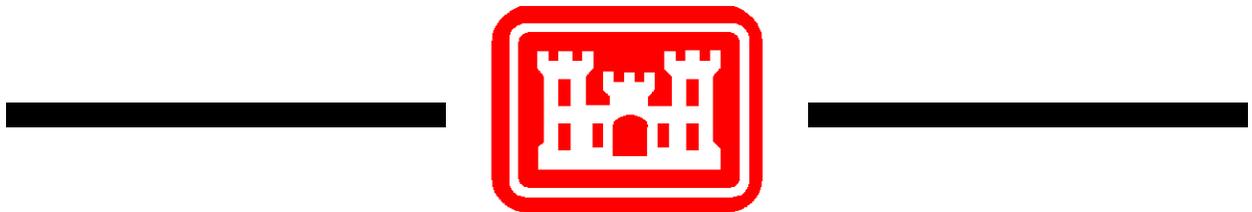


PUBLIC WORKS TECHNICAL BULLETIN 200-1-89
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**INTEGRATING NEPA ANALYSIS INTO ARMY
NON-NATIVE INVASIVE PLANT MANAGEMENT**



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INTEGRATING NEPA ANALYSIS INTO ARMY NON-
NATIVE INVASIVE PLANT MANAGEMENT

1. Purpose. This Public Works Technical Bulletin (PWTB) demonstrates ways for Army personnel to incorporate National Environmental Policy Act (NEPA) analysis into both Integrated Pest Management Plans (IPMPs) and non-native invasive plant species (NIS) Management Plans. As detailed components of installation Integrated Natural Resource Management Plans (INRMP), IPMPs are the most efficient means of integrating NIS management with the installation's other natural resource programs. The information provided will help installation personnel avoid pitfalls and errors potentially associated with meeting NEPA requirements related to NIS management.

a. Specifically, this PWTB strives to facilitate planning-level environmental assessment by providing much-needed guidance for strategic integration of NEPA analysis into NIS management plans and decisions.

b. This PWTB also focuses on developing a multi-criteria decision analysis (MCDA) framework to aid environmental assessment and integrated NIS planning. General recommendations and specific examples of approaches useful for technical experts are presented. However, rather than provide an exhaustive treatment of every potentially relevant aspect of NEPA and MCDA, the intent is to present sufficient information to stimulate greater consideration of the necessity and benefits of incorporating NEPA into early phases of NIS management planning.

c. All PWTBs are available electronically in Adobe® Acrobat® portable document format [PDF]) through the World Wide Web (WWW) at the National Institute of Building Sciences' Whole Building Design Guide (WBDG) Web page, which is accessible at the following link:

http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215

2. Applicability. This PWTB applies to all U.S. Army facilities within the continental United States, and all Corps of Engineers managed lands.

3. References.

a. National Environmental Policy Act of 1969 (NEPA) as amended (U.S. Code Title 42, sec. 4321 [42 USC 4321]).

b. Federal Noxious Weed Act of 1974 as amended (7 U.S.C. 2809).

c. Endangered Species Act, (Public Law [PL] 93-205 as amended, 16 U.S.C. 1531-1544).

d. Pollution Prevention Act of 1990 (PL 101-508).

e. Executive Order (EO) 13112, "Invasive Species," Federal Register, Vol. 64(25): 6183, 8 February 1999.

f. Army Memorandum, Army Policy Guidance for Management and Control of Invasive Species, Assistant Chief of Staff for Installation Management (DA-ACSIM), 26 June 2001.

g. Army Regulation (AR) 200-1, "Environmental Protection and Enhancement," 28 August 2007.

h. Code of Federal Regulations (CFR), Vol. 32, Chapter V, Part 651 "Environmental Analysis of Army Actions; Final Rule," 29 March 2002. This Final Rule is a revision of policy and procedures for implementing (NEPA) and Council on Environmental Quality regulations. It supersedes the guidance previously found in AR 200-2.

4. Discussion.

a. In 2001, the Department of Army - Assistant Chief of Staff for Installation Management (DA-ACSIM) issued policy guidance for the management and control of invasive species. This guidance summarizes Army requirements for compliance with

EO 13112, which outlines federal agency duties to prevent the introduction of invasive species, to provide for their control, and to minimize their possible impact. The DA-ACSIM policy guidance requires installations to:

i. budget funds to effectively plan and execute invasive species management on installations;

ii. manage invasive species within the context of the goals and objectives of their INRMP;

iii. monitor invasive species populations to determine when control measures are necessary and to evaluate the effectiveness of prevention, control, and restoration measures;

iv. give priority to invasive species management actions that restore native species habitat in ecosystems that have been invaded, support the installations primary military mission and/or contribute to the protection of federally listed threatened and endangered species and critical habitat;

v. ensure that invasive species do not detract from the usefulness of military training and testing lands; and

vi. implement management actions only after appropriate review under NEPA as implemented by 32 CFR 651 (2002, see item h above).

b. In general, comprehensive strategies for NIS management depend on a multi-pronged approach that includes prevention, early detection, control, monitoring, assessment, and education. NIS control is arguably the most challenging prong because it typically requires the greatest monetary investment, suffers the greatest setback from poor choices, demands the greatest coordination among multiple stakeholders, and necessitates environmental analysis under NEPA.

c. This document addresses the highly important but under-emphasized process of strategic, planning-level, NEPA review of NIS management actions. In this overview, environmental analysis of both the potential risks of adverse effects and the anticipated benefits of NIS management actions is advocated. Additionally, broadly focusing the environmental assessment on specific treatment types and site conditions under which the treatments will be applied can eliminate the need for individual case-by-case analyses. This approach is not trivial and is best conducted via a formalized, objective, transparent decision-making process. To date, neither guidance nor general discussion

of NEPA documentation for NIS management actions are widely available to Army or other public land managers.

d. NEPA review of NIS management alternatives can be aided by MCDA. MCDA is defined as an evaluation based on multiple criteria that are quantifiable indicators of the degree to which decision objectives are realized. MCDA is intended to provide a rational way to help decision-makers solve complex problems objectively. It is ideal for environmental analysis of NIS management alternatives because it can provide a framework in which to consider multiple spatial datasets that characterize local site conditions across a landscape and evaluate risk of impact to environmental resources. It also presents an ideal opportunity for Army installations to integrate NIS management planning with other natural resources management planning, a requirement of AR 200-1.

e. The cost relative to the benefit of applying a planning-level environmental analysis for NIS treatment alternatives (similar to the one described in this document) depends on the complexity of the NIS management issues on a given installation and the availability of data to support the analysis. However, the cost of developing NEPA documentation in a form that supports long-term and adaptive NIS management will most likely be far less expensive than numerous, spatially and temporally constrained, case-by-case, environmental analyses.

f. Appendix A contains a detailed approach for facilitating planning level environmental analysis of NIS management actions. Strategic integration of NEPA analysis into NIS management planning and decision making can influence plan development, reduce the risk of costly delays, and support long-term and adaptive management. Rather than provide an exhaustive treatment of every potentially relevant aspect of NEPA and MCDA, the intent is to present sufficient information to stimulate greater consideration of the necessity and benefits of incorporating NEPA into early phases of NIS management planning.

g. Appendix B lists literature cited in Appendix A.

h. Appendix C contains an informal survey distributed to Army installations to gather information about the extent and type of NEPA documentation prepared for NIS management actions.

i. Appendix D contains acronyms and abbreviations used throughout this PWTB.

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j. Peter Frank of Invasive Species Management, Inc. and Manroop Chawla of U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) provided invaluable assistance in developing this document.

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APPENDIX A

INTEGRATING NEPA ANALYSIS INTO ARMY NON-NATIVE INVASIVE PLANT MANAGEMENT DECISION MAKING

Introduction

Non-native invasive plant species (NIS) pose difficult challenges for integrated military and natural resources management on Army installations. Either directly or indirectly, NIS have the potential to negatively impact military operations, reduce military carrying capacity, and compromise long-term sustainability of training lands. NIS are known to increase wildfire risk, disrupt line-of-sight on training ranges, and reduce accessibility to training sites on multiple Army installations. NIS also can adversely affect natural resources in numerous ways, including impacts to threatened and endangered species (TES), wildlife habitat, and recreational, agricultural, forestry, and traditional Native American uses of Army lands. Furthermore, NIS can impact installation infrastructure by damaging power lines, disrupting drainage, and contributing to the destruction or deterioration of buildings. Boundary security also can be impacted when large infestations obscure sight lines for security personnel, or boundary fences lose their integrity.

These current or potential impacts have prompted Army natural resource managers to actively manage NIS populations. Numerous methods and tools are employed to combat the impacts of NIS. Mechanical methods like mowing, hand-pulling, chain saws, and brush hogs are commonly used. Herbicides are applied to isolated infestations with backpack or handheld sprayers, and to larger infestations with applicators mounted on trucks or all-terrain vehicles (ATVs) and, in some cases, airplanes. Biological controls are less widely used due to limited availability, but have the potential to provide effective and affordable suppression of NIS that are otherwise too abundant and widespread to control. The success of these management efforts is vital to the Army's numerous land management missions.

In certain situations, NIS control methods can cause significant harm to the environment or to human health. When this is a possibility, National Environmental Policy Act (NEPA) documentation may be required to implement a NIS control method. However, guidance does not exist to inform Army NIS managers when and how NEPA should be considered when implementing these control methods. The understanding and consideration of NEPA for

NIS management varies widely from installation to installation, with some installations providing thorough NEPA review prior to implementing NIS management, and others never considering NEPA; thus, when NEPA review of NIS management is performed, the scale, scope, and type of that review varies.

Inadequate consideration of NEPA can allow actions to proceed that may have serious effects on the environment or may cause delays to NIS management programs. Interruptions in the implementation of NIS management programs can exacerbate the many impacts NIS pose and increase the overall cost of controlling NIS. This PWTB provides background to NEPA and NIS management and proposes a method to effectively consider NEPA early in the NIS management planning phase and to support long-term NIS management programs that prevent or mitigate impacts to the environment and human health.

NEPA Background

Signed into law on 1 January 1970, NEPA promotes and enforces the consideration of environmental values in the actions of federal agencies. The intent of NEPA is to protect a sustainable environment, while balancing the needs of present and future generations. NEPA specifically mandates that federal agencies consider the potential environmental consequences of their proposed actions within their decision-making processes. The decision-making process should consider reasonable alternatives to the proposed actions and document the analysis used to make the decision. NEPA Section 101(a) states the following:

It is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

There are three levels of NEPA analysis: (1) Categorical Exclusion (CX); (2) Environmental Assessment/Finding of No Significant Impact (EA/FONSI); or (3) Environmental Impact Statement/Record of Decision (EIS/ROD). Determination of the appropriate level of NEPA analysis is provided in 32 CFR 651.12, "Determining Appropriate Level of NEPA Analysis." The level of

analysis required depends on the extent to which the proposed action has the potential to affect the environment. A detailed explanation of analysis levels is given here.

Categorical Exclusion allows the proposed action to proceed without a detailed environmental analysis. The proposed action must meet certain criteria in that a federal agency has previously determined that the action has no significant environmental impact. The Army has developed a list of general activities that are normally categorically excluded (32 CFR 651.29). None of the activities in 32 CFR 651.29 directly mentions NIS management activities. Appendix B of Part 651 provides a list of CXs.

If a proposed action fails the CX criteria, an EA or EIS is required. 32 CFR 651.29 provides general activities related to NIS management that fail CX criteria. If extraordinary circumstances related to a proposed action exist that may result in an impact to "threatened or endangered species (or critical habitat)," or "wetlands, coastal zones, wilderness areas, aquifers, floodplains, wild and scenic rivers, or other areas of critical environmental concern," the proposed action must provide further analysis in the form of an EA or EIS.

Environmental Assessment determines whether or not a proposed action would significantly affect the environment. The actual EA document includes brief discussions of: the need for the proposed action, alternative actions, possible environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted. If the EA determines that the proposed action would not significantly affect the environment, a FONSI is issued, and the proposed action can be implemented. The FONSI can also discuss ways in which impacts can be avoided or mitigated.

Environmental Impact Statement is prepared if the EA determines that the proposed action may result in significant environmental impacts. An example of a major NIS management action that may result in significant environmental impacts (thus requiring an EIS) would be proposals for aerial herbicide application. An EIS is a detailed evaluation of the proposed action and its alternatives. The public and other agencies may provide input into the EIS preparation and provide comments on the draft EIS. The EIS process requires formal interaction with the public to obtain comments on the draft EIS. The EIS review process can be lengthy and expensive; however, a benefit of performing an EIS is that, when approved, it provides strong legal backing for

multiple years. For long-term NIS management programs, the strong defense against legal challenges that an EIS provides can be attractive. For long-term decisions, a FONSI may be challenging to defend as the "significance" of effects, interested parties, and decisions can change.

If a proposed action is expected to result in significant impacts to the environment, or if a project is environmentally controversial, an EIS can be prepared without having to prepare an EA. When the final EIS is prepared, a public record of its decision is prepared that addresses how the findings of the EIS, including consideration of alternatives, were incorporated into the decision. The Record of Decision must specify the preferred alternative and identify any mitigation measures that were important in supporting the decision.

In addition to the proposed action, it is also important to consider cumulative impacts. A cumulative impact is defined as an impact on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place locally or regionally over a period of time.

Examples of EISs prepared to address control of invasive plant species are scarce. Most often, this issue is addressed in an EA. An EA is prepared when the proposed action does not have a significant impact on the environment. Many times, if there is a possibility for a potentially significant impact, mitigation measures are put in place to minimize the effects. In this case, an EA results in a mitigated FONSI. Mitigations are more easily accepted into the project plan early in the process, as opposed to later. If mitigations are suggested late in implementation of a project, they are often difficult to put into action. Mitigations should be analyzed at the same time that project alternatives are considered.

Preparing an EA takes less time than an EIS because there is no public involvement. An EIS is prepared, however, when an action clearly has significant impacts. The EIS requires a formal "scoping" process and has specified timelines for public review of the draft EIS and incorporation of public comments. Sometimes, an EA may be favored because of the added public involvement timeline of an EIS and additional cost. However, one need not prepare a "bullet proof" EIS. Over time, Army EISs have

become lengthy and complex, which is not necessary. The level of detail should be commensurate with the risk of impacts of a proposed action and alternatives. Scoping should be used to help focus the analysis and identify issues that are potentially significant and controversial. Such an approach will minimize unnecessary analysis, save time, and reduce costs.

Proponents of an action should use the NEPA process as it was intended, to identify issues that are likely to have an effect early so they can be addressed. In this evaluation, it is important to involve local citizens, advisory groups, and other stakeholders so they can assist in identifying potentially significant or controversial issues. Proponents need to consider reasonable alternatives and take a "hard look" at the magnitude of impacts of implementing these alternatives. This process requires a systematic examination of possible consequences and evaluation of their significance. The NEPA process is intended to help public officials make decisions that are based on environmental consequences and take actions that protect, restore, and enhance the environment. Part of this requirement includes documentation of potential impacts of a proposed action in an EA and/or an EIS.

Army Regulations

Further guidance and requirements related to the NEPA process for proposed actions on Army lands are contained in various Army regulations.

In 32 CFR 651 (Environmental Effects of Army Actions; Final Rule), there is specific guidance on how NEPA review should be conducted and a general description of what actions apply for different types of NEPA review. As stated in 32 CFR 651, the NEPA process should be considered early in the planning process, and it should be integrated with other Army project planning and decision-making actions (e.g., Master Plans, INRMPs). Early integration can avoid project delays and future conflicts. Additionally, AR 200-1 (Environmental Protection and Enhancement), Chapter 5 (Pest Management) specifically recommends that Installation Pest Management Plans (IPMPs) address NEPA requirements. Based on a preliminary survey of installations' NEPA analysis for NIS management, most NEPA review for NIS management is done for the entire IPMP document or within the higher level INRMP. This broader approval gives NEPA approval for NIS management to occur over the same time period that all other actions are approved within an IPMP or INRMP.

Chapter 5 of AR 200-1 also describes preparation of IPMPs which document pest management requirements, responsibilities, and resources to correct pest problems at each installation. Chapter 4 on Environmental Asset Management covers assets entrusted to the Army's care, including air, water, land, and natural and cultural resources. Part of Section 4-3 on Land Resources discusses integrated natural resources management. This Section (4-3d) specifically states, "Assure NEPA requirements are satisfied when preparing the INRMP." This same section further states to integrate the INRMP with the installation master plan, range plans, training plans, IPMPs, and other appropriate plans to ensure consistency.

Section 4-3 goes on to say that the Director of Public Works is the proponent for noxious weeds and invasive species management and that an invasive species management component of the INRMP consistent with specific federal and state initiatives should be prepared and implemented. It also states that, where applicable, invasive species management practices should be synchronized with objectives of the installation ITAM program.

A memorandum on Army Policy Guidance for Management and Control of Invasive Species (26 June 2001) and was issued to provide guidance for implementing EO 13112 (1999), which established the duty of federal agencies to prevent the introduction of invasive species, to provide for their control, and to minimize their potential economic, ecologic, and human health impacts. The Army memorandum stated that invasive species shall be managed within the context of the goals and objectives of an installation's INRMP and will be integrated into other installation plans as appropriate. Implementation of projects for the control/eradication or response to new introductions of invasive species shall meet the goals and objectives of an approved and current INRMP. Planned actions to address invasive species should be consistent with management objectives in INRMPs and undertaken only after appropriate review under NEPA as implemented by 32 CFR 651, "Final Rule." Actions should also be reviewed under the provisions of the Endangered Species Act where federally listed species or their habitats are present.

The Department of Defense Instruction (DoDI) 4150.07 (rev. 29 May 2008), "DoD Pest Management Program," implemented policy, assigned responsibilities, and prescribed procedures for the DoD Integrated Pest Management (IPM) Program. In Section 5.4.20, the instruction states that installations should annually update and coordinate the review and approval of their IPM plans. Enclosure 4 of DODI 4150.07 provides DoD IPM Program Elements and

Enclosure 5 provides a suggested format and content of IPM plans. The format includes preparation of standard operating procedures for control of noxious or invasive plants.

Integrating NEPA with Management Planning

Current Army compliance with NEPA appears to be procedural, focusing on providing the necessary analysis to acquire approval for individual projects rather than long-term plans. A study of the extent to which NEPA was integrated into Installation Master Planning (Keysar et al. 2002) concluded that integration was the exception rather than the rule. This observation conflicts with 32 CFR 651, which requires NEPA consideration early in the decision-making process. Environmental analysis is an inherently complex process that requires detailed review. Perhaps this complexity and the lack of detailed guidance for early integration are to blame. Table A-1 lists some possible reasons for the lack of early integration.

Table A-1. Reasons for lack of early integration of NEPA with agency planning.

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- Scope of strategic decision difficult to define and analyze
 - Detailed EA difficult to produce for early, conceptual, or strategic decisions
 - Fear of producing an EA document that is not legally acceptable for lack of detail
 - Fear of litigation, delays, and increased costs
 - Agencies retain discretion when to start EA
 - Not likely to be sued if EA not conducted early in the process
 - Reluctance to disclose entire scope of proposed policies and plans
 - Impacts appear less significant for projects than for policies and plans
 - Cumulative effects difficult to fully assess
 - Reluctance to start EA until project well-defined and likely to be approved
 - Funding to conduct EA for projects, rather than policies and plans

- Inadequate communication among environmental staff and planning staff
 - Environmental objectives not given same importance as other strategic criteria
 - Use of EA as a decision-justification tool
 - Lack of organizational support for early integration
 - Lack of methods and expertise
 - Unfamiliarity with strategic or programmatic EAs
 - Standard EA/EIS process not suited to iterative nature of planning
 - Reluctance to open up internal workings to public scrutiny
 - Detachment of decision makers from EA process
-

From: Keysar et al. 2002

When a complex NEPA review is conducted, this effort should benefit the proposed action by integrating it within a planning effort. Research has shown that NEPA aids decision making and influences agency planning. NEPA review can improve the quality of an IPMP or NIS management plan by detailing potential impacts of proposed control methods, and identifying alternative methods. Conversely, information contained in an IPMP or NIS management plan can also assist in the NEPA review process. For example, a typical NIS management plan will include a summary of where species are distributed, which is the basic information needed for identifying where control measures may cause environmental harm. Table A-2 lists some of the benefits of integrating NEPA in the Army's planning processes.

Table A-2. Benefits of Early NEPA
Integration in Army Planning

-
- Avoid delays in mission accomplishment
 - Efficient program or project execution later in the process
 - Identify potentially controversial issues during the planning process
 - Identify minor issues that have no measurable environmental effect and to help focus analyses

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- Inform the decision maker of environmental consequences at the same time as other factors
- Concurrent timing of permits and regulatory coordination
- Provision of necessary feedback to effect adaptive environmental management
- Cost savings through tiering (economies of scale, incorporating by reference, minimize effort spent on individual projects, eliminate the need for case-by-case analyses and documentation for construction projects)
- Ensure that the recommendations and mitigations upon which the decision was based are being carried out
- Ensure that environmental values are integrated into Army planning and decisions
- Prevent disruptions in the decision-making process

Presented in 32 CFR 651, Environmental Analysis of Army Actions, Final Rule (2002).

NEPA Review of NIS Management on Army Installations

To expand the understanding of the NIS management and planning being conducted on Army installations, U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) conducted a workshop and distributed a survey to installation natural resource managers. The survey assessed how installations address the impacts of invasive plant species, with specific questions related to NIS surveys, management planning, control implementation, and NEPA analysis (Appendix C).

The workshop, "Prioritizing Non-native Invasive Plant Species Management on Army Installations", was held at Fort Bragg, NC, on 4-5 March 2009. Attendees represented Army invasive species management practitioners from seven installations. The installations were chosen to represent a variety of geographical regions in the continental United States (e.g., Southwest, Midwest, Northeast, and Southeast).

At the workshop, attendees discussed their natural resource management goals within the context of NIS management. They also discussed the short-term, long-term, direct, and indirect impacts NIS pose to their installations, as well as the many

other challenges they face in managing NIS. Additionally, NEPA review of NIS management actions was discussed. Insights gained from the workshop discussion of NEPA were consolidated with the survey results.

Overall, data from 12 installations were gathered. Each installation surveyed had identified NIS on their land, whether from informal observations or a formal survey. NIS control efforts have been implemented on two-thirds of the installations at least once a year. Of the installations that are actively controlling NIS, all have summarized their management efforts in a plan, whether it is within an INRMP, an IPMP, or a stand-alone NIS management plan. The survey and workshop also discussed the limitations to successfully controlling NIS (Table A-3). The most significant limitation identified was funding, and the least significant limitation was NEPA requirements.

Table A-3. Installations' average ranking of the importance of limitations on managing invasive plant species (1 = significantly limits, 5 = has no impact).

Limitation	Impact (1-5)
Availability of funding	1.4
Lack of a management plan	3.1
Availability of accurate distribution data	3.2
Availability of suitable control methods	3.6
Regulatory conflicts	3.6
Barriers in installation communication and coordination	3.8
Conflicts with other land uses	3.9
Availability of qualified/interested contractors	4.0
Limitations on access	4.0
NEPA requirements	4.4

With one exception, every installation surveyed had conducted a NEPA review of their NIS management efforts. The installation that had not conducted a NEPA review expressed concern for consequences and was uncertain of the need for NEPA review. The installations that had conducted NEPA review did so within an INRMP or IPMP. NEPA review had not caused any delays to NIS management programs, and all installations surveyed expressed that NEPA requirements had little to no impact on the effectiveness of their NIS management efforts. Understanding of actual NEPA requirements for NIS management varied, and the methods for review also varied. The scale of NEPA review varied

from individual species control and case-by-case analysis of specific infestations, to general use of chemical control methods and programmatic control of NIS for multiple years. The broad variation in NEPA review methods and level of understanding about the need for NEPA review for NIS management indicates that there is a real need for guidance on the issue.

To gain further understanding of how NEPA review is handled across Army, specific NEPA documentation for NIS management was also collected from a few installations. One installation shared an EA that had been approved for their entire IPMP. The alternatives presented in this programmatic EA were for either full implementation of the IPMP or no action. The EA evaluated the effects of consolidating eight independent pest management programs into a single, integrated program directed by the IPMP. The effects of implementing the IPMP versus not implementing the IPMP were evaluated for natural resources, cultural resources, health and safety, the sociological environment, and the military mission. Impacts were categorized as short-term, long-term, direct, and indirect. The EA did not address or discuss potential impacts of control methods. The installation natural resource managers believe the EA provides adequate NEPA review to implement NIS management actions. Given that the EA did not specifically evaluate how control methods would be implemented or the process of deciding which control methods to implement, it is likely NIS management efforts on this installation are not protected from legal challenges.

Confusion about the need and resources for NEPA review of NIS management actions appears to have prevented some installations from preparing NEPA documentation, and other installations from potentially providing adequate NEPA review. Despite this, the future for NEPA compliance of Army NIS management programs is still encouraging. The survey indicates that most installations utilize a plan to summarize and guide their NIS management actions. Additionally, those installations that have conducted NEPA review have done so within the context of an INRMP or an IPMP. By providing guidance about how to properly integrate NEPA review of NIS management within an INRMP or an IPMP, Army installations can improve environmental compliance, protecting themselves from legal challenges and implementation delays.

NEPA Review of NIS Management Conducted by Other Federal Agencies

Several federal land management agencies other than DoD have prepared extensive NEPA review of their NIS management programs.

Many of these EIS are available on line. It is prudent to examine the approaches other federal agencies have used to comply with NEPA and to consider the strategies they recommend for use by DoD. For example, the U.S. Department of Agriculture's Forest Service (USFS) also published a series of discussion papers on the topic of invasive plant management decision making and NEPA (USDA 2001). The papers recommend strategies to achieve NEPA approval for adaptive management programs and discuss specific issues related to chemical and biological control methods. Some of the recommendations made in the discussion papers are similar to what is recommended here.

USFS EIS are commonly developed for regions or specific National Forests. For example, the EIS for the Deschutes-Ochoco National Forests and Crooked River National Grassland in Oregon was prepared for a combination of treatment methods (e.g., manual, mechanical, cultural, ground-based herbicide application, and site restoration) within a proposed integrated weed management approach. The project was intended to effectively treat invasive plants while minimizing adverse effects from treatment. Implementation was expected to reduce the rate of spread of existing and future infestations of invasive plants on the Forests and Grassland. Four alternatives were evaluated. The proposed action with modifications was selected as the preferred alternative because it provided appropriate and effective Forest-level management direction with regard to prevention practices, while maintaining management flexibility. The EIS detailed goals and objectives of the proposed effort, examined a range of reasonable alternatives, analyzed potential effects, and provided rationale for the selected alternative. The document provided a strong case for the selected alternative and described measures the USFS expects to take to further reduce the risk of adverse effects during future implementation (USDA 2007).

Another USFS EIS document provides remarkably broad NEPA coverage for NIS management. The Pacific Northwest Region, covering all or parts of four states, has conducted an EIS for a regional invasive plant management program (USDA 2005). The EIS covers the entire NIS management program, including NIS inventory, prevention strategies, control methods and restoration methods for all USFS properties within the region. The document details a framework for each part of the NIS management program, providing the guidelines for how NIS management decisions will be made. Potential impacts of control methods are also discussed in detail. Entire chapters are dedicated to the ways in which NIS management can affect non-

target plants and native plant communities, birds, mammals and amphibians, as well as human health and water quality. The document, at 300-plus pages with numerous appendices, and public review periods, must have been an enormous effort. However, it provides strong legal protection for all aspects of the NIS program for many years.

An EA for White River National Forest Invasive Plant Species Management (2007) documented specific effects of an adaptive invasive plant species control strategy as described in the proposed action. Screening criteria for alternatives were also summarized in the EA. Information on ecological risk assessment was provided to inform what risks are posed by a pesticide and whether changes to its use are necessary to protect the environment. Information on control measures was presented in an understandable manner and effectiveness of controls was presented in relative terms. This EA also presented an abundance of useful information on affected environment and environmental consequences, as well as direct, indirect, and cumulative effects. The EA also provided the context of the effects, both positive and negative, of treating invasive plant species. The decision made was supported by detailed analysis and was consistent with the intent of the Forest plan's long-term goals and objectives to increase the amount of forest and rangelands restored to, or maintained in a healthy condition, with reduced risk and damage from fire, insects, disease, and invasive species.

Similarly, the National Park Service (NPS) works to remove or control exotic species on its land. More than 100 NPS units have specifically identified exotic species as significant resource management threats. Notably, the NPS has included inventory and monitoring as action alternatives during NEPA review. The monitoring categories can also be used to implement a long-term adaptive management strategy. By implementing an adaptive management approach, managers can identify and respond to changing conditions and new information on an ongoing basis, and assess the need to make changes to treatment and restoration strategies. Emphasis is also placed on having regional invasive plant programs to keep track of changes in distribution and abundance of NIS, to determine if the invasive plant species have been reduced regionally, and which treatment methods (separate or in combination) are most successful for specific invasive species.

Some agencies tend to prepare EISs, while others prepare more EAs. Some, including the Army, prepare EAs to implement plans

such as INRMPs, IPMPs, and Master Plans. Whether an agency decides to prepare an EA or an EIS, it is important to consider all reasonable alternatives, document potential effects of these alternative actions, and provide enough supporting documentation and analysis so the decision maker is able to make an informed decision regarding the proposed action and the selected alternative.

Consequences of Improper NEPA Review

Despite the fact that most installations appear to be including NIS management efforts within their INRMP, or IPMP NEPA review, legal challenges can still interrupt NIS management. Delays can cause major setbacks in control efforts thereby stalling early detection treatments and putting TES, wildlife habitat, training, and other land management requirements at risk. Additionally, the NEPA review that may be required as a result of a legal challenge can be very expensive and time consuming.

We are not aware of any instances where a legal challenge has interrupted Army NIS control efforts. However, the USFS has experienced such challenges, which have stopped the application of herbicides until further NEPA reviews were conducted.

Common NIS Management Methods

Techniques for controlling NIS are constantly evolving as new methods are identified and more is learned about the biology of specific species. Control methods fall into general categories including: biological, mechanical, and chemical. The choice of control method usually depends on the extent and nature of the NIS infestation, the impact on non-target species, effectiveness of the method(s), compatibility with other control methods, feasibility at a given site, the management goal, and cost, land use, and legal restrictions. Each type of control method has varying levels of potential harm to the environment, culturally significant resources, or human health, with the potential requirement of NEPA review.

Biological

Biological control is the planned use of living organisms to reduce the reproductive capacity, density, and/or impact of an NIS (DeLoach 1997; USDA 2001). Examples of biological control include: grazing, introduced insect herbivores, and various disease agents. When effective, biological control can provide a cost-efficient, long-term, and self-sustaining solution (DeLoach 1997). However, it typically is not an effective means of

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eradication. Therefore, use of biological control is appropriate when suppression or containment, rather than eradication, is the management goal (DeLoach 1997). Biological controls have been shown to have numerous unintended environmental impacts, however. For example, a biocontrol agent (i.e., introduced insect herbivore) can become a pest itself, when it shifts from the target NIS to non-target native plants. As a result of these potential impacts, the USDA restricts use of biocontrol agents unless they have determined that an introduction is not likely to have a negative impact on the natural ecosystem.

There are two basic considerations that must be evaluated under NEPA for biocontrol agents. The initial decision whether a particular agent should be released is handled by the Agricultural Plant Health Inspection Service (APHIS). The second is a site-specific decision whether a biocontrol agent is appropriate for the locations where it is planned to be released.

Biocontrol agents undergo rigorous testing by APHIS prior to being cleared for release. This testing occurs in laboratories, where effectiveness for controlling the target species and host specificity are evaluated. The testing process also examines potential impacts to agriculture, rare plants, and other native species. APHIS also conducts an environmental analysis to satisfy NEPA requirements prior any new biocontrol agent being made available for use. It generally takes between 10 and 15 years for an agent to be cleared. Additional NEPA review may be necessary at the site level to assess whether the biocontrol agent is likely to have any adverse environmental impact. Currently, there are no CXs for the release of biocontrol agents.

Mechanical

Mechanical control treatments involve either removal of the above-ground portions of the weed, or removal of enough of the root and root crown to kill the plant. Examples of common mechanical methods include: mowing, hand removal, disking, and burning. Annuals and some biennials and perennials can be suppressed or contained if mechanical controls occur before fruits mature and viable seeds form. Mowing perennial herbaceous or woody NIS that have the capability to reproduce vegetatively can potentially exacerbate the problem by stimulating the production of new stems from vegetative buds below the cut surface. Mowing can also result in poor control if implemented after flowering and seed set due to the potential spread of

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seeds on equipment. Hand removal (pulling or uprooting) can be effective in small, newly established stands, but it is difficult to remove all plant parts with certainty. For large, established stands, hand removal is virtually impossible. In open, NIS-dominated sites, disking can act as an initial stressor to reduce NIS densities, particularly if target species are not capable of reproducing vegetatively from pieces of rhizome or roots. Prescribed fire is only appropriate when native species are fire tolerant, or when NIS have essentially displaced all of the native species. Mechanical control methods can result in unintended environmental harm. Examples include soil disturbance, erosion, trampling of native and endangered species, wildfires, or spreading invasive species on equipment.

Chemical

Management of NIS with chemical herbicides can be particularly effective for species not easily controlled by other methods. This is especially true for perennial species with persistent roots, species that reproduce vegetatively, or at sites prone to erosion. Examples of specific types of herbicide application methods include directed foliar sprays, stem injection, cut surface treatments, basal sprays, soil spots, and pelletized soil applications. Important considerations in choosing herbicides and application techniques include: effectiveness on target species, site conditions, season, effect on non-target species, cost, availability of licensed applicators, and regulations. The Armed Forces Pest Management Board provides a list of pesticides allowed for use on DoD lands. Herbicide use for NIS management is the most controversial control method. Potential adverse effects of herbicides are generally questioned in all proposed actions.

State pesticide boards regulate herbicides and their usage to ensure impacts to humans and the environment are prevented or mitigated. Generally, label instructions that restrict where and how chemicals can be applied must be followed. NEPA review of environmental and human health impacts for herbicides is conducted during the chemical registration process.

Despite the numerous regulations in place to prevent harm, chemical control methods still pose serious potential environmental and human health risks when improperly used. Non-target species are at risk of being harmed, water quality can be impacted, and accidental human exposure can occur. These site-specific impacts require further NEPA review beyond what is performed during the chemical registration process. These

concerns are greatest in situations where large amounts of herbicides are applied broadly by an airplane-, truck-, or ATV-mounted sprayer, or by a tractor-pulled sprayer. It is rare, however, that a large contiguous area is treated with broadcast herbicide application. Treatments are usually small and scattered across a landscape, with only a small percentage of the land area actually treated for NIS. These factors contribute to a limited risk of herbicide exposure and adverse impacts to the environment, humans, and wildlife. When demonstrated through NEPA review, this limited potential for adverse effects generally does not prevent use of herbicides for NIS management actions.

Approaches for Incorporating NEPA into Invasive Plant Management Planning

Due to a lack of supplemental guidance from the U.S. Environmental Protection Agency on the NEPA requirements for NIS management and the potential consequences of not properly conducting NEPA analysis, we propose methods here to facilitate environmental assessment early in the process of planning NIS management. This proposal involves developing a thorough management plan that provides the details necessary for NEPA review. A thorough NIS management plan:

- identifies where NIS are located,
- prioritizes where control actions will be implemented,
- details control methods and their potential impacts,
- describes a decision-making method for implementation that avoids adverse impacts,
- identifies methods for NEPA review, and
- establishes a means for monitoring.

With this process approved by NEPA within an INRMP, IPMP, or stand-alone plan, field crews are free to control NIS following the details of the plan.

NIS Management Planning

An NIS management plan should begin by identifying where NIS are located on the installation. The survey methodology should be summarized, allowing it to be repeated. Updating information about the distributions of NIS on the installation is important, as it ensures current information is accurate and accessible for future NEPA review.

Once the distribution of NIS infestations is summarized, the scope of the problem can be determined and a decision can be

made as to whether the project is long-term (numerous infestations of multiple species) or short-term (a few small infestations of a few species). NIS control projects are typically complex, requiring a long-term perspective and commitment to management follow through.

A list of possible control methods should then be identified. For each method, general restrictions on use should be detailed (e.g., Table A-4). Control methods usually fit into the three general categories described in the previous section (e.g., chemical, mechanical, biological).

Table A-4. Examples of general restrictions on uses of chemical control methods.

-
- All herbicides will be applied strictly in accordance with the label directions.
 - All state and federal pesticide laws will be adhered to.
 - Herbicides will be applied under the direction of a licensed applicator.
-

For each category of control, specific potential impacts should be identified (Table A-5). These serve as the potential environmental impacts of the proposed action that a NEPA review would analyze. Additionally, these impacts are an important determinant of which control method is chosen at a given site. As such, the decision-making process for selecting control methods will consider these impacts. The plan should clearly describe the decision-making process for selecting the most appropriate control method that avoids or mitigates impacts.

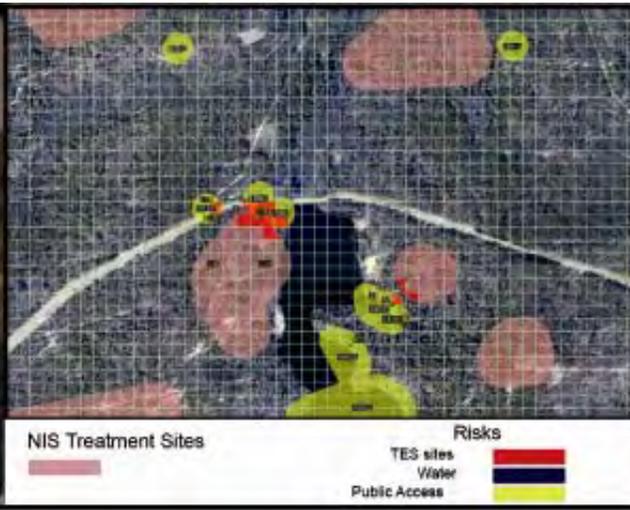
These impacts are spatially and temporally explicit, in the sense that they vary depending on where and when the control methods are implemented on the landscape (Figure A-1). Most, if not all Army installations have extensive spatial databases that describe TES populations, wetlands, sensitive habitats, and any other resource that should be protected. Using these spatial data, along with the information from Table A-5, a map can be created detailing where potential impacts could occur. This map can serve an important role in deciding what control methods to implement.

Table A-5. Potential environmental and human health risks for general categories of NIS control.

Control method	Risk	Locations
Chemical	Water contamination	Near water body, or water source
	Erosion	Large monocultures of NIS, steep slopes, highly erodible soils, and large upslope contributing areas
	Non-target species	Sensitive habitats, TES sites
	Human health	Near schools, residences, public areas
Biological	Non-target species	Sensitive habitats, TES sites
Mechanical	Erosion	Steep slopes, highly erodible soils, and large upslope contributing areas
	Trampling	Sensitive habitats, TES sites
	Wildfire	Near schools, residences, public areas, fire sensitive TES and habitats
	NIS spread	Any NIS infestation



A NEPA-approved Installation NIS Management Plan records the decision-making process, determining where and how to treat NIS.



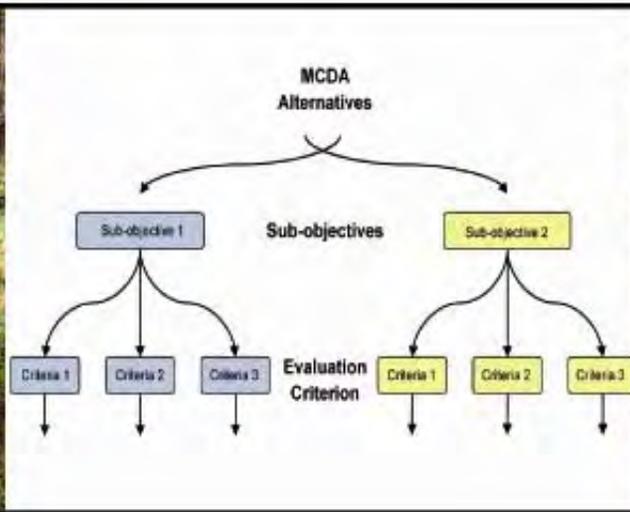
Locations of NIS treatment sites are compared to the areas potentially at risk to NIS treatment methods.



NIS treatment methods can potentially impact threatened and endangered species, water sources, public access areas, and cultural sites.



Field crews record the sensitive resources within an NIS treatment site, along with information about the NIS present.



A multi-criteria decision analysis (described below) uses existing datasets and data recorded at the site to determine the best treatment alternative in real time.



With this sequence of decisions, field crews can implement NIS treatments knowing that it is the most appropriate method for the site.

Figure A-1. A visual representation of the decision-making methods recommended for determining NEPA-approved NIS treatment methods.

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For every infestation, there are a number of control methods that can be implemented, depending on the goals of the NIS program, the methods available, the budget, the species present, and the potential environmental and human health risks. The decision about which NIS control method to implement is best determined at the time of implementation, rather than when a plan is drafted months or years before implementation. Field crews implementing NIS control actions can evaluate the actual conditions on the ground along with the feasibility of the control methods. These on-the-ground decisions can be informed with a decision framework that identifies where potential environmental impacts for a control method may occur (e.g., herbicides near wetlands, TES, public use areas, etc.), and which methods should be avoided at those locations to prevent or minimize the risk of adverse environmental impacts. If it is determined that a method commonly used to control an NIS could cause environmental harm at a site, an alternative method that causes no harm or less harm could be chosen. This sort of decision making typically occurs informally, but having the decision-making methods clearly detailed in an NIS management plan and approved during NEPA review can help ensure the most suitable, accepted control method is implemented.

Multi-criteria Decision Analysis and Environmental Analysis

The decision-making process detailed in the NIS management plan should take into account multiple datasets when evaluating which control methods can be used. The datasets will generally fall into two categories: those characterizing (1) the benefits of implementing NIS control measures and (2) the potential risks of implementing control measures. The process of evaluating and combining the multiple datasets can be aided by multi-criteria decision analysis (MCDA) (Malczewski 1999; Jankowski et al. 2001). MCDA is defined as an evaluation based on multiple criteria, wherein the criteria are quantifiable indicators of the degree to which decision objectives are realized. MCDA is intended to provide a rational way to help decision makers solve complex problems objectively. MCDA is ideal for NIS management decisions because it can provide a framework by which to incorporate multiple diverse stakeholder interests with multiple datasets describing resources affected by NIS and potentially adversely affected by NIS control methods.

MCDA has been used extensively for environmental decision making. Examples include contaminated sediment management, selection of National Park boundaries, land condition assessment

for allocation of military training areas, waste management activities, forestry planning, fisheries management, and landfill siting. An MCDA can fulfill NEPA requirements for consideration of all relevant environmental, ecological, technological, economic, and sociopolitical factors relevant to evaluating and selecting among alternatives. Appropriately considering all of these factors is difficult without the assistance of a formal decision-making process.

Each installation faces unique NIS management challenges due to varied training land uses, land management needs, protected-species concerns, and habitat types. The type of MCDA most appropriate is influenced by the complexity of the training and land management requirements, as well as the availability of data to support analyses. For example, a relatively simple MCDA may suffice for small installations with few potential impacts from NIS management and a limited number of stakeholders. Larger installations with multiple potential NIS impacts, detailed NIS distribution data, and many stakeholders representing diverse interests will likely need a more complex MCDA approach.

It is proposed that an MCDA can be used as a decision framework within a NEPA analysis to objectively and transparently determine which NIS management alternatives can be implemented under site-specific conditions. The MCDA evaluates management alternatives for each site where NIS management actions are to be implemented. The MCDA weighs the risks of implementing a specific NIS control method with the benefits or requirement for NIS control. The MCDA combines relevant data as evaluation criteria and stakeholders' expert opinions about the relative importance of criteria as weights to objectively identify which alternative control method should be implemented. All MCDA frameworks essentially consist of five elements or steps, as outlined below.

1. *Identification of relevant evaluation criteria.* To identify relevant evaluation criteria (Step 1), stakeholders must work together to define the MCDA problem (i.e., what NIS control method(s) are appropriate at a particular place given the risks associated with the method and the benefits of managing NIS). Specific criteria can then be developed to describe all aspects of the MCDA problem. Data are then collected as parameters to provide values for each criterion.

2. *Criteria standardization*

Criteria must be standardized because data have likely been measured with different units. The standardization should make all of the values positively correlated with the desired outcome of the problem.

3. *Criteria preference weighting*

Not all criteria are as important or relevant to determining the overall outcome of the MCDA. Various stakeholders will also have different preferences or opinions about the importance of each criterion. Therefore, stakeholders' preferences are captured and applied by weighting the criterion data.

4. *Criteria combination*

The standardized and weighted criteria are then combined to determine the overall outcome of the MCDA. This process can be a simple addition of criteria, or it can involve more complex combination functions, depending on the datasets.

5. *Uncertainty analysis*

To build confidence in the MCDA results, uncertainty should be analyzed. A sensitivity analysis can assess the general stability of the stakeholders' rankings, identify criteria that are especially responsive to weight changes, and help visualize the spatial dimension of weight sensitivity. Criteria and weights need to be validated to ensure overly cautious or risky decisions do not dominate.

A general visual representation of the five steps is shown in Figure A-2. These steps are also described in more detail in Public Works Technical Bulletin 200-1-57: Prioritizing Non-native Invasive Plant Management on Army Installations (Hohmann and Frank 2008).

Following these steps, an MCDA can compare alternative control methods at numerous sites to determine which method poses the least risk to site-specific concerns (e.g., water quality, TES, human health, erosion, etc.), and has the greatest benefit (e.g., effectiveness of control, necessity of control at site, cost savings, etc.).

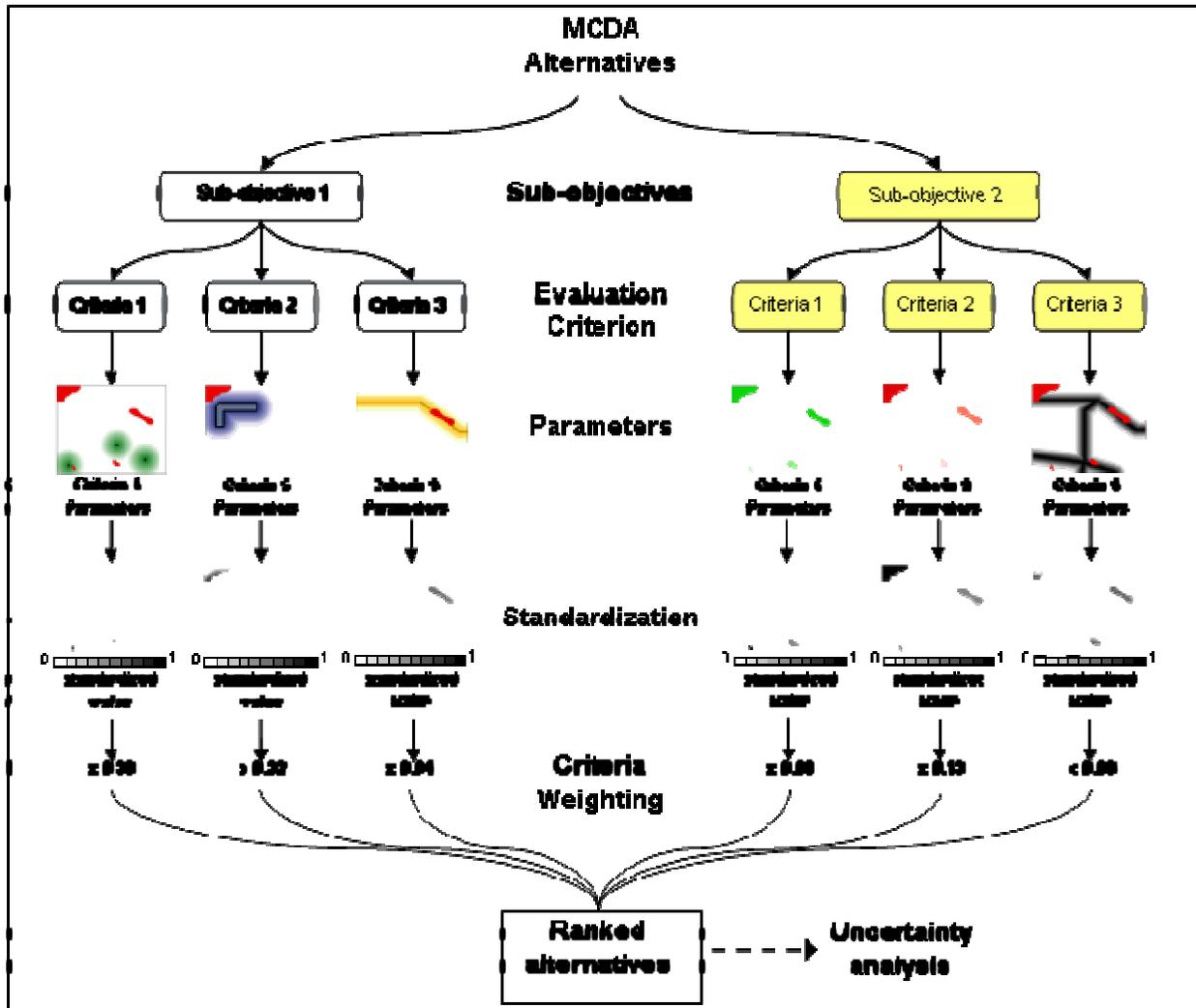


Figure A-2. Flow chart depicting the steps in a multi-criteria decision analysis.

Monitoring and Adaptive Management

Given the long-term nature of NIS control efforts, periodic reviews of the data, assumptions, and analyses are necessary. Continuous monitoring of NIS populations and the effects of control methods on the infestations and environment should provide the appropriate data to adapt the decision-making process as necessary in the future. Likewise, adaptive management can be included in the NIS management plan as a way to update decisions without having to initiate a new NEPA review each time a change is needed. Adaptive management provides an avenue to respond to future changes but can also validate assumptions made about environmental effects. This is important for long-term NIS management because there is a need to determine whether the basis for previous decisions is valid.

Conclusion

Careful consideration of the potential environmental and human health risks is necessary when planning NIS management on Army installations. This consideration should be recorded in the form of a Categorical Exclusion, Environmental Assessment, or Environmental Impact Statement. Which level of NEPA review is most appropriate depends on the potential impacts of proposed NIS management actions. Based on a review of NIS management planning on Army installations, we concluded that many installations would benefit from a more strategic, thorough, and dynamic NEPA review process.

This PWTB proposes a method to apply MCDA within an NIS management plan, to broadly evaluate the risks and benefits of NIS control methods based on site-specific conditions. This MCDA can be used for numerous years and, when subject to a NEPA review, will provide strong legal backing for NIS control measures. It also eliminates the need for separate NEPA review of every proposed NIS control action.

Unfortunately, modules to support MCDA are not integrated into most geographic information system (GIS) software (e.g., ESRI). Currently, IDRISI (Eastman 1999) is the most widely available and powerful GIS software for implementing MCDA. Still, many MCDA steps can be accomplished with common GIS map algebra capabilities, as well as spreadsheet and mathematical software (e.g., MATLAB). Importing and exporting large files among various software programs can create numerous complications, however. Additional software capabilities are needed to aid the use of MCDA.

APPENDIX B

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APPENDIX C

QUESTIONNAIRE: NON-NATIVE INVASIVE PLANT SPECIES MANAGEMENT ON ARMY INSTALLATIONS

Background

There are several factors that potentially complicate NEPA analysis as it relates to invasive plant management on Army installations. First, formal EPA guidance specifically related to development of Environmental Assessments (EA) and Environmental Impact Statements (EIS) is not available for invasive plant management, as it is for many other topics (e.g., grazing, air quality, fisheries management, etc.). Second, Army installations have many unique land management challenges (e.g., frequent training use, exaggerated risk of exposure to invasive plant propagules, access restrictions, etc.) that do not exist on other federal properties, but greatly affect invasive plant management approaches and environmental impact assessment. Third, certain invasive plant management actions can directly or indirectly impact human health and the environment, potentially invoking multiple statutes and regulations (e.g., Endangered Species Act, Clean Air Act, Clean Water Act, Pollution Prevention Act, etc.). Fourth, invasive plant management planning and implementation demands the input and buy-in of multiple, diverse installation stakeholders (e.g., trainers, Department of Public Works, forestry, wildlife, cultural resources, endangered species and other resource managers). However, most Army installations lack dedicated invasive plant management personnel to facilitate planning, environmental analysis, and implementation. Consequently, there are oftentimes many perceived and real uncertainties about roles, responsibilities, and processes.

ERDC is working to develop strategies and tools for integrating environmental analyses into invasive plant management planning, which will facilitate tiering of NEPA documentation and help ensure NEPA compliance. This portion of the survey is intended to inform ERDC of your installation's NEPA documentation for invasive species management. This information will not be shared in any way that is individually identifiable.

(NOTE: Please complete actual survey that begins on the following page.)

Survey Tool

(1a) Have prior or planned invasive plant management actions undergone environmental analysis (i.e. NEPA review)?

- Yes (progress to question 2)
- No

(1b) If no, do you see any potential consequences of not having conducted any environmental analyses of invasive plant management actions?

- Yes
- No

(1c) Why hasn't any environmental analysis been prepared? (If answer is "no need," skip to question 6)

- Too time intensive
- Lack of personnel
- Lack of funding
- Uncertainty about need
- Lack of guidance
- Uncertainty about responsibility
- No need

(2) How is environmental analysis performed?

- Case by case (i.e., site-specific) as needed
- Specific treatment conditions throughout installation are collectively evaluated (i.e. condition specific) during planning
- Other: _____

(3) Are alternative actions presented in the analysis?
Too time intensive

- Yes
- No

(4) What control actions are approved by existing NEPA documentation?

(5) Where is the NEPA review handled?

- Integrated Pest Management Plan
- Integrated Natural Resources Management Plan
- Invasive Species Management Plan
- Stand-alone Plan
- Other:

NOTE: Please continue survey on the next page.

(6a) Which of the following NEPA documents been developed for invasive species management?

- Record of Consideration
- Environmental Assessment
- Environmental Impact Statement

(7) Have delays in development of NEPA documentation stalled invasive plant management?

Yes

Explain how

No

(6b) Was assistance available in development of NEPA documents?

Yes

Who helped? _____

No

Please provide any recommendations you may have for improving the NEPA process as it relates to invasive plant management, or any other comments you may have regarding the NEPA process and invasive species management on Army installations.

APPENDIX D

ACRONYMS AND ABBREVIATIONS

Term	Spellout
ACSIM	Army Chief of Staff for Installation Management
APHIS	Agricultural Plant Health Inspection Service
AR	Army Regulation
ATV	All-terrain vehicle
BLM	Bureau of Land Management
CECW	Directorate of Civil Works, U. S. Army Corps of Engineers
CEMP-CE	Directorate of Military Programs, U. S. Army Corps of Engineers
CERL	Construction Engineering Research Laboratory
CFR	Code of Federal Regulations
CX	Categorical Exclusion
DA	Department of the Army
DoD	Department of Defense
DoDI	Department of Defense Instruction
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
FONSI	Finding of No Significant Impact
GIS	Geographic information system
HQUSACE	Headquarters, U.S. Army Corps of Engineers
INRMP	Integrated Natural Resources Management Plan

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Term	Spellout
IPMP	Integrated Pest Management Plan
MCDA	Multicriteria Decision Analysis
NEPA	National Environmental Policy Act
NIS	Non-native invasive plant species
NPS	National Park Service
PL	Public Law
PWTB	Public Works Technical Bulletin
ROD	Record of Decision
TES	Threatened and endangered species
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service

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