions that influence invasive plant spread when developing fuel management plans.



Photo: Kathy VanZuuk, National Forest

Invasive plants can spread after implementing fuel reduction/prescribed burn in areas where invasive plants were initially present.



Photo: Forest Schafer, North Lake Tahoe Fire Protection District

Include invasive plant considerations as a part of community outreach for fuel reduction projects.

- Human-caused factors include:
 - Fuel break construction methods
 - The scale of fuel breaks
 - Maintenance methods
 - Maintenance frequency
 - Connectivity to roads and trails (e.g. distance to roads and road level)
 - Extent of private inholdings in a given area
 - Fire regime changes
- Environmental conditions:
 - Proximity to populations of invasive plants
 - Overstory canopy cover
 - Litter cover, rock cover, duff depth, and bare ground
 - Vegetation type
 - Elevation
 - Slope
 - Fire regime
 - Climate change
- For information on conducting a site assessment on invasive plant infestation, see PL7 on page 12.
- e. In prioritizing fuel treatment activities, consider site-specific information on the following in addition to target conditions like habitat integrity and fuel load:
 - The role of invasive plants in preventing the achievement of target conditions (or vegetation management goals)
 - The role of invasive plants in affecting the fire regime.



Photo: Forest Schaefer, North Lake Tahoe Fire Protection District

Burned and unburned areas after a prescribed burn. Fuel management activities are themselves a type of disturbance, which can create openings for invasive plants.

- f. For details on preventing invasive plant spread during vegetation management, see Chapter 8: Vegetation Management on page 29.
- g. For all types of fuel treatment projects (e.g., prescribed burning, thinning and pile burning) where the potential for introduction or spread is moderate to high as a result of implementation, remove high risk areas from the project footprint, develop a pre-fire treatment prescription (including any post-fire mitigation/follow-up), or incorporate project design features to reduce the risk of spreading or introducing invasive plants.
 - Focus on invasive plant species that have been identified as local early detection priorities. For more information, see CalWeedMapper (www.calweedmapper.calflora.org).
 - Learn about how fire affects the particular species of interest. For more information, see FEIS (www.fs.fed.us/database/feis/).
- h. Develop outreach and education information for adjacent property owners and fire safety councils about the effects of fuel treatments on invasive plants, and BMPs to reduce spread of invasive plants on their own property and nearby wildlands.

FM2: Maintain active management of invasive plants on fuel management sites.

- a. Implement ongoing Integrated Pest Management (IPM) activities for all fuel management sites to keep invasive plants from spreading.
- b. Capitalize on opportunities for coordinating efforts with those focusing on invasive plant management. There may be opportunities for supporting invasive plant management goals as well as fuel reduction goals through the efforts of multiple parties. Any activities that are counterproductive to one set of goals can be identified and revised.

FM3: Reduce disturbance when implementing fuel management activities.

- a. Maintain shaded fuel breaks, where appropriate, in key fire suppression areas to reduce the need for bulldozing and cutting operations during emergency fire suppression.
- b. To prevent the spread of invasive plants, remove only enough vegetation and ground cover to accomplish the fuel management and resource objectives.
 - Construct fuel breaks no wider than necessary to accomplish fuel reduction and resource objectives.
 - Remove vegetation adjacent to prescribed fire control lines only as needed to prevent additional fire spread or for safety and access.
 - For more information on preventing invasive plant spread during vegetation management, see Chapter 8: Vegetation Management on page 29.
- c. Favor thinning techniques that do not result in ground disturbance—such as hand thinning, thinning using a chainsaw, mowing, or mastication—over techniques that result in ground disturbance—such as grapple piling or blading, whenever this can be done with no loss in fuel management effectiveness.
 - Ground disturbance can promote invasive plant establishment and spread. Reduce soil disturbance. See Chapter 7: Soil Disturbance on page 27.



Photo: Forest Schaefer, North Lake Tahoe Fire Protection District

If heavy equipment is required, use equipment with less exerted ground pressure per square inch to reduce soil compaction.

FM4: Incorporate invasive plant considerations when using prescribed fire.

- a. Use both invasive species-specific and site-specific knowledge when assessing the use of fire on invasive plants. Consider invasive plant biology/life cycle, site conditions, plant community composition and distribution, and fire regime.
 - b. Consider follow-up treatments including mechanical, chemical or re-vegetating areas treated with fire.
 - c. When feasible, reduce the amount of control line construction and associated soil disturbance during prescribed burning, and plan for rehabilitation where necessary. For details on control line construction, see FM3 on page 42.
 - d. Incorporate invasive plant information into pre-burn briefings when needed.
 - e. When using prescribed fire to control invasive plants, burning should be integrated into an Integrated Pest Management (IPM) prescription. Evaluate the potential impact when using fire to control invasive plants. When planning to use herbicide treatments in concert with the burn, submit pesticide use permit applications with enough lead time to secure permission prior to implementing a prescribed burn.
- If heavy equipment is required for thinning, use alternative mechanized equipment with greater reach or less exerted ground pressure per square inch to reduce soil compaction or the total area disturbed.
 - Mow fuel breaks before invasive plants set seeds to prevent spread. For details on mowing, see VM2 on page 30.
- d. Transition vegetation (trees or shrub) removal in such a way that invasive plants are less likely to become established in the interior of the fuel break or fuel management unit. For instance, when working along roads, thin vegetation in the fuel break to a minimum level in order to meet fuel objectives, thus providing a potential vegetative barrier (i.e., competition) to reduce the spread of invasive plants from the roadside to the interior.
 - e. Where fuel reduction and resource objectives necessitate ground disturbance and soil exposure, or substantial ground cover and canopy removal, include appropriate revegetation or invasive plant management strategies in the fuel treatment plan.
 - Rehabilitate/restore or treat disturbed areas after fuel management activities and conduct follow up monitoring on these areas susceptible to invasive plant spread.
 - Cover and reduce exposure of bare ground. Use on-site chipping or treated fuels from mastication.



10.3 Fire Suppression BMPs

Firefighter and public safety is the first priority in every fire management activity. Along with resource management objectives and the ability to hold a fire line, human safety should dictate fire suppression strategy and tactics including line placement. After human safety has been accounted for, land managers should attempt to incorporate invasive plant prevention measures into fire suppression activities in order to reduce post-fire resource impacts. Fire suppression activities can spread and promote the establishment of invasive plants by disturbing soil, dispersing plant parts and seeds, and altering plant nutrient availability. For example, simple prevention practices include cleaning vehicles, equipment, clothing and gear between activity areas and avoiding invasive plant populations when constructing indirect fire lines or locating activity areas, such as staging areas.

After human safety has been accounted for, attempt to incorporate invasive plant prevention measures into fire suppression activities. Photo: Martin Hutten, Lassen National Park

In addition to the following BMPs, also refer to related BMPs in:

- Chapter 4: Tool Equipment and Vehicle Cleaning for cleaning protocols.
- Chapter 5: Clothing, Boots and Gear Cleaning for cleaning protocols.
- Chapter 7: Soil Disturbance for erosion control measures.

FS1: Develop operational procedures related to fire suppression to reduce the spread of invasive plants.

- a. Incorporate the following into the Delegation of Authority given to the Incident Commander:
 - The importance of invasive plant prevention
 - The techniques to be used to prevent the spread of invasive plants
- b. Incorporate prevention awareness information and operational practices in the Incident Action Plan (IAP).
- c. Encourage Resource Advisors to consider invasive plant issues as part of their focus on every incident.

- d. When feasible, plan travel routes to avoid spreading invasive plants from infested to non-infested areas. For details on travel route planning, see Chapter 3: Travel on page 19.
- e. Develop standardized invasive plant prevention direction for use in the Wildland Fire Decision Support System (WFDSS) and make it readily available to Agency Representatives. Ensure that the direction is consistent with relevant resource and wildland fire management plans. Include incident-specific invasive plant information in the WFDSS, as needed.

FS2: Locate indirect fire lines to reduce additional disturbance and invasive plant spread where feasible.

- a. Safety and holding ability remain the priority motivation for any fire line location; however, when feasible, place indirect fire lines in areas free of invasive plants.
- b. Provide the Resource Advisors, the Field Observer or other appropriate personnel (crew bosses, Incident Commander, Division Supervisors, etc., depending on the size of the incident organization) with priority invasive plant identification aids and maps.
- c. Tie fire lines into pre-existing fuel breaks and managed fuel zones. Use existing natural and man-made breaks (lakes, streams, roads, trails, etc.) when feasible.
- d. As feasible, keep ground disturbance to a minimum.



Photo: Jeanne Pincha-Tulley, Tahoe National Forest

Soil disturbance can facilitate invasive plant spread. Where feasible, locate indirect fire lines to reduce additional disturbance.

FS3: Locate fire activity areas in locations free of invasive plants where feasible.

- a. Fire activity areas include:
 - Incident Base Camp and staging areas
 - Fire crew camps, including spike camps
 - Helibases
 - Drop points
 - Parking areas
- b. Coordinate with the Resource Advisor in choosing fire activity areas with the most reasonable qualities of resource protection and safety concerns.
 - Use pre-approved infrastructure when available. For details, see FP2d on page 38.
 - Map fire activity areas for post-fire invasive plant monitoring.
- c. Keep fire activity areas free of invasive plants.
 - Incorporate cleaning stations in fire activity areas for equipment, personnel and vehicles.
 - For BMPs on keeping activities areas clean, see PL9 and PL10 on page 13 and 14.
- d. Where situations dictate that the fire activity areas must be located on a site infested with invasive plants, take actions to reduce the spread of invasive plant seeds. Examples include:
 - Consider flagging, fencing, or placing cones at the perimeters of invasive plant populations to keep people out.
 - Consider mowing or otherwise treating invasive plants.
 - Designate travel routes to avoid invasive plants.
 - Clean equipment before leaving infested sites.
- e. For more information on worksite management, see PL10 on page 14.

FS4: Clean vehicles, equipment, clothing and gear before arriving and leaving fire activity areas.

- a. For detailed recommended cleaning protocols, see:
 - Chapter 4: Tool Equipment and Vehicle Cleaning on page 21
 - Chapter 5: Clothing, Boots and Gear Cleaning on page 23
 - Checklist E: Inspection and Cleaning on page 43



Photo: Garrett Dickman, Yosemite National Park

Clothing, personal protective equipment, and hand tools can spread invasive plants. Clean them between fire activity areas when feasible.



Photo: Julie Nelson, Shasta-Trinity National Forest

Remove dirt from the undercarriage of vehicles prior to entering and exiting fire activity areas.

b. Inspect and clean equipment and vehicles during check-in and before demobilization from fires, especially if vehicles have been traveling from out-of state, off-road, or through areas infested with invasive plants. The following are examples only and don't represent the entire list of equipment that potentially could need to be cleaned:

- Keep fire hoses clean and free from invasive plant parts when feasible.
- Inspect helicopter nets for invasive plant parts and seeds. Bundle and store nets in areas free of invasive plants. Consider spreading nets on clean tarps or concrete/asphalt pads, so nets can be inspected, loaded and bundled up for storage in a weed-free state.
- Inspect and remove weed seed and plant parts from cargo nets and other external loads.

c. Prior to arriving and leaving a fire, clean equipment. For example:

- Personal belongings (e.g., boots, clothes,

sleeping bag, tent)

- Personal Protective Equipment (PPE) (e.g., gloves, helmet, goggles, fire pack, fire shelter)
- Back-pack pumps
- Hand tools (e.g., shovels, pulaskis, axes, fire rakes, and hoes).

FS5: Use water sources free of invasive plants for fire suppression when feasible.

- a. Avoid use of water sources known to contain aquatic invasive plants to prevent the spread of aquatic invasive plants to other water bodies.
- b. Avoid moving water on the surface of vehicles, tools and equipment from infested water sources to water sources that are not infested with invasive plants. Inspect and clean equipment prior to use in another water body.
- c. Any equipment that draws water from one water source should not be drained into another water source. Flush equipment, such as portable pumps and hoses, with clean water between



Photo: Athena Demetry, Sequoia and Kings Canyon National Parks

Stage gear on tarps to avoid contact with invasive plants prior to loading and transport.



Photo: Jeane Pincha-Tulley, Tahoe National Forest

Aquatic invasive plants can spread through water-drafting equipment, tools and vehicles. Use water sources free of invasive plants and clean equipment between water bodies when feasible.



10.4 Post-Fire Activity BMPs

uses and between fire activity areas.

Post-fire activities include four phases: Suppression damage repair, burned area emergency response (BAER), burned area rehabilitation (BAR), and restoration.

- Suppression damage repair is focused on restoring fire lines and features that were damaged by the fire suppression activities. Activities include rehabilitating fire line and staging areas, fixing roads and fences, etc.
- BAER is aimed to protect life and property from post-fire events. BAER is implemented to prevent erosion, stabilize soil, and minimize damage from post-fire flooding immediately after wildfires to prevent further damage to life, property, water quality and deteriorated ecosystems.
- BAR is implemented to restore ecosystems and repair damage caused by fire. Activities include

the repair or improvement of fire-damaged lands that are unlikely to recover naturally, or repair of minor facilities damaged by fire.

- Restoration is the long term land management program.

Activities conducted for these purposes can result in invasive plant spread. Vehicles, equipment, erosion control, revegetation materials, humans, livestock, and support animals, can inadvertently spread invasive plant parts and seeds.

The effects of fire on invasive plant spread can also vary depending on the biology of the native vegetation, the level of disturbance, and the habitat condition. A ready-to-use burned-area integrated invasive plant management plan that is consistent with long term land management objectives will help identify priority areas for invasive plant monitoring, the appropriate treatments and prevention measures for post-fire activities.

Cover bare ground with non-invasive plants or weed-free erosion control materials as soon as possible following a fire. Photo: S. Kocher, UC Cooperative Extension

In addition to the following BMPs, also refer to related BMPs in:

- Chapter 2: Project Materials for procuring and managing erosion control and revegetation materials on page 15.
- Chapter 4: Tool, Equipment and Vehicle Cleaning for cleaning protocols on page 21.
- Chapter 5: Clothing, Boots and Gear Cleaning for cleaning protocols on page 23.
- Chapter 9: Revegetation and Landscaping for general prevention measures on page 31.

PF1: Manage access to burned areas.

- a. Use an interdisciplinary team to determine when activities (including public access, agency work, and grazing, etc.) may resume in burned areas. The team should include natural resource staff knowledgeable about invasive plants.
- b. Consider how vehicles can spread invasive plants and how to reduce their risk. For example, close public access to burned areas temporarily to reduce the risk of introduction and spread of invasive plants.
- c. Restrict travel to established roads and trails to avoid compacting soil. Off-road travel could reduce the recovery of desired plants and will create additional disturbance or act as invasive plant vectors.
 - Examples include: Block access to fire lines to prevent vehicles from traveling on them. Place sufficient soil, downed trees, slash, root wads, or boulders to block vehicle access and to slow the flow of water, both of which may carry seeds of invasive plants.
- d. Manage human, pack animal, and livestock entry into burned areas until desirable vegetation has recovered sufficiently to resist invasive plant establishment.
- e. Consider deferring livestock grazing in burned areas until vegetation has successfully reestablished.
 - Grazing removes plant biomass, reduces levels of competition, and increases the availability of soil nutrients, thus increasing the potential for invasive plant establishment. Grazing also increases soil disturbance, thus creating a seed bed for invasive plants.

- Grazing Management Plans and permits should emphasize the potential recovery times for burned areas to reduce conflict with permittees.
- f. For additional information on access, see Chapter 3: Travel on page 19.

PF2: Use weed-free materials during post-fire activities.

- a. When procuring seeds, soil stabilization and revegetation materials, see Chapter 2: Project Materials on page 15.
- b. When acquiring local plant materials, see Chapter 9: Revegetation and Landscaping on page 31.



Use local native plant materials for revegetation.

Photo: S. Kocher, UC Cooperative Extension

PF3: Cover and rehabilitate soil disturbed by suppression activity.

- a. Cover bare soil that results from fire lines by pulling duff, litter, and cut material back over lines as soon as possible, or by using weed-free mulch (e.g., hydromulch, chipped fuels).
- b. Implement erosion control practices. See SD2 on page 28.
- c. Encourage the reestablishment of native vegetation by limiting soil disturbance and ensuring invasive plants do not become established.
 - Consider planting locally collected, genetically appropriate, native species to compete with invasive plants.
 - For details, see Chapter 9: Revegetation and Landscaping on page 31.
- d. Limit soil disturbance during post-fire activities.

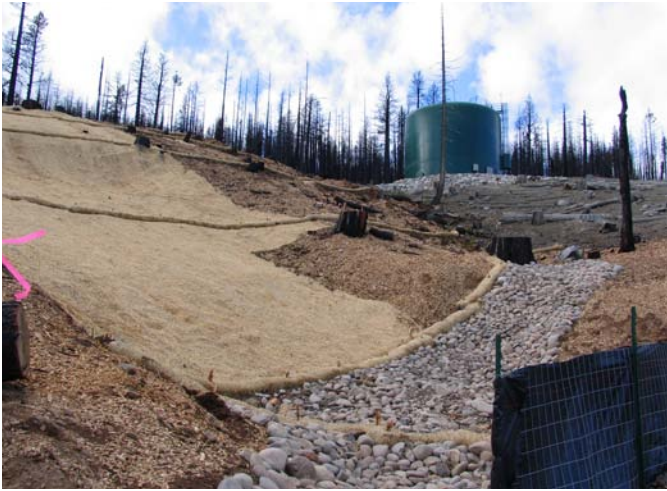


Photo: S. Kocher, UC Cooperative Extension

Erosion control with weed-free materials post-fire is important for reducing invasive plant spread.

- e. For details on rehabilitating disturbed soil, see RL3 on page 33.

PF4: Develop and implement post-fire integrated invasive plant management prescriptions.

- a. Develop both short-term and long-term treatment prescriptions (including monitoring) to manage invasive plants.
- b. Work with a local invasive plant specialist to develop and review BAER reports.
- c. Concentrate prevention efforts in high risk areas:
 - Areas highly susceptible to invasive plants establishment and spread include:
 - Areas where invasive plants are already present
 - Wet areas (creeks, seeps, meadows, and seasonal streams)
 - High severity burn areas (high overstory mortality, exposed mineral soil)
 - Burn areas adjacent to roads and trails
 - Areas disturbed by fire suppression activities:
 - Dozer/hand lines (especially where they intersect pre-existing roads or trails)
 - Drop points/sling sites
 - Retardant drops
 - Fire activity areas
 - Transportation corridors

- Roads and trails
- Perpetually disturbed areas
 - Campgrounds, dumpsters, and parking lots
 - Residential areas
- d. Secure funding to inventory and treat invasive plants, such as BAER and BAR funding.
- e. Inspect, evaluate, control and monitor invasive plants at all fire activity areas as needed.
 - Inspect for and map establishment and spread of invasive plants:
 - At fire access roads, cleaning sites, fire lines, staging areas, observation points, sling road sites, safety zones, and within areas affected by fire suppression activity (e.g., riparian areas, fire activity areas, etc.).
 - For more information on conducting a site assessment for invasive plant infestations, see PL7 on page 12.
 - Evaluate invasive plant status and risks.
 - For additional suggestions on areas and species to prioritize, see Prioritizing BMP Implementation on page 5.
 - Control invasive plants.
 - Practice early detection and rapid response



Photo: Garrett Dickman, Yosemite National Park

Practice early detection and rapid response during the first 5-10 years following fire to detect and control new populations of invasive plants within the fire area.

during the first 5-10 years following fire to detect and control new populations of invasive plants within the fire area.

- Control infestations to prevent spread within burned areas; control nearby infestations to prevent spread into burned areas.
- For a list of reference on invasive plant control and management, see General Resources on page 61.
- Monitor for new infestations of invasive plants.
 - Monitoring needs to determine whether objectives of the management actions have been achieved and the retreatments if objectives have not been met.
 - Monitoring will sometimes extend to secondary effects (i.e., the influence of fuel management on fuel characteristics, and ultimately on fire behavior and fire regimes).



Photo: Garrett Dickman, Yosemite National Park

Determine soon after a fire whether revegetation is needed to speed recovery of a desirable native plant community, or whether desirable plants in the burned area will recover naturally.

PF5: Revegetate burned areas to reduce the spread of invasive plants.

- a. Determine soon after a fire whether revegetation is needed to speed recovery of a desirable native plant community, or whether desirable plants in the burned area will recover naturally.
- b. Secure funding and revegetate areas vulnerable to invasive plants (e.g. areas that are near existing populations of invasive plants, intersections of dozer lines with road systems).
- c. Avoid use of fertilizer. Supplemental nutrients may favor growth and spread of invasive plants.
- d. For details, see Chapter 9: Revegetation and Landscaping, on page 31.
- e. Create a monitoring plan for revegetation.
 - Monitor burned areas until desirable vegetation is established. Burned areas may be susceptible to weed infestation for 5-10 years or more.
 - For more details on monitoring, see PL11 on page 14.

Checklist Introduction

The following checklists contain only the BMP statements to provide a quick and portable reference for field activities. Checklists A, B, C and D are organized by land management activities, and Checklist E is organized by items to inspect and clean. These checklists can be attached to a field notebook, clipboard, or corkboard in an office for easy reference. BMP selection depends on the particular nature of the project or conditions. Land managers are encouraged to modify and develop their own invasive plant prevention checklists according to their specific needs.

Checklist A: Site Assessment, Field Mapping & Monitoring

This checklist is designed for those who perform site assessments, field mapping and monitoring.

Checklist B: Routine Vegetation Management

This checklist is designed for those who perform routine vegetation management.

Checklist C: New Project - Planning

This checklist is designed for those who perform planning tasks for new projects.

Checklist D: New Project - Implementation

This checklist is designed for those who perform pre-activity and implementation tasks for new projects. Some of these tasks include pre-work training, scheduling and revegetation and landscaping.

Checklist E: Inspection & Cleaning

This checklist is designed for use before entering and leaving worksites and should be used when acquiring inspection and cleaning equipment.

Key to BMP Chapter Acronymns

- CB – Clothing, Boots and Gear Cleaning BMPs, Chapter 5, page 23
- FM – Fuel Management BMPS, Chapter 10.2, page 40
- FP – Fire Management Planning BMPs, Chapter 10.1, page 37
- FS – Fire Suppression BMPs, Chapter 10.3, page 44
- PF – Post-Fire Activity BMPs, Chapter 10.4, page 47
- PL – Planning, Chapter 1 , page 9
- PM – Project Materials, Chapter 2 , page 15
- RL – Revegetation and Landscaping, Chapter 9 , page 31
- SD – Soil Disturbance, Chapter 7 , page 27
- TE – Tools, Equipment and Vehicle Cleaning, Chapter 4 , page 21
- TR – Travel, Chapter 3 , page 19
- VM – Vegetation Management, Chapter 8 , page 29
- WD – Waste Disposal, Chapter 6, page 25

Checklist A: Site Assessment, Field Mapping & Monitoring

BMP #	Best Management Practice							Comments
		<i>Project Manager</i>	<i>Field Supervisor</i>	<i>Crew</i>	<i>Contractor</i>	<i>Completed</i>		
BEFORE YOU START								
Planning								
PL6	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
PL7	Review internal documentation and consult local groups and online resources for information on existing invasive plant infestations on and near worksite.							
PL8	Schedule activities to minimize potential for introduction and spread of invasive plants.							
PL9	Integrate cleaning BMPs into planning for land management activities.							
PL10c	Treat invasive plants at access roads and staging areas before using them.							
CB1	Plan to wear clothing, boots and gear that do not retain soil and plant material.							
Travel								
TR1	Plan travel to reduce the risk of invasive plant spread (avoid travel through infested areas, and travel from clean to infested worksites).							
TR2	Integrate cleaning activities into travel planning.							
Inspection & Cleaning								
TE1 & CB2	Designate cleaning areas for tools, equipment, vehicles, clothing, boots and gear.							
TE2 & TE3	Inspect and clean soil and plant materials from tools, equipment, and vehicles before entering the worksite.							
DURING								
Inspection & Cleaning								
TE2 & TE3	Inspect and clean soil and plant materials from tools, equipment, and vehicles before leaving the worksite.							
CB3	Clean clothing, footwear and gear before leaving the worksite.							
TE4	Clean livestock and support animals.							
Soil Disturbance								
SD1	Minimize soil disturbance.							

Checklist B: Routine Vegetation Management

BMP #	Best Management Practice							Comments
		<i>Project Manager</i>	<i>Field Supervisor</i>	<i>Crew</i>	<i>Contractor</i>	<i>Completed</i>		
BEFORE YOU START								
Planning								
PL6	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
PL7	Conduct a site assessment for invasive plant infestations before carrying out field activities.							
VM1	Schedule vegetation management activities to maximize the effectiveness of control efforts and minimize introduction and spread of invasive plants.							
PL9	Integrate cleaning BMPs into planning for land management activities.							
PL10c	Treat invasive plants at access roads and staging areas before using them.							
CB1	Plan to wear clothing, boots and gear that do not retain soil and plant material.							
Travel								
TR1	Plan travel to reduce the risk of invasive plant spread (avoid travel through infested areas, and travel from clean to infested worksites).							
TR2	Integrate cleaning activities into travel planning.							
Inspection & Cleaning								
TE1 & CB2	Designate cleaning areas for tools, equipment, vehicles, clothing, boots and gear.							
TE2 & TE3	Inspect and clean soil and plant materials from tools, equipment, and vehicles before entering the worksite.							
Waste Disposal								
WD1	Designate waste disposal areas for invasive plant materials.							

Checklist B: Routine Vegetation Management *(continued)*

BMP #	Best Management Practice							Comments
		<i>Project Manager</i>	<i>Field Supervisor</i>	<i>Crew</i>	<i>Contractor</i>	<i>Completed</i>		
DURING								
Inspection & Cleaning								
TE2 & TE3	Inspect and clean soil and plant materials from tools, equipment, and vehicles before leaving the worksite.							
CB3	Clean clothing, footwear and gear before leaving the worksite.							
TE4	Clean livestock and support animals.							
Vegetation Management								
VM2	Manage vegetation with methods favorable to desirable vegetation.							
VM3	Retain existing desirable vegetation and canopy.							
Soil Disturbance								
SD1	Minimize soil disturbance.							
SD2	Implement erosion control practices.							
Waste Disposal								
WD2	Render invasive plant material nonviable when keeping it on-site.							
WD3	When disposing of invasive plant material off-site, contain it during transport.							
Monitoring								
PL11	Monitor the site for invasive plants after land management activities.							

Checklist C: New Project - Planning

BMP #	Best Management Practice	Project Manager	Field Supervisor	Crew	Contractor	Completed	Comments
PL2	Include invasive plant risk evaluation as a component of initial project planning and environmental analysis.						
PL3	Integrate invasive plant prevention BMPs into design, construction, vegetation management and maintenance planning activities.						
PL4	Coordinate invasive plant prevention efforts with adjacent property owners and local agencies.						
PL5	Develop monitoring plans for BMP implementation and effectiveness.						
PL9	Integrate cleaning BMPs into planning for land management activities.						
PL11	Designate staff to monitor the worksite for invasive plants after land management activities.						
RL1	Develop revegetation and landscaping plans that optimize resistance to invasive plant establishment.						
PM1	Plan to use a weed-free source for project materials.						

Checklist D: New Project - Implementation

BMP #	Best Management Practice							Comments
		<i>Project Manager</i>	<i>Field Supervisor</i>	<i>Crew</i>	<i>Contractor</i>	<i>Completed</i>		
BEFORE YOU START								
Training & Scheduling								
PL6	Provide prevention training and appropriate invasive plant identification resources to staff and contractors prior to starting work.							
PL8	Schedule activities to minimize potential for introduction and spread of invasive plants.							
TR1	Plan travel routes to reduce the risk of invasive plant spread.							
TR2	Integrate cleaning activities into travel planning.							
Site Preparation								
PL7	Refer to site assessment for locations of invasive plant infestations before carrying out field activities.							
PL10a	Protect likely invasive plant introduction sites such as pull-outs, trailheads, campgrounds and parking lots by mulching, planting or paving.							
PL10c	Treat invasive plants at access roads and staging areas before using them.							
Project Materials								
PM1	Acquire weed-free project materials.							
PM2	Prevent invasive plant contamination of project materials during transport.							
RL2	Acquire plant materials locally. Verify that species used are not invasive.							
Inspection & Cleaning								
CB1	Select clothing, boots and gear that do not retain soil and plant material.							
TE1 & CB2	Designate cleaning areas for tools, equipment, vehicles, clothing, boots and gear.							
TE2 & TE3	Inspect and clean soil and plant materials from tools, equipment, and vehicles before entering the worksite.							
Waste Disposal								
WD1	Designate waste disposal areas for invasive plant materials.							

Checklist D: New Project - Implementation *(continued)*

BMP #	Best Management Practice						Comments
		Project Manager	Field Supervisor	Crew	Contractor	Completed	
DURING							
Inspection & Cleaning							
TE2 & TE3	Inspect and clean soil and plant materials from tools, equipment, and vehicles before leaving the worksite.						
TE4	Clean pack, grazing and support animals.						
CB3	Clean clothing, footwear and gear before leaving the worksite.						
Project Materials							
PM1	Use a weed-free source for project materials.						
PM2	Prevent invasive plant contamination of project materials when stockpiling and during transport.						
Vegetation Management							
VM2	Manage vegetation with methods favorable to desirable vegetation.						
VM3	Retain existing desirable vegetation and canopy.						
Soil Disturbance							
SD1	Minimize soil disturbance.						
SD2	Implement erosion control practices.						
SD3	Manage existing topsoil and duff material to reduce contamination by invasive plants.						
Revegetation & Landscaping							
RL3	Revegetate and/or mulch disturbed soils as soon as possible to reduce likelihood of invasive plant establishment.						
Waste Disposal							
WD2	Render invasive plant material nonviable when keeping it on-site.						
WD3	When disposing of invasive plant materials off-site, contain it during transport.						
Monitoring							
PL11	Monitor the site for invasive plants after land management activities.						

Checklist E: Inspection & Cleaning

Clothing and Gear:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Hats		
2. Hoods		
3. Collars and cuffs		
4. Clothing folds or flaps		
5. Ventilation openings		
6. Pockets		
7. Zippers		
8. Straps or Velcro grips		
9. Belts or buckles		
10. Buttons, fasteners, and rivets		
11. Laces or ties		
12. Gloves		
13. Pant cuffs		
14. Socks		

Boots or Shoes:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Shoelaces or ties		
2. Straps or Velcro grips		
3. Shoe tongues		
4. Treads		

Hand and Power Tools:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Chainsaw chain		
2. Hand saw blades		
3. Mower deck and blades		
4. Weed-eater blades		
5. Crevices on other tools		

Hand and Power Tools:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Chainsaw chain and body		
2. Hand saw blades		
3. Mower deck and blades		
4. Weed-eater blades and guard		
5. Crevices on all other tools		

Checklist E: Inspection & Cleaning *(continued)*

Vehicles and Large Equipment (including ATVs, OHVs, motorcycles and bikes):

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Truck bed		
2. Exhaust systems		
3. Vent openings		
4. Grills: Front and back		
5. Tray under radiator		
6. Top of transmission		
7. Stabilizer bar		
8. Shock absorber joint with axles		
9. Front and rear axles		
10. Top of front suspension units		
11. Wheel well/quarter panels		
12. Ledges under bumper (front and rear)		
13. Tire rims and treads		
14. Between rear wheel brake drums and the rim of the wheel		
15. At the bend in the fuel inlet tube		
16. Spare tire and mounting area		
17. Under the floor mat (inside cab)		
18. Under the seat (inside cab)		
19. Upholstery (inside cab)		
20. Beneath foot pedals (inside cab)		
21. Gear shift cover folds (inside cab)		

Livestock and Support Animals:

Check for soil, seeds, and plant material	Inspected	Cleaned
1. Underbelly		
2. Legs		
3. Hooves		
4. Coat or wool		
5. Ears		
6. Tack (saddles, blankets, panniers)		

General Resources

The following are websites that contain, and link to, significant amounts of information on invasive plant management.

California Invasive Plant Council

<http://www.cal-ipc.org>

This site provides a wide range of invasive plant information specific to California. Resources include prevention, invasive plant inventory, CalWeedMapper, invasive plant profiles with links to articles, publications, reports, and educational brochures.

California Department of Food and Agriculture Integrated Pest Control Branch

<http://www.cdfa.ca.gov/plant/ipc/index.html>

The Integrated Pest Control Branch conducts a wide range of pest management and eradication projects as part of the Division of Plant Health and Pest Prevention Services Pest Prevention Program. This site provides the Encycloweedia, noxious weeds and weed ratings, and the CalWeed Database.

Center for Invasive Plant Management

<http://www.weedcenter.org>

The Center for Invasive Plant Management (CIPM) is a hub for management information in the western U.S. Includes plant biology and management information; education information; and publications. CIPM also provides grants to weed projects in western states. Grant information is available at this site.

Invasive.org: Center for Invasive Species and Ecosystem Health

<http://www.invasive.org>

This site provides an easily accessible archive of high quality images of invasive and exotic species of North America with identifications, taxonomy and descriptions for use in educational applications.

Invasive Species Council of California

<http://www.iscc.ca.gov>

The Invasive Species Council of California provides general information on invasive species in California including animals, plants, insects, and plant and animal disease.

National Invasive Species Council

<http://www.invasivespecies.gov>

The National Invasive Species Council (NISC) was established by Executive Order (EO) 13112 to ensure that Federal programs and activities to prevent and control invasive species are coordinated, effective and efficient.

National Invasive Species Information Center

<http://www.invasivespeciesinfo.gov>

This site is a gateway to invasive species information; covering Federal, State, local and international sources. The information center is maintained by the U.S. Department of Agriculture's National Agricultural Library.

USDA Forest Service Invasive Species Program—Control and Management

<http://www.fs.fed.us/invasivespecies/controlmgmt/index.shtml>

This page provides links for more information on research, management planning, Forest Service activities, and pest-specific control and management.

Weed Research and Information Center

<http://wric.ucdavis.edu>

The University of California's Weed RIC provides control notes and photos for invasive plants as well as agricultural weeds.

Prevention Resources

A Builder and Contractor's Guide to Preventing the Introduction and Spread of Invasive Weeds

<http://ucanr.org/sites/csnce/files/57340.pdf>

El Dorado County's Invasive Weed Management Group provides an illustrated pamphlet with tips and considerations that contractors and landscapers can integrate into their general practice in order to stop unsightly and costly invasive plant infestations before they begin.

Hazard Analysis and Critical Control Point (HACCP) Planning for Natural Resource Pathways

<http://nctc.fws.gov/EC/Resources/pdf/HACCP%20Manual.pdf>

The HACCP plan is a structured process that assesses a natural resource management activity, identifies possible risks, and facilitates the removal or reduction of non-target (i.e. invasive) species. The five-step process records important elements of who, what, where, when, how and why of each activity to help manage target problems and improve best management practices.

Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species

<http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2010.pdf>

The U.S. Bureau of Reclamation has developed a set of procedures to address the transport of invasive species and pests through equipment movement. This manual provides guidance for inspecting and cleaning vehicles and large equipment.

Storm Water Quality Handbook: Project Planning and Design Guide

<http://www.dot.ca.gov/hq/oppd/stormwtr/ppdg/swdr2010/PPDG-July-2010-r2.pdf>

This handbook provides guidance on the process and procedures for evaluating project scope and site conditions to determine the need for and feasibility of incorporating BMPs into projects. The key objective of this guide is to provide the overall process for selecting and designing BMPs within the Caltrans planning and design processes and incorporating those BMPs into the appropriate documents.

USDA Forest Service. The Early Warning System for Forest Health Threats in the United States

http://www.fs.fed.us/foresthealth/publications/EWS_final_draft.pdf

This is a monitoring framework for early detection and response to environmental threats (e.g., insects, diseases, invasive species, and fire) to forest lands. The framework is based on the following steps: 1) identify potential threats, 2) detect actual threats, 3) assess impacts, and 4) respond.

USDA Forest Service—Dangerous Travelers: Controlling Invasive Plants along America's Roadsides (Video)

<http://www.fs.fed.us/invasivespecies/>

The video outlines the best management practices that road crews should be following in their day-to-day operations. This is the first in a series on "Best Management Practices for Invasive Species Prevention." Ordered on DVD by contacting: USDA Forest Service; San Dimas Technology and Development Center; 444 East Bonita Avenue; San Dimas, CA 91773; (909) 599-1267.

Fire and Fuel Management Resources

A Manual of California Vegetation, 2nd Edition

<http://www.cnps.org/cnps/vegetation/manual.php>

Sawyer, J.O., Keeler-Wolf, T., and Evens, J. 2009.

California Native Plant Society Press.

California Native Plant Society has adopted a definitive system for describing vegetation statewide. This standard vegetation classification has been accepted by state and federal agencies. The principal vegetation unit is called “Alliance” (or series), which is a floristically defined vegetation type identified by its dominant and/or characteristic species.

Emergency Stabilization/Burned Area Rehabilitation

<http://www.fws.gov/fire/ifcc/esr/home.htm>

DOI National Burned Area Emergency Stabilization and Rehabilitation Group provides policy, guidance, and reference materials on BAER, BAR and incident business management.

Fire Ecology by USGS Western Ecological Research Center (WERC)

<http://www.werc.usgs.gov/ResearchTopicPage.aspx?id=6>

To restore more normal fire dynamics to a particular region, managers need to know how fire has historically affected the local system, and how it functions today. Researchers at the (WERC) are making contributions to this effort through detailed studies of fire history and fire ecology in the Sierra Nevada forests, California shrublands, and Mojave and Sonoran deserts.

Fire in California’s Ecosystems

[http://www.ucpress.edu/book](http://www.ucpress.edu/book.php?isbn=9780520246058)

[php?isbn=9780520246058](http://www.ucpress.edu/book.php?isbn=9780520246058)

Sugihara, N.G., Van Wagtendonk, J.W., Fites-Kaufman, J., Shaffer, K., and Thode, A. Klinger, R.C. ML. Brooks, and Randall, J.M. (eds.) 2006. The University of California Press. Berkeley, California.

Written by many of the foremost authorities on the subject, this book synthesizes the knowledge of the science, ecology, and management of fire in California. It introduces the basics of fire ecology, including an historical overview of fire and vegetation in California; an exploration of the history and ecology of fire in each of California’s nine bioregions; an examination of fire management in California; and discussion on current issues related to fire policy and management.

USDA Forest Service’s Fire Effect Information System website (FEIS)

<http://www.fs.fed.us/database/feis/>

FEIS summarizes and synthesizes research about living organisms in the United States—their biology, ecology, and relationship to fire.

Wildland Fire Decision Support Systems (WFDSS)

https://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml

The US Geological Survey hosts a web-based decision support system that assists fire managers and analysts in making strategic and tactical decisions for fire incidents and provides a record of these decisions.

Glossary

Ankle-gaiters: a protective covering for the lower leg and ankle designed to prevent snow, mud, gravel, or seeds from entering the top of the boot. Gaiters can also prevent seeds from adhering to pants, socks, boots and laces.

Best management practices: methods or techniques found to be the most effective and practical in achieving an objective, such as preventing or minimizing invasive plant spread, while making the optimum use of resources.

Burned Area Emergency Response (BAER): an emergency risk management action taken within one year of wildfire containment to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of a fire, or to repair/replace/construct physical improvements necessary to prevent degradation of land or resources. BAER should be a part of all Fire Management Plans. It should cover acceptable methods, techniques, and materials to stabilize and rehabilitate soils, native vegetation, and prevention of further damage.

Burned Area Rehabilitation (BAR): efforts undertaken within three years of wildfire containment to repair or improve fire-damaged lands unlikely to recover naturally to management approved conditions, or to repair or replace minor facilities damaged by fire. The process concludes with long-term restoration.

CEQA: California Environmental Quality Act. A statute passed in 1970 to institute a statewide policy of environmental protection. <http://ceres.ca.gov/ceqa>

Clean: not contaminated with viable invasive plant propagules.

Contaminated: contains viable invasive plant propagules.

Control line: an inclusive term for all constructed or natural barriers used to control a fire.

Critical control point: the best point, step, or procedure at which significant hazards can be prevented or reduced to minimum risk. Source: USFWS-NCTC. 2004. Hazard Analysis and Critical Control Point (HACCP) Planning for Natural Resource Pathways.

Delegation of Authority: an instrument signed by both the Incident Commander and Agency Administrator which identifies the acceptable methods of fire suppression and rehabilitation, notes any specific concerns (such as prevention of invasive plant spread), and names an Agency Representative that will speak for the Agency regarding resource matters.

Desiccate: to kill a plant by drying it thoroughly.

Disturbance: any activity leading to increased sunlight and bare ground, conditions that can be suitable for invasive plant introduction.

Duff: partially decomposed organic matter lying beneath the litter layer and above the mineral soil. It includes the humus and fermentation layers of the forest floor.

Early detection and rapid response (EDRR): a cost-effective approach to invasive plant management that aims to detect newly established invasive plant infestations early and to remove them before they spread.

Environmental stewardship: responsible use and protection of the natural environment through conservation and sustainable practices.

Equipment: machinery such as mowers and bulldozers used during land management activities.

Eradicate: the complete elimination of an invasive plant population, including all viable propagules.

Field Observer (FOBS): this Incident Command System position is responsible for collecting and reporting situation information for an incident

through personal observations and interviews and reports to the Situation Unit Leader.

Fire activity areas: an inclusive term for areas used for fire suppression activities, which include incident areas, Incident Base Camp, staging areas, fire crew camps, spike camps, helibases, drop points, parking areas, etc.

Fire frequency: the recurrence of fire in a given area over time, stated as number of fires per unit time.

Fire line: A line to break up fire fuels. Also known as a control line, a fire line is scraped or dug, by hand or mechanically, into mineral soil.

Fire Management Plan (FMP): a plan which identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. It defines a program to manage wildland fires (wildfire, prescribed fire, and wildland fire use). The plan is supplemented by operational plans, including but not limited to preparedness plans, preplanned dispatch plans, and prevention plans. Fire Management Plans assure that wildland fire management goals and components are coordinated.

Fire Management Unit (FMU): a land management area definable by objectives, management constraints, topographic features, access, values to be protected, political boundaries, fuel types, major fire regime groups, etc., that set it apart from the characteristics of an adjacent FMU. The FMU may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

Fire regime: characteristic pattern of burning over large expanses of space and long periods of time. Fire regimes are described for a specific geographic area or vegetation type by the characteristic fire type (ground, surface, or crown fire), frequency, intensity, severity, size, spatial complexity, and seasonality.

Fire suppression: all work and activities connected with fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fuel break: a generally wide (60 to 1000ft. or 18 to 305m) strip of land on which native vegetation has been permanently modified so that a fire burning into it can be more readily controlled.

Fuel treatment: manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning).

Fuel zone: a defined area within which fuels are managed to influence fire behavior and/or fire regimes.

Fuel: living and dead vegetation that can be ignited.

Hand line: fire line constructed with hand tools.

Impact: the cumulative effect, economic and ecological, of an invasive plant population on natural resources.

Incident Action Plan (IAP): contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written. When written, the plan may have a number of attachments, including: incident objectives, organization assignment list, division assignment, incident radio communication plan, medical plan, traffic plan, safety plan, and incident map. Formerly called shift plan.

Incident Base Camp: location at the incident where the primary logistics functions are coordinated and administered. (Incident name or other designator will be added to the term Base.) The incident command post may be collocated with the base. There is only one Base per incident.

Incident Commander: this Incident Command System position is responsible for overall management of the incident and reports to the agency administrator for the agency having incident jurisdiction. This position may have one or more deputies assigned from the same agency or from an assisting agency(s).

Incident Management Team: the incident commander and appropriate general and command staff personnel assigned to an incident.

Indirect attack: A method of suppression in which the control line is located at some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks, fuel breaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions.

Indirect fire line: fire line built for implementing indirect attack during fire suppression.

Infested: populated by invasive plants.

Invasive plants: non-native plants that cause economic or ecological harm. Used interchangeably with "weeds".

Land management plan: a document prepared with public participation and approved by an agency administrator that provides general guidance and direction for land and resource management activities for an administrative area. The plan identifies the need for fire's role in a particular area and for a specific benefit. The objectives in the plan provide the basis for the development of fire management objectives and the fire management program in the designated area.

Land manager: a person who manages public or private land.

Management unit: see Fire Management Unit (FMU).

Minimum Impact Suppression Tactics (MIST): the concept of using actions with a minimum amount of impact to effectively achieve the fire management protection objectives consistent with land and resource management objectives.

Monitoring: evaluating the success of prevention measures and management actions; including regular inspection of worksites to detect change, in this case the presence or absence of invasive plants.

Native plants: plants that evolved in a particular region. Plants that evolved without human intervention in a particular region, such as a California bioregion or watershed. These are usually species that occurred naturally before European colonization of North America.

NEPA: National Environmental Policy Act. A national law that established a U.S. national policy promoting the enhancement of the environment. <http://ceq.hss.doe.gov>

Nonviable: when a plant propagule is not able to produce a new plant.

Pathways: processes through which invasive plants can be introduced or spread.

Prescribed fire: a fire ignited on purpose, with planned oversight and specific management goals. The fire is applied to fuels in specified environmental conditions that allow the fire to be confined to a predetermined area and, at the same time, to produce fire behavior that will attain the planned management objectives.

Project materials: materials that soil and invasive plant parts and seeds can adhere to. These materials include soil, mulch (woody and straw), aggregate (sand and gravel), wood products (firewood and brush), landscape material (plants and seed), erosion control materials (silt fence, straw bales, straw wattles, geotextiles, and rip rap), pack animal feed, and packing/shipping materials.

Propagule: plant reproductive material, such as seeds, rhizomes or stolons.

Pulaski: a hand tool used in wildland fire suppression for construction firebreaks. The tool combines an axe and an adze in one head, and it can be used to both dig soil and chop wood.

Resource Advisor: personnel primarily responsible for identifying and evaluating potential impacts and benefits of fire operations (wildfire or prescribed fire) on natural and cultural resources. The Resource Advisor anticipates impacts on resources as suppression or prescribed fire operations evolve; communicates requirements for resource protection to the Incident Commander (IC) or Incident Management Team (IMT); ensures that planned mitigation measures are carried out effectively; and provides input in the development of short- and long-term natural resource and cultural rehabilitation plans.

Retardants: any substance except plain water that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

Scout: the act of searching for, locating, and documenting invasive plants on a worksite.

Seed set: the plant reproductive stage during which seeds mature.

Site assessment: the act of scouting for invasive plant species found within the worksite, including documentation of exact locations and densities of invasive plants, and determining priority areas for implementing prevention BMPs

Slash: debris resulting from such natural events as wind, fire, or snow breakage, or such human activities as road construction, logging, pruning, thinning, or brush cutting. Slash includes logs, chunks, bark, branches, stumps, and broken understory trees or brush.

Source populations: infestations of invasive plants which produce seed or other reproductive plant parts that can spread to new areas.

Spike camp: remote camp usually near a fire line, and lacking the logistical support that a larger fire camp would have.

Staging areas: locations where tools, equipment and vehicles are assembled before and during projects.

Sterile: not able to reproduce.

Support animals: dogs that provide hearing or seeing assistance.

Suppression: all the work of extinguishing a fire or confining fire spread.

Target conditions: land or resource conditions that are expected to result if goals and objectives are fully achieved.

Tools: implements used during land management activities, such as shovels and chainsaws.

Transitional pastures: designated areas where grazing animals can graze before and after being used for vegetation management.

Vectors: people or things that can carry invasive plants or their propagules from one place to another inadvertently.

Vehicle: cars, trucks, and all terrain vehicles used during land management activities.

Viable: when a propagule is able to produce a new plant.

Waste-disposal areas: locations where waste can be disposed without the risk of spreading invasive plant materials.

Water sources: natural and man-made water bodies. Water sources do not include equipment.

Weed-free forage: hay, oats, and other feed for pack and grazing animals from a clean source (not contaminated with viable invasive plant propagules).

Weed-free materials: project materials from a clean source (not contaminated with viable invasive plant propagules).

Weeds: used interchangeably with “invasive plants” (non-native plants that cause economic or ecological harm). Not all weeds are considered invasive plants, but for the purpose of this document the two terms are used interchangeably.

Wildfire: a wildland fire whose ignition is unplanned, such as a fire caused by lightning, volcanoes, unauthorized and accidental human-caused fires, and escaped prescribed fires.

Wildland Fire Decision Support Systems (WFDSS): a web-based decision support system that assists fire managers and analysts in making strategic and tactical decisions for fire incidents and provides a record of these decisions.

Wildland Fire: a general term describing any non-structure fire that occurs in wildlands. Wildland fires include wildfires and prescribe fires.

Wildland Urban Interface (WUI): the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildlands.

Worksites: locations or properties where land management activities occur.

Definitions of fire and fuel management terms in this glossary are adapted from the following references:

- Guidance from Implementation of Federal Wildland Fire Management Policy http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf
- National Wildfire Coordination Group website <http://www.nwccg.gov/pms/pubs/glossary/index.htm>
- The Bureau of Land Management Fire Management Glossary website <http://www.blm.gov/wy/st/en/programs/Fire/glossary.2.html>

References

The following documents were used as a basis for this manual. You may find additional information of interest in these references.

- Adirondack Park Agency. **Best management practices for controlling invasive plants in the Adirondacks.** 2006. Adirondack Park Agency. Available: <http://www.adkinvasives.com/terrestrial/Ecology/documents/BMPsGeneral2006.doc>
- Athan, Tara. **Minimizing the Dispersal of Weed Propagules in Materials Best Management Practices -Draft.** 2008. Inland Mendocino Cooperative Weed Management Area. Mendocino, CA. Available: <http://www.alt2is.com/imcwma/joomla/>
- Athan, Tara. **Minimizing the Dispersal of Weed Propagules in Material Best Management Practices – Draft.** 2009. Inland Mendocino Cooperative Weed Management Area. Mendocino, California. Available: http://www.alt2is.com/imcwma/joomla/component/option,com_docman/task,cat_view/gid,46/Itemid,70/lang,en/
- Australian Weeds Committee. 2004. **Weeds of National Significance. Chapter 2: Managing Mimosa.** Available: <http://www.weeds.org.au/WoNS/mimosa/>
- Bell, C. and Lehman, D. 2005. **Weed Prevention and Management Guidelines for Public Lands.** Ellen Mackey, editor. Los Angeles Weed Management Area. Los Angeles, CA. Available: <http://acwm.co.la.ca.us/pdf/WeedBMPres.pdf>
- Blonski K., Miller C., and Rice C.L. 2010. **Manage Fire in the Urban Wildland Interface.** Solano Press Books. Point Arena, California.
- Brooks, M. and Lusk, M. 2008. **Fire Management and Invasive Plants: A Handbook.** U.S. Fish and Wildlife Service. Arlington, VA. Available: http://www.fws.gov/invasives/pdfs/USFWS_FireMgtAndInvasivesPlants_A_Handbook.pdf
- Bureau of Land Management. 1991. Record of Decision, Noxious Weed Management. Amendment to Lolo National Forest Plan. **Appendix 4: Proto-type Weed Prevention Measures.** BLM, Colorado. Available: http://www.blm.gov/co/st/en/BLM_Programs/botany/lolostip.html
- Bureau of Land Management. 2008. **Weed Prevention and Management Guidelines for Public Lands.** Bureau of Land Management, California. Available: <http://www.blm.gov/ca/st/en/prog/weeds/weedprevent.print.htm>
- California Department of Transportation. 2003. **Caltrans Stormwater Quality Handbook Maintenance Staff Guide.** California Department of Transportation. Sacramento, CA. Available: http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/pdfs/management_ar_rwp/CTSW-RT-02-057.pdf
- California Department of Transportation. 2006. **Caltrans Landscape Manual, Chapter E Landscape.** California Department of Transportation. Sacramento, CA. Available: <http://www.dot.ca.gov/hq/maint/manual/ChE.pdf>
- Clark, J. 2003. **Invasive Plant Prevention Guidelines.** Center for Invasive Plant Management. Bozeman, Montana. Available: http://www.weedcenter.org/store/docs/CIPM_prevention.pdf
- Diablo Firesafe Council. 2009. **Best Management Practices Guidebook for Hazardous Fuel Treatments in Contra Costa County.** Available: http://www.diablofiresafe.org/pdf/BMP_Chp1.pdf

- DiVittorio, J., Grodowitz, M., Jeffers, L. and Whitaker, S. 2010. **Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species.** Bureau of Reclamation. Denver, Colorado. Available: <http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2010.pdf>
- Duncan, C.A., Brown, M.L. 2006. **Statewide Roadside Vegetation Management Plan-Integrated Weed Management Component.** Montana Department of Transportation. Helena, MT. Available: http://www.mdt.mt.gov/publications/docs/manuals/weed_mgmt_plan.pdf
- Evans, C., Moorhead, D., Barger, C. and Douce, G. 2006. **Invasive Plant Responses to Silvicultural Practices in the South.** The University of Georgia Bugwood Network. Tifton, GA. Available: <http://www.invasive.org/silvicsforinvasives.pdf>
- Ferguson, L., Duncan, C., and Snodgrass, K. 2003. **USDA Forest Service Backcountry Road Maintenance and Weed Management.** Technology and Development Program, USDA Forest Service. Missoula, MT. Available: <http://www.fs.fed.us/invasivespecies/documents/BackcountryRdMtceWeed.pdf>
- Fleming, J. 2005. **Vehicle Cleaning Technology for Controlling the Spread of Noxious Weeds and Invasive Species.** San Dimas Technology & Development Center, USDA Forest Service. Available: <http://www.fs.fed.us/eng/pubs/pdf/05511203.pdf>
- Frazier, J. and Grant, S. 2002. **The BAER Facts.** USDA Forest Service. Stanislaus National Forest. Available: <http://www.fws.gov/fire/ifcc/esr/Library/USFS%20The%20BAER%20Facts.pdf>
- Interagency Burned Area Rehabilitation Guidebook, Version 1.3.** 2006. Available: http://www.fws.gov/fire/ifcc/esr/Policy/BAR_Guidebook11-06.pdf
- Johnson, A. 2008. **2008-20 Best Practices Handbook for Roadside Vegetation Management.** Minnesota Department of Transportation Office of Research Services. St. Paul, MN. Available: <http://www.lrrb.org/pdf/200820.pdf>
- Jolly, D.F. 1993. **Minimum Impact Suppression Tactics (MIST).** Excerpt from USDA Forest Service Northern Region Minimum Impact Tactics Guidelines –Fireline Handbook. Missoula, Montana. Available: http://www.blm.gov/pgdata/etc/medialib/blm/mt/blm_programs/fire/mifo.Par.53312.File.dat/Appendix1.pdf
- Long Island Weed Management Area. 2005. **Best Management Practices for Land Managers.** Long Island Weed Management Area. Cold Spring Harbor, NY. Available: <http://www.invasive.org/gist/products/wma/li-managers.pdf>
- Martin, K. 2009. **Yosemite National Park Annual Fire Management Plan.** Yosemite National Park Service. Available: <http://www.nps.gov/yose/parkmgmt/upload/2009.fire.op.doc.pdf>
- Massachusetts Aquatic Invasive Species Working Group and the Massachusetts Association of Conservation Commissions. 2006. **Introductions of Invasive Species through Construction and Development Activities: The Role of Local Agents in Stopping the Spread.** Available: http://www.maccweb.org/documents/development_fact_sheet.doc
- Massachusetts Association of Conservation Commissions. 2006. **Standard Conditions for Wetlands Orders to Prevent the Introduction of Invasive Plant Species on Construction Sites.** Available: http://www.maccweb.org/documents/Standard_Conditions.doc
- McKenzie, D., Falk, D.A., and Miller, Ca. (eds.) 2011. **The Landscape Ecology of Fire (Ecological Studies).** Springer Science + Business Media.
- Merriam, K.E., Keeley, J.E., and Beyers, J. 2007. **The Role of Fuel Breaks in the Invasion of Nonnative Plants: US Geological Survey Scientific Investigation Report.** The US Department

of the Interior and US Geological Survey.
Available: http://pubs.usgs.gov/sir/2006/5185/pdf/sir_2006-5185.pdf

National Park Service. **Draft Pacific West Region Weed Management Prevention in Parks Best Management Practices (Master List).**

New Hampshire Department of Transportation. 2008. **Best Management Practices for Roadside Invasive Plants.** Available: <http://www.nh.gov/dot/org/projectdevelopment/environment/documents/BMPsforRoadsideInvasivePlants.pdf>

Newman, J., Stringer, J. and Townsend, L. 2007. **Manual for Forest Pest Control (Category 2).** Pesticide Safety Education Program of the UK College of Agriculture. Available: <http://pest.ca.uky.edu/PSEP/Manuals/cat%202%20manual.pdf>

New York State Department of Transportation. 2004. **Environmental Procedures Manual.** Chapter 4.8 - Invasive Species. Albany, NY. Available: <https://www.dot.ny.gov/divisions/engineering/environmental-analysis/manuals-and-guidance/epm/repository/4-8invas.pdf>

North American Weed Management Association. **Gravel Pit Inspection Standards.** Available: <http://www.nawma.org/WeedFree.html>

Perron, C. 2008. **Best Management Practices for Roadside Invasive Plants.** New Hampshire Department of Transportation. Available: <http://www.nh.gov/dot/bureaus/environment/documents.htm>

Riverside County Environmental Programs Department. **Western Riverside County Multiple Species Habitat Conservation Plan.** Available: <http://www.tlma.co.riverside.ca.us/mshcp/volume1/index.html>

Sawyer, J.O., Keeler-Wolf, T., and Evens, J. 2009. **A Manual of California Vegetation, 2nd Edition.** <http://www.cnps.org/cnps/vegetation/manual.php>

Siegel, S. and Donaldson, S. **Measures to Prevent the Spread of Noxious and Invasive Weeds During Construction Activities.** University of Nevada Cooperative Extension. Reno, NV. Available: <http://www.unce.unr.edu/publications/files/nr/2003/FS0359.pdf>

Sugihara, N.G., Van Wagtendonk, J.W., Fites-Kaufman, J., Shaffer, K., and Thode, A. Klinger, R.C. ML. Brooks, and Randall, J.M. (eds.) 2006. **Fire in California's Ecosystems.** The University of California Press. Berkeley, California.

Transportation Research Board of the National Academies. 2006. **NCHRP Synthesis 363 – Control of Invasive Species, a Synthesis of Highway Practice.** Washington, D.C. Available: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_363.pdf

U.S. Bureau of Reclamation. 2010. **Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species.** Available: <http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2010.pdf>

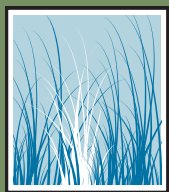
USDA Forest Service. 1992. **Wallowa-Whitman National Forest Weed Prevention Practices and Analysis Guidelines.** Available: <http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/Forest-BMPs/waw-weed-prevention-practices.pdf>

USDA Forest Service. 1999. **Colville National Forest Weed Prevention Guidelines.** USDA FS Memo 2080. Available: <http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/Forest-BMPs/col-table-noxious-weed-prev-final.pdf>

USDA Forest Service. 2001. **USDA Guide to Noxious Weed Prevention Practices.** Version 1.0. Available: <http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/Forest-BMPs/2001-Weed-Prevention-Practices-Manual.pdf>

USDA Forest Service. 2002. **Okanogan and Wenatchee National Forests Weed Management and Prevention Strategy and Best Management Practices.** Version 1.0. Available: <http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/Forest-BMPs/oka-wen-prevent-6-2002-finalver1.pdf>

- USDA Forest Service. 2005. **Fremont-Winema National Forests Invasive Species Prevention Practices.** Available: <http://www.fs.fed.us>
- USDA Forest Service. 2005. **Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision.** Oakland, CA. Available: <http://www.fs.fed.us/r6/invasiveplant-eis/FEIS/ROD/ROD-R6-NR-FHP-PR-02-05.pdf>
- USDA Forest Service. **Dangerous Travelers: Controlling Invasive Plants along America's Roadsides (Video).** Available: <http://www.fs.fed.us/invasivespecies/>
The video can also be ordered on DVD by contacting: USDA Forest Service; San Dimas Technology and Development Center; 444 East Bonita Avenue; San Dimas, CA 91773; (909) 599-1267.
- U.S. Department of Transportation Federal Highway Administration. 2001. **"The Problem with Invasive Plant Species."** Greener Roadsides. Washington, D.C. Available: <http://www.fhwa.dot.gov/environment/greenerroadsides/fal01p1.htm>
- West, W. University of California Cooperative Extension. **A Builder and Contractor's Guide to Preventing the Introduction and Spread of Invasive Weeds.** El Dorado County Invasive Weed Management Group. El Dorado, CA. Available: <http://ucanr.org/sites/csnce/files/57340.pdf>
- West, W. University of California Cooperative Extension. **A Landowner's Guide to Preventing the Introduction and Spread of Invasive Weeds.** El Dorado County Invasive Weed Management Group. El Dorado, CA. Available: <http://ucanr.org/sites/csnce/files/57339.pdf>
- Wildland Fire Leadership Council. 2009. **Guidance for Implementation of Federal Wildland Fire Management Policy.** Available: http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf
- Wisconsin Forestry Invasives Leadership Team. 2009. **Best Management Practices for Invasive Species: A Field Manual for Foresters, Landowners and Loggers.** Wisconsin Council on Forestry. Available: <http://council.wisconsinforestry.org/invasives/transportation/>
- Wisconsin Forestry Invasives Leadership Team. 2009. **Best Management Practices for Preventing the Spread of Invasive Species by Outdoor Recreation Activities in Wisconsin.** Wisconsin Council on Forestry. Available: <http://council.wisconsinforestry.org/invasives/recreation.php>
- Wisconsin Forestry Invasives Leadership Team. 2009. **Wisconsin's Urban Forestry Best Management Practices for Preventing the Introduction and Spread of Invasive Species.** Wisconsin Council on Forestry. Available: <http://council.wisconsinforestry.org/invasives/urban/>
- Wisconsin Forestry Invasives Leadership Team. 2010. **Invasive Species Best Management Practices for Transportation and Utility Rights-of-Way.** Wisconsin Council on Forestry. Available: <http://council.wisconsinforestry.org/invasives/transportation/>
- Yosemite National Park Resources Management and Science. 2010. **Yosemite National Park Weed-Free Gravel Program: Program Overview.** National Park Service. Available: http://www.cal-ipc.org/symposia/archive/pdf/2010/notes_YosemiteWeedFreeGravelProgram.pdf
- Young, S., Claassen V. 2007. **Vegetation Control and Maintenance Along Roadsides: Study II Final Report.** California Department of Transportation. Sacramento, CA. Available: http://www.dot.ca.gov/hq/LandArch/research/docs/Veg_Conversion_Final_Report.pdf
- Zouhar, K., Smith, J., Sutherland, S., and Brooks, M.L. 2008. **Wildland Fire in Ecosystems: Fire and Nonnative Invasive Plants.** USDA Forest Service. Available: http://www.fs.fed.us/rm/pubs/rmrs_gtr042_6.pdf



CaI-IPC