



The Integrative Forest Stewardship Approach to Forest Health

Natural Resource Report NPS/MWRO/NRR—2014/825





ON THIS PAGE

View of Mount Rushmore from the Iron Mountain Road, South Dakota. Part of the Black Hills forest ecosystem.
Credit: National Park Service

ON THE COVER

View toward Hanging Rock with forested river bluffs, islands, and floodplain. Effigy Mounds National Monument
Credit: National Park Service

The Integrative Forest Stewardship Approach to Forest Health

Natural Resource Report NPS/MWRO/NRR—2014/825

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Executive Summary

Forest resources within the National Park Service (NPS) are faced with an increasing number of challenges to their long term sustainability and ecological integrity, such as invasive species, climate change, urban encroachment, and the demands from multiple land use.

The *Integrative Forest Stewardship Approach to Forest Health (IFS)* is a multi-disciplinary, science-based “systems approach” that was developed for park managers to promote the optimal health of forest resources in national parks. Developed by the NPS Midwest Region to address identified forest management needs of Midwestern parks, the *IFS* is not a decision-making document. Rather, it advocates a process for achieving a general desired condition in which a park’s forest resources are managed to promote their *ecological integrity* and *ecological resilience* through the implementation of the principles of *ecosystem management*. For the *IFS*, achieving these conditions represents excellence in forest stewardship and forest ecosystem health. This is accomplished in a manner that is appropriate to each type of forest resource and consistent with the purpose of each park. Implementation of this approach is intended to help forest resources within parks to better withstand disturbance events, whether coming from human actions, natural disasters, incursions from invasive species, forest insects and disease pathogens (both native and non-native), or climate-related trends.

By consolidating forest management-related information and contacts, the *IFS* was developed to be a useful tool that provides park resource managers with a raised awareness of, and improved access to, forest stewardship information. Divided into three sections and presented in an electronic format as a “living document,” reference, and source for forest management-related information that is updated over time, the *IFS* approach will help parks achieve these general desired conditions by bringing together, and *integrating*, a wide variety of pertinent forest stewardship guidance (forest ecology and management, forest pest detection and management, fire management, hazardous trees, *etc.*), potential funding sources, and technical assistance contacts from multiple sources, including potential public and private partners.

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Purpose of this Document



Prairie and forest ecotone or boundary. View from Elk Ridge, Wind Cave National Park Credit: National Park Service

The *Integrative Forest Stewardship Approach to Forest Health (IFS)* is a multi-disciplinary, science-based “systems approach” that was prepared for park managers to promote the optimal health of forest resources in national parks. Developed by the NPS Midwest Region to address identified forest management needs of Midwestern parks, the *IFS* is not a decision-making document. Rather, it advocates a process for achieving a general desired condition in which a park’s forest resources are managed to promote their *ecological integrity* and *ecological resilience* through the implementation of the principles of *ecosystem management*. For the *IFS*, achieving these conditions represents excellence in forest stewardship and forest ecosystem health. Hence, this strategy directly supports NPS resource management policies. This is accomplished in a manner that is appropriate to each type of forest resource and consistent with the purpose of each park. Implementation of this approach is intended to help park staff manage forest resources to better withstand disturbance events, whether coming from human actions, natural disasters, incursions from invasive species, forest insects and pathogens (both native and non-native), or climate-related trends.

The *IFS* supports the forest management goals of parks, which can range from forest preservation, restoration, rehabilitation, or the reconstruction of a forest to promote its ecological form and function or for specific cultural purposes. This applies to the management of wildlife corridors, watershed protection, protection of cultural landscapes and specimen trees. Therefore,

the *IFS* applies to both natural and cultural resource-focused parks – or a blend of both management emphases – particularly if they manage natural forest components or human-designed landscapes containing trees within their cultural landscape. Thus, the *IFS* ranges in its applicability from the management of forested ecosystem units to individual landscape trees within parks, according to individual needs.

A key feature of this holistic, or “systems approach,” is to realize that forest resources within parks are components of the greater surrounding natural landscape and *ecosystem*, – to the extent practicable and as appropriate to the various parks’ enabling legislation, resource management emphases, and to its regional context. By taking this perspective, strategic thinking and actions are applied to benefit forest management within national park units that are often “islands” of protection and preservation for unique natural resources within the greater surrounding landscape. These park-based biodiversity “arks” are frequently highly dependent for their own long term ecological integrity, resilience and preservation, on the environmental health and quality of their surrounding regional landscape. In this fashion, the *IFS* approach facilitates species movement and connection with external ecosystem components and processes, which can help to mitigate the effects of climate change, urbanization, and other stressors.

The *IFS* encourages the pro-active identification of problems and actions to address stressors to a forest system’s health in a timely and comprehensive manner. It accomplishes this, in part, through the application of *Integrated Pest Management (IPM)* to a park’s forest resources, as well as through the implementation of comprehensive strategies that result from the recommended development of a *Resource Stewardship Strategy (RSS)*. Implementation of these comprehensive strategies, together with the *IFS*’s “systems approach” methodology, will help resource managers to integrate their management actions with other programs and partners, as appropriate. This will help to achieve excellence in comprehensive forest stewardship within the parks resulting in ecosystem resiliency and improved resource management.

By consolidating forest management-related information and contacts, the *IFS* is a useful tool for providing park resource managers with a raised awareness of, and improved access to, forest stewardship information. The *IFS* is presented in an electronic format as a “living document” that can be updated over time. It is divided into three sections: I. *Purpose of the Document*, II. *The IFS Strategy*, and III. *Tools, Program, and Contacts*. Each section of the *IFS* can help parks achieve the general desired conditions by bringing together and *integrating*, a wide variety of pertinent forest stewardship guidance (forest ecology and management, forest pest detection and management, fire management, hazardous trees, *etc.*), potential funding sources, and technical assistance contacts from multiple sources, including potential public and private partners.

Section I: Benefits from Integrated Forest Stewardship: An Holistic Approach

Ecosystem Health – An Endpoint Benefit

Productive, resilient forests are healthy ecosystems. Forests are intricate webs of interacting living and non-living components and each part can have an effect on the system's overall health. Therefore, the health of a forest can measurably affect individual biotic and abiotic ecosystem features.

An *ecosystem* is “A dynamic complex of plant, animal, fungal, and microorganism communities and their associated nonliving environment interacting as an ecological unit.” [*Saving Nature's Legacy: Protecting and Restoring Biodiversity*. 1994. Noss, Reed F. and Allen Y. Cooperrider. Island Press, Washington, D.C. and Covelo, California]. This association of living and nonliving elements forms a matrix of inextricably interrelated natural and cultural systems. Therefore, ecosystems are both natural and cultural phenomena.

Since forests are complex systems, a holistic view is crucial, as results from using the IFS's “systems approach.” Thus, forest health is best addressed at the ecosystem level and not by only looking at a small patch of trees. An exception to this general “rule” is when a park's forest resources exist only at the small patch scale, particularly within parks with a cultural resource emphasis. In these cases, the health of individual trees is a concern, and this can best be addressed by arborists who also employ integrated pest management practices (IPM). (University of Florida IFAS Extension:

<http://www.sfrc.ufl.edu/extension/ee/foresthealth/whatisahealthyforest/section1.html>)

Therefore, by implementing the *IFS* approach to forest stewardship, a park is making a strong contribution to their region's *ecosystem health*. *Ecosystem health* represents “...a desired endpoint of environmental management, but it requires adaptive, ongoing definition and assessment...”, according to Robert Costanza and Michael Mageau, (*Aquatic Ecology*, Vol. 33, Number 1, 105-115; 1999. Kluwer Academic Publishers, The Netherlands). A healthy ecosystem is one that is sustainable – that is, it has the ability to maintain its structure (organization) and function (vigor) over time in the face of external stress (resilience).

Opportunity for Action: The Need for an Integrative Forest Strategy

With the advent of the 21st Century, the NPS and other forest management organizations are faced with an increasing number of challenges to their long term sustainability and ecological integrity of forests. These include threats from current and future invasive species, forest insects and diseases; potential impacts from global climate change; losses to native biodiversity, internal and external habitat fragmentation; problems stemming from park-land ownership division; genetic isolation; unnatural fire regimes; pressures from adjacent park/rural/urban interfaces and from human development in the surrounding geographic region; qualitative changes due to the aging of forest ecosystems; and pressures from potentially increasing numbers of park visitors, as well as from internally-driven initiatives and developments. In addition, changes to ecosystem components, such as species presence, biodiversity and associations, that originally evolved under natural disturbance-initiated conditions have been reduced or eliminated, mostly due to human alterations to the ecosystem.

Ecological integrity is the ability of an ecological system to support and maintain a community of organisms that has a species composition, diversity, and functional organization comparable to those of natural habitats within a region.

In consideration of these formidable challenges to the forest resources within its parks, it is recognized that most NPS forest resources would benefit from increased active management to advance overall forest health through improved forest stewardship. So, to promote forest health, the *IFS* was developed to:

- 1) Help parks determine what forest resources they have, health condition, and threats
- 2) Provide guidance for obtaining technical assistance to develop a general desired condition;
- 3) Review current management strategies and promote practices that reduce or halt forest degradation
- 4) Promote forest stewardship in parks by providing access to relevant information;
- 5) Sustain long-term forest health by focusing efforts to establishment and maintain ecological integrity and resilience using effective ecosystem management practices.

Rationale for Improving Forest Ecological Integrity and Resilience

As the respected American wildlife ecologist and conservationist Aldo Leopold observed, “To keep every cog and wheel is the first precaution of intelligent tinkering.” [Page 190, Leopold, Aldo. (1966) {1949, 1953}. *A Sand County Almanac – With Essays on Conservation from Round River*. Ballantine Books, pp. 295]. In the spirit of Leopold’s admonition, the *IFS* strategy is based upon the belief that any natural, interactive *system* – whether an ecosystem, a biome, an ecological community, or an individual organism – can achieve its highest level of potential long-term health when it is complete (or whole) and when it benefits from the presence of all of its natural components, including natural form and functions. When this general desired condition is present – which is termed having *ecological integrity* – that natural system is also most likely to have the greatest *ecological resilience*, or ability to recover from impairments to that system, such as from invasive species, diseases, catastrophic natural events and climatic variations, and from adverse human actions. Once achieved and maintained, these qualities provide for long term resource sustainability.

Since many NPS units are rather limited in their geographic size and frequently lack strong ecological connections to their surrounding natural ecosystem because of incompatible adjacent land uses, relatively few NPS units can claim to contain a complete forest ecosystem, biome, or ecological community. Because of this disconnection to the surrounding ecosystem’s components, processes, and flow of genetic materials, forest resources within parks tend to lose their ecological integrity over time.

By promoting ecological integrity and resilience as a general desired condition, or end goal, in forest resource management within NPS units, park resource managers can:

- 1) Conserve and sustainably manage their forest resources.
- 2) Restore as many of the missing ecosystem components to sustain forest systems in the park as is practicable and appropriate.

- 3) Work to promote the establishment of linkages to the greater landscape outside of parks in order to facilitate dynamic species movement and to connect with external ecosystem components and processes.
- 4) Protect these resources from further impairment.

With the *IFS* approach, *ecological integrity* is the end goal, or general desired condition, for sustainable forest resource stewardship within a park; *ecosystem management* is the process to get there. Both contribute to the establishment of *ecological resilience*. Therefore, managing for ecological integrity and resilience represents a desirable attribute, condition, or goal for promoting the long-term sustainability of park natural and wilderness resources, and particularly for NPS forest resources.

The goals of the *IFS* approach are grounded in the NPS Organic Act of 1916 and the NPS General Authorities Act of 1970. According to *NPS Management Policies 2006*, Section 1.4.3:

“The fundamental purpose of the national park system, established under the Organic Act and reaffirmed by the General Authorities Act, as amended [by the Redwood amendment of 1978], begins with a mandate to conserve park resources and values. This mandate is independent of the separate prohibition on impairment [as established through both the Organic Act of 1916 and as a reiteration of the provisions of the Organic Act through the Redwood amendment of 1978] and applies all of the time with respect to all park resources and values, even when there is no risk that any park resources and values may be impaired.”

In addition to its compliance with NPS policies, implementation of this *IFS* approach can make a significant contribution to the enhancement and protection of the nation’s natural resource-based “life support” system.

Forests as Natural Resources, Cultural Resources, or Both?

Forest and forest resources in national parks can be managed as natural resources, cultural resources, or a blend of both, and is strongly influenced by the purpose of the park, based on its enabling legislation. Hence, management considerations can occur anywhere along a transitional scale between purely natural or purely cultural emphases, depending upon the legislated purpose of the park, and the park’s overall resource conditions, and the relationship of the park’s forest resources to that purpose and those resource conditions.

Logically, a park that was created for the primary purpose of preserving unique natural resource features, such as specific forest ecosystems or ecosystem components, should manage those resources along ecological parameters. Conversely, parks that were established to preserve unique or important cultural features and events would generally manage their forest resources as part of the park’s main cultural purpose. However if that park’s forest resources are *a natural feature within the cultural landscape* and play a significant role or contribution in meeting that purpose, then the park’s forest resources are managed *in a balanced approach* for both natural AND cultural resource purposes and values,. For example, entire forests may be cultural resources in their own right, such as when they are part of or contain an entire ethnographic landscape or Traditional Cultural Property. They may contain specific cultural resources, such as individual trees with historic or cultural significance relative to the park’s purpose and interpreted story, or they could be part of an intentionally designed cultural landscape. Yet the

trees and the forest they create still need to be managed to some extent as biological resources in harmony with the cultural goals.



Sunrise at dawn over the Mound City Group in Chillicothe, Ohio. A cultural landscape containing forest resources. Hopewell Culture National Historic Park Credit: National Park Service

Before proceeding with implementation of the *IFS*, park resource managers should seek clarification of their park’s forest management purposes and objectives with appropriate experts and partners. For example, those working within cultural resource-purposed parks should refer to their park’s Cultural Landscape Report (CLR) for guidance on landscape maintenance. Forests may be: cultural landscapes or parts of cultural landscapes; ethnographic resources or contain ethnographic resources (*e.g.*, cambium-peeled trees); archeological resources (*e.g.*, pre-contact culturally modified trees); they may contain historic buildings, historic structures or historic objects. They may also be located within designated Wilderness, which does not alter the mandate to preserve cultural resources found within the forests; it just alters the approach to management (*i.e.*, using minimum tools). In addition to, or in the absence of, specific cultural resource planning documents, they should consult with the cultural resource technical expert for the park or the region for guidance and reach consensus on site management goals.

The “Bottom Line” on Potential Benefits from the IFS Approach

The long-term benefits from implementation of the IFS systems approach can be significant for promoting and maximizing long-term forest health and sustainability. First, the park can realize the four potential benefits that could come from establishing the general desired condition that their forest resources should be managed to promote their ecological integrity and resilience, in support of reasons presented under “Rationale for Improving Forest Ecological Integrity and Resilience” page 4 above.



Elkhorn Tavern in Winter, Pea Ridge National Military Park, Arkansas. A cultural landscape with its associated forest resources. Credit: National Park Service

Second, the IFS can help park resource managers to improve the resistance of their park's forest resources to, and minimize impairment from, pests, insects and diseases, and to potentially recover more quickly from other disturbances, both of natural and human origin, while also improving their safety for visitors and staff.

Support for Taking Action

NPS *Management Policies 2006* provides guidance regarding "Unacceptable Impacts" to park resources. When applied to forest stewardship and the maintenance of resource quality, it states:

"The impact threshold at which impairment occurs is not always readily apparent. Therefore, the Service will apply a standard that offers greater assurance that impairment will not occur. The Service will do this by avoiding impacts that it determines to be unacceptable. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable." (NPS *Management Policies 2006*; Section 1.4.7.1, Unacceptable Impacts; p. 12). Here, "impairment" is defined as *"An impact that, in the professional judgment of a responsible NPS manager, would harm the integrity of park resources or values and violate the 1916 Organic Act's mandate that park resources and values remain unimpaired."* (NPS *Management Policies 2006*; Glossary, p. 158).

Further guidance on resource “impairment” can be found at *NPS Management Policies 2006*; Section 1.4, Park Management, sub-sections 1.4.4 and 1.4.5, p. 11).

In addition, *NPS Management Policies 2006* also provides guidance for “Improving Resource Conditions within the Parks:

“The Service will also strive to ensure that park resources and values are passed on to future generations in a condition that is as good as, or better than, the conditions that exist today. In particular, the Service will strive to restore the integrity of park resources that have been damaged or compromised in the past. Restoration activities will be guided by that natural and cultural resource-specific policies identified in chapters 4 and 5 of these Management Policies.” (*NPS Management Policies 2006*; Section 1.4.7.2,

Improving Resource Conditions within the Parks; p. 12-13).

The IFS also supports the following goals contained within the NPS Director’s Call to Action, (<http://www.nps.gov/calltoaction/>) a Service-wide initiative that is a call to all NPS employees and partners to commit to actions that advance the Service toward a shared vision for 2016 and the Service’s second century. The IFS supports the following Call to Action goals:

22: Promote large landscape conservation to support healthy ecosystems and cultural resources;

37: Protect the health of our watersheds by improving water quality, aquatic habitat, and ensuring adequate flows for public enjoyment;

38: Protect clean, clear air and spectacular scenery now and for future generations.

In the face of the broad array of diverse threats to forest health, solutions to these challenges must be derived from many sources. The intention behind the *IFS* is to draw from a wide variety of sources the contacts, key information, and practical assistance that are useful for raising awareness of forest stewardship requirements, that facilitate a more pro-active and comprehensive strategy to overall forest stewardship excellence, and that promote a balanced approach to forest stewardship with other park resource priorities, needs and external influences.

“Some Restrictions Do Apply”

It should be noted that implementation of the *IFS* strategy to the stewardship of forest resources within NPS parks does have some restrictions as it cannot:

- Entirely remove future threats from invasive or exotic species, insects, or pathogens.
- End the occurrence of catastrophic natural events.
- Stop potential climatic variations or their associated impacts.
- Guarantee that there will never be any potentially adverse human impacts to park forests.

Note: The current accepted definition of the term “exotic” is defined in Executive Order 13112, Invasive Species, available at <http://www.invasivespeciesinfo.gov/laws/execorder.shtml>.

It is also important to note that while implementation of the *IFS* strategy can directly support a park’s purpose, it is not intended to be used to change the purpose of a park, as defined from its

enabling legislation, together with its primary management guidance documents. Likewise, it is not intended to change the defined management direction of a park's forest resources as defined from its enabling legislation or its management documents.

The IFS and Environmental Compliance

The *IFS* is not a decision-making document; it is a strategy advocates a strategy for park managers that provides a holistic, multi-disciplinary, science-based “systems approach” for improving and sustaining the overall health of forest resources in national parks. It advocates a process for achieving the general desired condition in which a park's forest resources are managed over time to promote *ecological integrity* and *ecological resilience* through the implementation of the principles of *ecosystem management* in a manner that is consistent with the purpose of each park *and* appropriate to each type of forest resource. The *IFS* also advocates linkages to the greater landscape outside of parks to facilitate dynamic species movement, connection with external ecosystem components and processes, and to help mitigate the effects of climate change.

Beyond raising awareness to various resource management tools, techniques and opportunities for accomplishing this goal, and beyond providing professional contacts who might provide technical assistance to this end, any actions that result from or occur in conjunction with the implementation of any aspect of the *IFS* may need to be evaluated for their potential impacts to the environment, as required by the National Environmental Policy Act (NEPA) of 1969, as amended, and as required under the National Historic Preservation Act, Section 106. Depending on the proposed action, the appropriate environmental compliance may be a memo to the files, a categorical exclusion, an environmental assessment, or an environmental impact statement. Please review any resulting proposed actions with your park's NEPA Coordinator and Section 106 Coordinator early in the discussions of your project to determine the level of environmental documentation that may be needed, if any.

Section II: Principles for Promoting Excellence in Forest Health and Management



View across the Yellow River Valley, Effigy Mounds National Monument. Floodplain and upland forest biomes. Credit: National Park Service

The purpose of Section II is to provide parks with a strategic framework for thinking about how to best promote the concept of managing forest resources within national park units using a multi-disciplinary, science-based “systems approach” in order to improve and sustain the optimal health of their forest resources, as defined within the *IFS*’s Section I: Purpose, Opportunity for Action, and *IFS* Guide. It defines what is meant by managing for *ecological integrity and ecological resilience through ecosystem management*, in a manner that is consistent with the purpose of each park *and* appropriate to each type of forest resource and management emphasis, as well as many related terms and concepts. For the *IFS*, achieving these conditions represents excellence in forest stewardship and forest ecosystem health. Whether a forest possesses natural or cultural values, the integrated approach to forest stewardship is equally applicable as an approach for managing for resource resilience. With this systems approach to forest resource stewardship, park resource managers are encouraged to consider management of their park’s forest resources from both within *and* outside the park by taking a regional landscape and inter-connectivity perspective. In the end, a park’s forest health is tied directly to, and as a contributing component of, the greater natural and cultural environmental systems of its geographic region.

Know Your Forest Resource!

Before a park undertakes the *IFS* approach, it is essential to understand the forest resources at the park and what components are critical to sustain the ecological integrity of the resource to maintain itself

For the purpose of the *IFS* approach, a “*forest resource*” constitutes *any* arboreal (tree) feature, component, or entity within, or associated with, a park. An individual tree, a group planting, or a large, expansive forested area that can also constitute an ecological community can be a forest resource. Therefore, the holistic *IFS* systems approach methodology should be applied, as appropriate, to each park’s forest resources as they occur *anywhere along a continuum* that ranges from:

- 1) Natural or native forest biomes or communities, including remnants, ecotypes, corridors, or patches;
- 2) Forest resources as part of the managed cultural or ethnographic landscape, including human-designed forest plantations or forested landscapes; or
- 3) Individual specimen trees as landscape design elements and aesthetic components of the park’s cultural or developed landscape.

The *IFS* approach does apply to both natural and cultural resource-focused parks, particularly if they manage natural forest components or human-designed landscapes containing trees within their cultural landscape. One example of this natural-cultural resource interface can be observed from Acadia National Park’s Bakers Island Lighthouse. In the image below, the cultural landscape needs to be managed within the larger context of the natural landscape. While this may present some conflict in management goals and approaches, each cultural and natural component of the landscape has its own specific management goals and requires its own specific management actions that must be integrated to create landscape scale continuity. The *IFS* approach would recognize these separate needs and also manage for unity.



Interface between cultural resources and natural forest. Baker Island, Acadia National Park, Maine
Credit: National Park Service

In coordination and compliance with a park's Cultural Landscape Inventory, CLI, or Cultural Landscape Report, CLR (<https://irma.nps.gov/App/Portal/Home>, search by park name, or by "Cultural Landscape Inventory" or "Cultural Landscape Report"), or the NPS *Inventory and Management (I&M) Program*, and in consultation with fire ecology experts, park cultural resources are inventoried and documented to help resource managers to determine what is culturally important about a park's landscape. The CLR directs the treatment of cultural resources, which may include the care of individual trees and other forest resources. Therefore, the emphasis of any particular *IFS* principle depends upon the specific resource management goals of the park.

Getting Started: How to Use the IFS

Part A: IFS Short-term Strategic Principles

Part A encourages parks to use Best Management Practices (BMPs), including the application of Integrated Pest Management (IPM) principles to proactively address forest insects and diseases, and to work to establish a good working relationship with forestry experts from within the NPS, from the US Forest Service through the Memorandum of Understanding (MOU) between the agencies in support of forest health, universities and Extension offices, and other forest management professionals, in order to achieve the highest level of excellence in the management of their forest resources now.

General Desired Condition:

Forest resources within the park are managed through the application of BMPs for optimal health and are well-maintained. They are regularly and proactively monitored for the presence of forest insects, diseases, and damage, are not a threat to human health and safety, and present minimal risk for collateral damage to park resources and private property.

IFS PRINCIPLE 1: APPLY BEST MANAGEMENT PRACTICES (BMPs) TO FOREST RESOURCE MANAGEMENT

Parks use established BMPs in the day-to-day management of their forest resources to maintain, improve, or restore optimal health and condition to those resources in a manner that is consistent with the purpose of the park and appropriate for each type of forest resource and its management emphasis.

What are “Best Management Practices”?

According to NPS Management Policies 2006 (Glossary, p. 156):

“Best Management Practices (BMPs) are practices that apply the most current means and technologies available to not only comply with mandatory environmental regulations, but also maintain a superior level of environmental performance.”

BMPs are directly related to the application of Sustainable Practices and Principles. They are also defined by NPS Management Policies 2006 (Glossary, p. 159) as “Those choices, decisions, actions, and ethics that will best achieve ecological/biological integrity; protect qualities and functions of air, water, soil, and other aspects of the natural environment; and preserve human cultures. Sustainable practices allow for use and enjoyment by the current generation, while ensuring that future generations will have the same opportunities.

In the end, BMPs are synonymous with Environmental Leadership, which:

“advocates, on both personal and organizational levels, cooperative conservation, best management practices, best available technology, adaptive management, the principles of sustainability, and making collaborative decisions that demonstrate a commitment to those practices and principles.” NPS Management Policies 2006 (Glossary, p. 157).

It is through the day-to-day implementation of BMPs that parks achieve the highest level of excellence in the management of their forest resources now! For example, BMPs include such techniques and considerations as the application of Integrated Pest Management (IPM), Inventory and Monitoring (I&M) of park resources, and the appropriate application of fire management.

General Desired Condition:

Forest resources within the park are well-managed based upon NPS policies and BMPs, but also through guidance and expertise provided by a broad network of forest stewardship professionals, located both within and outside of the NPS. The park actively cultivates a strong working relationship with these partners, including the US Forest Service (through the Memorandum of Understanding [MOU] between the agencies in support of forest health), universities and Extension offices, and other forest management professionals.

IFS PRINCIPLES 2: ESTABLISH WORKING RELATIONSHIPS WITH INTERNAL AND EXTERNAL FORESTRY MANAGEMENT PROFESSIONALS

Parks establish good working relationships with forestry experts from within the NPS, from the US Forest Service (through the Memorandum of Understanding [MOU] between the agencies in support of forest health), universities and Extension offices, and other forest management professionals, in order to have the information, technical assistance, and potential funding assistance necessary to help them to achieve excellence in forest health, as well as their identified forest stewardship goals.

Why Establish Working Relationships with Other Forest Management Professionals?

Forests are complex, living systems. Similarly, individual trees can require the application of certain technical expertise to help ensure their optimal health in a designed landscape. Unless a park has someone on staff who has been educated in forest ecology or as an arborist (a specialist in planting and transplanting, pruning, and diagnosing the ailments of trees, and in tree surgery and tree maintenance), achieving excellence in forest or tree stewardship can be challenging, if not almost impossible, for the average person. Add to that the IFS's position that park resource managers should be encouraged to consider management of their park's forest resources from both within and outside the park by taking a regional landscape and inter-connectivity perspective, then it becomes imperative that more help is needed to achieve the IFS-recommended general desired conditions. It is for these reasons that parks should establish good working relationships with forestry experts from within the NPS, from the US Forest Service (through the Memorandum of Understanding (MOU) between the agencies in support of forest health, universities and Extension offices, and other forest management professionals, in order to have the information, technical assistance, and potential funding assistance necessary to help them to achieve excellence in forest health, as well as their identified forest stewardship goals. Please refer to Section III, Tools, Programs and Contacts for Achieving Forest Health, to help your park to get started in establishing these good working relationships with other forest management professionals.

Part B: Preparing Our Forests for the Future through Ecological Integrity and Resilience

The *IFS* recommends the application of the following *IFS Strategic Principles* by park leadership and resource managers to help improve and sustain the overall optimal health of forest

resources within national park units long into the future. They are intended to be applied, to the extent practicable and appropriate, to achieve the highest level of *ecological integrity and ecological resilience* through *ecosystem management*.

The principles presented under Part B apply to parks that require their forest units to be managed as *natural and cultural resources* with the combined strategic goal and general desired condition of managing these resources for their overall ecological integrity and, resilience. Management goals for both natural and cultural forest resources can range from their preservation, restoration, rehabilitation, reconstruction, or the reconstruction of ecological form and function. Concerns in achieving these goals may include the ongoing protection of the various types of forest resources from damage due to the effects of natural processes, including pests, insects and diseases (both native and non-native), and from human abuse (both accidental and intentional).

Sustainable Resource Stewardship

The principles presented under Part B, and the methodologies suggested under Part C of this Section, are intended to help parks move their forest resources into a position of long-term sustainable resource stewardship. Resource stewardship is defined within NPS Management Policies 2006 as follows:

“The cultural and natural resource protection ethic of employing the most effective concepts, techniques, equipment, and technology to prevent, avoid, or mitigate unacceptable impacts.”
(NPS Management Policies 2006; Glossary; p. 159).

General Desired Condition:

The dominant ecological characteristics of forest resources within the park (e.g., elements of composition – both physical and biological, structure, function, and ecological processes) occur within their natural ranges of variation and allow them to withstand most perturbations imposed by natural environmental dynamics or human disruptions.

IFS PRINCIPLE 3: ECOLOGICAL INTEGRITY

Parks manage their forest resources to achieve maximum ecological integrity as a general desired condition in a manner that is consistent with the purpose of the park and appropriate for each type of forest resource and its management emphasis.

What is “Ecological Integrity”?

For the purpose of this IFS strategy, the definition of the term “*ecological integrity*” is taken from the NPS’s draft *The Ecological Integrity Assessment Framework: A Framework for Assessing the Ecological Integrity of Biological and Ecological Resources of the National Park System* (version 1.0, January 2009):

“Ecological integrity is the ability of an ecological system to support and maintain a community of organisms that has a species composition, diversity, and functional organization comparable to those of natural habitats within a region. An ecological system has integrity, or a species population is viable, when its dominant ecological characteristics (e.g., elements of composition, structure, function, and ecological processes) occur within

their natural ranges of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human disruptions.” (Parrish, J.D., D.P. Braun et al., 2003. “Are We Conserving What We Say We Are? Measuring Ecological Integrity within Protected Areas” BioScience 53(9): 851-860.

Simply stated, ecosystems have *integrity* when their native components are intact, including:

- Abiotic components (the physical elements, *e.g.*, water, rocks, soil).
- Biodiversity (the composition and abundance of species and communities in an ecosystem, where forests, grasslands, bogs, and wetlands represent *landscape diversity*, while species such as black bears, brook trout, vireos, eastern white pine and American chestnut represent *species diversity*).

This includes the natural ecosystem processes (the physical, chemical, and biological “engines,” or processes, that make ecosystems work, *e.g.*, fire, flooding, predation, ecosystem form and function, and organisms’ ability to reproduce).

The adoption of ecological integrity as a resource management general desired condition by the NPS through the *IFS* strategy directly supports the NPS Organic Act of 1916 (16 U.S.C. 123, and 4), as set forth in the Act of August 25, 1916 (39 Stat. 535) and amendments thereto, which states, in part:

“The [National Park] service...shall promote and regulate the use of Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

Adoption of this definition of ecological integrity by the *IFS* strategy also places the NPS in a parallel natural resource management position with Parks Canada, whose functional – and concise – concept of ecological integrity is reflected within the *Canada National Parks Act*, the law governing national parks in Canada (<http://www.pc.gc.ga>). There, “ecological integrity” means, with respect to a park,

“...a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes.”

With this definition helping to guide its natural resource management, Parks Canada’s objective is to allow people to enjoy national parks as special places without damaging their integrity.

Additional Considerations Regarding Ecological Integrity

While the *IFS* has adopted the statement above as its definition of *ecological integrity*, the reader should know that the concept of ecological integrity is not without some controversy and professional opinions on the topic can differ.

In developing a paradigm for ecological (or ecosystem) integrity, De Leo and Levin make the following statements, in their excellent and thought-provoking paper *The Multifaceted Aspects of Ecosystem Integrity* (De Leo, G.A. and S. Levin, 1997. *The Multifaceted Aspects of Ecosystem Integrity*. Conservation Ecology [online] **1** (1): 3. Available from the Internet: URL <http://www.consecol.org/vol1/iss1/art3/>):

“According to Webster's dictionary, ‘integrity’ is ‘the state of being unimpaired, sound,’ ‘the quality or condition of being whole or complete.’ Therefore, a system subject to external disturbance will retain its integrity if it preserves all its components as well as the functional relationships among the components. Similarly, ecosystems are organized structurally into populations, species, and communities of organisms that interact with each other and with abiotic features of the environment, and functionally into production and consumption components that process energy and materials (Limburg et al. 1986). Measurable definitions of integrity include those of Cairns (1977): “the maintenance of the community structure and function characteristic of a particular locale or deemed satisfactory to society,” and of Karr and Dudley (1981): “the capability of supporting and maintaining a balanced, integrated, adaptive, community of organisms having species composition, diversity, and functional organization comparable to that of natural habitats of the region.” Integrity is a definition that reflects the capability of the system to support services of value to humans; even Karr and Dudley's definition reflects a human perspective.

“The concept of ecosystem integrity is not free from criticisms (Anderson 1991, Rolston 1994). However, rather than engaging in endless debates over which is the best and most comprehensive definition of integrity, we agree with Noss (1995a) that it is much more useful to characterize in detail the functional and structural aspects of ecosystems to provide a conceptual framework for assessing the impact of human activity on biological systems and to identify practical consequences stemming from this framework.”

In consideration of this, it should be noted that the concept of ecological, or ecosystem, integrity is far from a panacea for any management problem, including forests. De Leo and Levin note that the definition of ecosystem integrity simply reflects the capability of ecosystems, however defined, to support services, including purer aesthetics, that humans value. Ecosystem integrity is not an absolute, monolithic concept, but a multi-dimensional, scale-dependent abstraction; there is no unequivocal way to apply it in decision making. Measures of integrity must recognize the importance of maintaining processes that support those critical services (De Leo, G.A. and S. Levin, 1997. *The Multifaceted Aspects of Ecosystem Integrity*. Conservation Ecology [online] **1** (1): 3. Available from the Internet: URL <http://www.consecol.org/vol1/iss1/art3/>).

How should a resource manager implement notions of ecosystem integrity? De Leo and Levin go on to suggest that the first step is to recognize that this is not the domain of the manager or of the scientist alone. Integrity reflects the ability of ecosystems to sustain services to humans, and the identification of those services can best emerge from multi-sector partnerships, in which all stakeholders seek agreement on the uses to which an ecosystem will be put, recognizing the linkages with other ecosystems. From such an agreement on uses can come the identification of a set of measures that represent the status and trends of those services (De Leo, G.A. and S. Levin, 1997. *The Multifaceted Aspects of Ecosystem Integrity*. Conservation Ecology [online] **1** (1): 3. Available from the Internet: URL <http://www.consecol.org/vol1/iss1/art3/>).

General Desired Condition:

Forest resources and their associated ecosystem within the park have the capacity to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks, to the greatest extent practicable.

IFS PRINCIPLE 4: ECOLOGICAL RESILIENCE

Parks manage their forest resources to achieve maximum ecological (ecosystem) resilience as a general desired condition in a manner that is consistent with the purpose of the park and appropriate for each type of forest resource and its management emphasis.

What is “Ecological Resilience”?

The IFS strategy has adopted the following definition of ecological (or ecosystem) resilience:

“Ecological resilience is the capacity of an [eco]system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.” (Walker, B., C.S. Holling, S.R. Carpenter and A. Kinzig. 2004. Resilience, Adaptability and Transformability in Social-Ecological Situations. *Ecology and Society* 9(2): 5. [online] URL <http://ecologyandsociety.org/vol9/iss2/art5//>).

Further clarification of the term ecological resilience comes from the Resilience Alliance:

“What [ecological resilience] means is that a resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future. Humans are part of the natural world. We depend on ecological systems for our survival and we continuously impact the ecosystems in which we live from the local to global scale. Resilience is a property of these linked social-ecological systems (SES).” (Quoted from the “Resilience Alliance,” <http://www.resalliance.org>).

General Desired Condition

Forest resources and their associated ecosystem within the park achieve sustainability based on an adaptive, collaboratively developed vision of desired future conditions that integrates ecological, socioeconomic, and institutional perspectives, applied within a geographic framework, and defined primarily by natural ecological boundaries.

IFS PRINCIPLE 5: ECOSYSTEM MANAGEMENT *Parks manage their forest resources to maintain or restore the composition, structure, function, and delivery of ecosystem services of their natural or modified ecosystems for the goal of achieving sustainability as a general desired condition in a manner that is consistent with the purpose of the park and appropriate for each type of forest resource and its management emphasis.*

What is “Ecosystem Management”?

“Ecosystem management is an approach to maintaining or restoring the composition, structure, function, and delivery of services of natural and modified ecosystems for the goal of achieving sustainability. It is based on an adaptive, collaboratively developed vision of desired future conditions that integrates ecological, socioeconomic, and institutional perspectives, applied within a geographic framework, and defined primarily by natural ecological boundaries,” (United Nations Millennium Ecosystem Assessment, 2005).

From another perspective, ecosystem management focuses on the conditions of the ecosystem, with goals of maintaining soil productivity, gene conservation, biodiversity, landscape patterns, and the array of ecological processes (Issued by the Society of American Foresters, 1993).

For the purposes of this *IFS* strategy, the concept of “*ecosystem management*” is adopted from that used by Parks Canada (<http://www.pc.gc.ca>). For NPS parks, ecosystem management promotes consideration of the following:

- Ecological integrity should be assessed with an understanding of the regional evolutionary and historic context that has shaped the system. For example, current associations and use, and past occupation and management of the land by American Indians or traditionally associated peoples, as well as historic, non-native occupations and uses, such as agriculture, mining, forestry, etc., should be taken into account when managing for ecological integrity of a national park;
- Because ecosystems are constantly changing, conservation strategies should maintain or restore key ecological processes that reflect natural, dynamic conditions. For example, prescribed burning is used as a way to reintroduce fire in national parks;
- National parks are part of larger ecosystems and must be managed in that context. This calls for parks to be integrated into their surrounding landscape to the extent practicable so that they do not function as isolated islands;
- Populations of species should be managed to levels that have a high likelihood of maintaining themselves;
- Ecosystems have characteristic rates of change. Understanding rates and direction (trajectory) are critical to understanding the system. For example, how do the influences from climate change affect parks and how does the range of plausible climate futures projected for a park influence management decisions regarding ecological integrity?
- Parks have a limited capacity to withstand use. Accommodating visitors is a basic tenet of the NPS’s Organic Act of 1916, as amended, but human use and facilities should be adapted to be compatible with supporting an appropriate carrying capacity to protect park ecosystems through the type, amount, and timing of visitor use;
- Ecological integrity is not an absolute, monolithic concept, but a multi-dimensional, scale-dependent abstraction that can best be assessed and understood at a landscape scale. While ecological integrity cannot be assessed at the scale of a single forest stand, campground, or parking lot, it can be impacted at any scale.

According to Jacobson and Long (Jacobson, Michael and Alan Long. 1998. Ecosystem Management (EM) as a Basis for Forest Stewardship on Private Lands. School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida), common elements within ecosystem management definitions can be summarized as follows:

- 1) Ecosystem management is a *process* (a *means* to an end, not the end in itself);
- 2) Ecosystem management means:
 - a) Focusing on long term resource sustainability.
 - b) Maintaining and enhancing biodiversity.
 - c) Thinking in broad spatial and temporal scales.
 - d) Integrating economics, sociology and ecological systems in planning.
 - e) Adapting management plans in response to monitoring and new scientific information.
 - f) Recognizing the complexity and interconnectedness of “ecosystems.”
 - g) Recognizing that humans are part of the ecosystem.

Factors and Tools Related to Ecosystem Management

Ecosystem management depends on the identification of factors which influence the state of the environment, such as ecosystem stressors and climate change, which will inform the type of resource strategy that should be used and how to best evaluate/monitor that strategy. Some examples of these include:

Factors

Ecosystem Stressors

Stressors are events, actions, factors, or long-term change in natural processes that prevent ecosystems from recovering their integrity. By their very nature, stressors affect the state of ecological integrity, as well as those cultural resources related to ecological integrity, within national parks.

Stressors originate from both inside and outside the parks. Inside the parks, the presence of non-native species, the extinguishing of natural fires, high levels of visitor use, transportation corridors, non-conforming activities, and inappropriate infrastructure all affect ecological integrity. Stressors from outside also cause problems, ranging from regional – such as changes in the landscape in lands adjacent to national parks, urban development, logging, mining, agriculture and transportation – to global in nature, such as long-range movement of air pollutants and climate change. Parks are part of larger ecosystems and very much reflect the state of the larger regions where they are located.

Some examples of internal and external stressors include, but are not limited to:

- Habitat loss.
- Habitat fragmentation.
- Changing climatic trends or extreme events (*e.g.*, abrupt climate change).

- Loss of large carnivores.
- Pesticide impacts.
- Pest species (native or non-native).
- Overuse of resources.
- Shifting human value system overlaid on the ecosystem.

Climate Change

The National Park Service Director stated in a 2011 interview that climate change is:

“...the greatest threat to the integrity of the National Park System that we’ve ever faced.”
[quote from NPS Director Jonathan B. Jarvis in *National Park Service Climate Change Response Strategy*, September 2010; U.S. National Park Service, Washington, D.C.]

Influences from climate change are already impacting natural and cultural resources, including forest resources, which the NPS is charged to protect. The range of impacts and effects that the NPS and other protected area managers will have to deal with are unprecedented and most not well understood.

Secretarial Order 3289, Amendment 1, states that:

“Each bureau and office of the Department must consider and analyze potential climate change impacts when undertaking long-range planning exercises...”

In 2010, the NPS completed its *Climate Change Response Strategy*, a document that outlines a broad framework for how the agency will address climate change. Planning for climate change within an adaptation framework is a cornerstone of that document.

In the new planning world of uncertain climate futures, our traditional ways of “forecast planning,” where we assume a level of knowledge and controllability, become risky. In response to this, the NPS has been exploring a planning process known as *Scenario Planning* in the context of a changing climate, where the objective is to develop and test decisions under a variety of plausible futures.

Human Stressors

Many stressors to forest resources within parks originate with humans and their actions within the local, regional and global ecosystems. These include the introduction – intentionally or otherwise – of invasive species, ranging from forest insects and diseases to larger plants and animals, both native and non-native; contributions to global climate change from human activities; losses to native biodiversity; external habitat fragmentation from adjacent park/rural/urban interfaces and from human development in the surrounding geographic region; disruptions to ecosystem form, function and natural disturbances, including the suppression of natural fire regimes; pressures on forest resources from exploitation and unsustainable recreation from potentially increasing numbers of park visitors; qualitative changes due to the aging of forest ecosystems; and from internally-driven initiatives and developments. Many of these stressors can be effectively addressed while others are beyond our control.

Tools

Ecosystem Restoration

Ecosystem restoration is the process of human intervention in an ecosystem to reestablish the appropriate historical mix of species, numbers, structure, function and processes. For parks, this often means restoration to the period of significance of that park, per its enabling legislation, General Management Plan (GMP), Foundation Document, and Cultural Landscape Report (CLR). This process can be modeled on an ecosystem in a location with similar conditions that is known to be healthy and resilient. It is also intended to try and restore, to the extent practicable, ecosystem form and function by returning as much biodiversity and physical processes to the ecosystem as possible. Forested ecosystems present a unique challenge for ecosystem restoration since many of the ecological connections and processes that bring vibrancy and health to a forest remain unknown.

Ecosystem restoration practices may include:

- Reintroducing native species where they are absent, as appropriate.
- Removing species that are not naturally occurring populations, as appropriate.
- Altering ecological processes to occur at rates that are considered natural for the region.

Examples of the first approach include the reintroduction of *species at risk*. An example of the second approach is the removal of invasive species through individual park actions and through *Exotic Plant Management Teams (EPMTs)*. The last restoration practice mentioned can be illustrated through the application of *prescribed fires* or *controlled flooding*.

In addition, the recent trend in park resource management science is to:

- Recognize that park management should be focused more on ecosystems than on species.
- A shift from a hands-off approach to an active management approach..
- Move away from seeing national parks as stand-alone conservation spaces to seeing them as part of larger systems, including the role of humans, where influences from outside a park – beneficial and harmful – must be considered by park management.

The first statement is based on the belief that ecosystems work best with all parts working together. The second statement recognizes that it is often necessary to intervene in ecosystems to undo the effects of activities in and around the park and maintain the values that parks were created to protect. The last statement presents a trend of increasing interest.

To assist the NPS in maintaining the health and integrity of its priority natural and cultural forest resources, as well as its parks' ecosystems, the *IFS* strategy considers maintenance and restoration of ecological integrity to be a high priority and general desired condition. This particularly applies to those parks with forest units requiring a balanced approach to managing their natural and cultural resources as components of the natural landscape. Realistic goals and objectives can define the direction and extent of ecosystem development with the realization that, in some cases, ecosystem restoration is simply not practical or applicable. These changes must

then be carefully monitored to ensure that ecological integrity of the park's forest resources, as well as its environment, continues to improve.

Fire Management

The application of fire to park environments has been a highly controversial and emotionally charged topic for the NPS, as well as for other resource management organizations, for over 100 years. For most of that time park managers – and society – have viewed fire as a destructive force and have called for fire suppression.

More recently, ecological science has presented a new understanding of fire as an essential part of nature and forested ecosystems. Eliminating fire from some ecosystems is like shutting out the wind or the rain. The question is what is the best and most effective way to return fire to park ecosystems, as well as to their forests, that have evolved under a fire-disturbance regime? Fires were a prevalent factor in forests before the European settlement of this continent, and evidence exists that fire was used as a management tool by American Indians in many, but not all, forests. With fire suppression, most researchers agree that native ecosystems have been significantly altered. Fire-dependent forest ecosystems are becoming older and more closed-in. The open habitats favored by many species are getting rarer. Vegetation mosaics and the biodiversity they sustain are being lost.



Fire management using prescribed burning Credit: U.S. Forest Service

Fire ecology recognizes fire as the re-newer, recycler and re-arranger of many – but not every – ecosystem. Some forest ecosystems have evolved with fire and are, essentially, fire-dependent in sustaining their species diversity, structure, and vigor. Other forests are not fire-dependent for their ecological integrity. But when fire is necessary, it kick-starts regeneration by providing ideal growing conditions for many species, but not for all. Many plants and animals have

adapted to fire and the conditions it creates. The cones of many pine species have co-evolved with fire so they open and shed their seeds when critical temperatures are reached during fires.

Integrated Pest Management (IPM)

The management of forest resources often includes managing for the threats from forest insects and diseases through the implementation of *Integrated Pest Management (IPM)*. IPM is a tool that can be used in conjunction with other ecosystem management techniques to help parks achieve their forest stewardship goals.

According to *NPS Management Policies 2006*, IPM is:

“a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, by cost-effective means, while posing the least possible hazard to people, resources, and the environment.”
(*NPS Management Policies 2006; Glossary, p.158*).

A principle feature of IPM is recognizing when the threshold of acceptable pest damage has been surpassed.

Pests are defined as:

“...living organisms that interfere with the purposes or management objectives of a specific site within a park or that jeopardize human health or safety.” (*NPS Management Policies 2006; Sec. 4.4.5, Pest Management, and 5.3.1.5, Pest Management*).

The NPS employs IPM specialists at the park, Region, and Washington, D.C. levels who are skilled in addressing forest IPM issues and who serve as technical liaisons to the USFS. In addition, the park, Region, and Servicewide IPM position, provide review and approval or denial of forest insect and disease treatments through the Service’s electronic Pesticide Use Proposal System (PUPS). In addition, the USFS Field offices provide technical assistance, on-site visits, and biological evaluations. Beyond these services and particularly at the small scale level of forest patches and individual trees, certified arborists are generally available on a commercial basis to provide assistance to parks in managing tree health within their parks.

Inventory and Monitoring

NPS parks provide a home for many plants and animals that contribute to the health and stability of a forested ecosystem – from native fungi, mosses, flowers and shrubs to insects, amphibians, reptiles, and mammals. An important challenge for NPS parks is to know what plants and animals occur in a given park, what ecosystems they are part of, and how these species and ecosystems are changing over time, particularly in forested ecosystems.

Park inventories can provide this information by telling us what kind of plants and animals we have, and for some species, about how many we have. In the same way that animals and plants can be classified into species, park ecosystems can be classified into ecosystem types, such as wetlands, forests, grasslands. These can be characterized through inventories and mapping. The cultural resource values of forests are captured in cultural resource inventories, including the Cultural landscape Inventory (CLI), the Ethnographic Resources inventory (ERI), and the Archeological Sites Management Information System (ASMIS). The NPS has a statutory

requirement under Section 110 of the National Historic Preservation Act to identify all cultural resources within each national park.

In addition to knowing what resources we have, we also need to know how the numbers and condition of park species or ecosystems, are changing over time. Monitoring, particularly over the long term, helps us to know how these ecosystems are reacting to environmental changes, and can provide a baseline for assessing ecological integrity and resilience. Information on NPS *Inventory and Monitoring (I&M)* networks and contacts can be found at: <http://science.nature.nps.gov/im>. Information on NPS Cultural Resource inventories can be found at: <http://inside.nps.gov/waso/waso.cfm?prg=68&lv=2>.

Vital Signs Monitoring

Natural resource monitoring is a major component of the NPS Natural Resource Challenge - a program to revitalize and expand the natural resource program within the park service and improve park management through greater reliance on scientific knowledge. The overall purpose for natural resource monitoring is to determine the status and trend in the condition of selected park resources. Monitoring results will be used to assess the efficacy of management and restoration efforts, provide early warning of impending threats, and provide a basis for understanding and identifying meaningful change in natural systems characterized by complexity, variability, and surprises. Monitoring data may help to determine what constitutes impairment and to identify the need to initiate or change management practices.

The intent of park vital signs monitoring is to track a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values. The elements and processes that are monitored are a subset of the total suite of natural resources that park managers are directed to preserve "unimpaired for future generations," including water, air, geological resources, plants and animals, and the various ecological, biological, and physical processes that act on those resources. Information on NPS *Vital Signs Monitoring*, *Vital Signs Networks*, and contacts can be found at: <http://www1.nrintra.nps.gov/im/monitor/index.cfm>

Landscape Ecology and Landscape-Scale Conservation

When forest resources cover extensive geographic areas, it is often beneficial to consider their management within the context of the greater forested and non-forested landscape, both natural and cultural. A useful approach for doing this is through the application of landscape ecology. Landscape ecology is the study of spatial variation in landscapes at a variety of scales. It includes the biophysical and societal causes and consequences of landscape heterogeneity. Above all, it is broadly interdisciplinary. The conceptual and theoretical core of landscape ecology links natural sciences with related human disciplines. Landscape ecology can be portrayed by several of its core themes:

- The spatial pattern or structure of landscape, ranging from wilderness to cities;
- The relationship between pattern and process in landscapes;
- The relationship of human activity to landscape pattern, process and change; and
- The effect of scale and disturbance on the landscape.

More information on landscape ecology can be found through universities that teach landscape ecology or through organizations such as the *International Association for Landscape Ecology* (<http://www.landscape-ecology.org/>).

According to the *Center for Large Landscape Conservation*, located in Bozeman, Montana, the concept of conserving landscape connectivity has gained recognition, over the last ten to twenty years, as a key strategy to protect biodiversity, maintain viable ecosystems and wildlife populations, and promote climate change adaptation for wildlife species. Habitat corridors are the primary tool used to achieve connectivity. It can be considered to be a sub-set of the broader discipline of landscape ecology.

The following definitions of terms have been adopted from the *Center for Large Landscape Connectivity*. The *Center* identified key terms involving “corridors” and “landscape connectivity” through a literature review to gain a better understanding of the terminology pertinent to landscape connectivity, then synthesized their findings into the definitions presented below to add clarity to connectivity discussions (<http://www.climateconservation.org>) and (<http://www.twp.org/sites/default/files/terminology%20CLLC.pdf>).

Landscape Connectivity

"Connectivity" can be broken down into "structural connectivity" and "functional connectivity." Structural connectivity refers to the physical relationship between landscape elements whereas functional connectivity describes the degree to which landscapes actually facilitate or impede the movement of organisms between areas of habitat.

Functional connectivity is a feature of both landscape structure and the behavioral response of organisms to this structure. Thus, functional connectivity is both species- and landscape-specific. Distinguishing between these two types of connectivity is important because structural connectivity does not imply functional connectivity. In general, when the IFS uses the term "connectivity," it is using the functional definition. The concept of connectivity is also important for cultural resources to prevent the fragmentation of historic properties, both visually and functionally. Fragmentation can also block access for traditionally associated people for cultural practices, such as traditional plant collecting. Fragmentation can also destroy the historic integrity of a landscape, or a landscape's context.

Habitat Corridors

Early definitions of habitat corridors approached the concept from a very literal perspective describing them as "linear" or "narrow" strips of land. But central to the rationale behind corridors is the capacity to facilitate movement, which occurs in different patterns and processes, and at different scales depending on the species of interest. Thus, habitat corridors need not be linear or narrow and must be defined from the perspective of the organism or process being targeted for conservation.

More recent definitions reflect a broadened understanding of habitat corridors, which are now described as components of the landscape that facilitate the movement of organisms between areas of intact habitat. Implicit in this definition is the idea that corridors are functional as well as structural elements of the landscape *and* that they are species-specific. For the NPS, a more

integrating concept is that of “landscape conservation corridors” which includes building linkages between conserved lands to protect natural and cultural resources.

Please refer to the following link for excellent information on landscape –scale conservation corridors: <ftp://ftp-fc.sc.egov.usda.gov/WHMI/NBHpdf/nbh613.pdf>

Linkage

Although the term is frequently used synonymously with corridor, "linkage" technically refers to broader regions of connectivity important to facilitate the movement of multiple species and maintain ecological processes. Landscape connectivity principles are noted in the box below.



Example of a forest that is part of the greater natural and cultural landscape mosaic of patches, corridors, matrix and structure. Fall view from East Overlook, Pea Ridge National Military Park, Arkansas Credit: National Park Service

Matrix

Throughout the literature reviewed here, definitions of the "matrix" were generally vague. Most commonly, the matrix is defined as "non-habitat" and/or the portion of the landscape in which habitat patches and corridors are "embedded." This very black and white interpretation fails to capture the myriad land cover types and functional continuum that constitute the matrix.

Precisely, the matrix is any land cover type other than the type of interest. In other words, the matrix may be anything from urban development to agricultural land to grassland or forest.

Matrix lands have the potential to function as habitat – though always as less preferred habitat – as well as the capacity to be barriers to movement. Just as with connectivity, the role played by

the matrix will depend both on its composition and on the unique behavioral response of the species under consideration.

The understanding of matrix is quite different for cultural resource professionals, however. For them, the matrix is the repository of “landscape characteristics”, or broad patterns of human interaction with land that still reflect their historic condition. Here, the focus is to preserve individual features and the matrix in its entirety.

Landscape Permeability

In contrast to landscape connectivity – which characterizes the capacity of individual species to move between areas of habitat via corridors and linkage zones – permeability refers to the degree to which whole landscapes, encompassing a variety of natural, semi-natural and developed land cover types, are compatible with wildlife needs and sustain ecological processes. Multi-scale, multi-stakeholder, sustainable land management strategies that not only target conservation areas like reserves and corridors, but also target the matrix (non-habitat), including areas of human development, are essential to achieving landscape permeability. From the cultural resource perspective, landscape permeability should also translate into access to perpetuate traditional cultural processes.

Scale

In the context of connectivity, scale refers to the spatial and/or temporal dimension in which the conservation target (i.e. species or process) operates. Since species vary widely in the distances and timeframes in which they travel, identifying the operative scale(s) of the focal species or process is critical to designing successful connectivity management programs.



An example of landscape scale in forest management. Flint Trail, Glen Canyon National Recreation Area, Utah Credit: National Park Service

Ecological Network

The ecological network concept embodies several key elements: connectivity at the landscape scale, which is achieved through conservation areas and corridors; permeability at the landscape scale, which is achieved through buffer zones and sustainable use of the matrix; and incorporation of human cultural and/or socioeconomic factors with wildlife needs. Thus, it appears that Bennett

(<http://www.cbd.int/doc/pa/tools/The%20Development%20and%20Application%20of%20Ecological%20Networks.pdf> The Development of Ecological Networks 2004) has aptly defined ecological networks as coherent systems of natural or semi-natural landscape elements configured and managed with the objective of maintaining or restoring ecological functions as a means of conserving biodiversity while also providing appropriate opportunities for the sustainable use of natural resources.

For cultural resources, an equivocal “*cultural resource network*” would consist of those cultural resources, which are the collective evidence of the past activities and accomplishments of people, that *exist within the larger landscape matrix*. Buildings, objects, features, locations, and structures with scientific, historic, and cultural value are all examples of cultural resources. Cultural resources are finite and non-renewable resources that, once destroyed, cannot be returned to their original state. Cultural resources include prehistoric and historic archeological sites, historic standing structures, bridges, cemeteries, and monuments, among others.

Impacts to resources eligible for the National Register of Historic Places must be mitigated through excavation, avoidance, or preservation. All Federal and most State agencies are required to identify and protect cultural resources on the lands they manage (As modified from http://www.nysm.nysed.gov/research/anthropology/crsp/crm_faq.html).

Landscape Connectivity Principles

Patches

- Large reserves/patches are better than small reserves/patches.
- Connected reserves/patches are better than separated reserves/patches.
- Unified reserves/patches are better than fragmented reserves/patches.
- Several reserves/patches (redundancy) are better than one reserve/patch.
- Nearness is better than separation.

Corridors

- Continuous corridors are better than fragmented corridors.
- Wider corridors are better than narrow corridors.
- Natural connectivity should be maintained or restored.
- Introduced connectivity should be studied carefully.
- Two or more corridor connections between patches (redundancy) are better than one.

Matrix

- Manage the matrix with wildlife in mind.

Structure

- Structurally diverse corridors and patches are better than simple structure.
- Native plants are better than introduced plants.

[From: USDA Natural Resources Conservation Service; National Biology handbook, Subpart B –Conservation Planning. 190-VI-NBH, November, 2004. <ftp://ftp-fc.sc.egov.usda.gov/WHMI/NBHpdf/nbh613.pdf>]

Part C: How to Apply Strategic Thinking to Forest Stewardship in Parks

Part C recommends using the *Resource Stewardship Strategy (RSS)* as the strategic resource planning tool with which a park can define long-term, science and scholarship-based comprehensive strategies that are designed to achieve and maintain the policy-based conditions of a park's priority natural and cultural resources (including forest resources), as established in its *General Management Plan (GMP)* and/or *Foundation Document*. It is through this means that strategies for managing a park's forest resources for their ecological integrity and resilience can be identified and defined, in balance with other park resources.

The *Resource Stewardship Strategy (RSS)* is the preferred tool for parks to use to identify and develop long-term, science and scholarship-based comprehensive strategies. These strategies are designed to achieve and maintain the policy-based conditions of a park's priority natural and cultural resources (in the absence of any other more specific plan), as established in its *General Management Plan (GMP)* and/or *Foundation Document*. In addition, they can directly contribute to the implementation of sustainable forest management in the park. Furthermore, the *RSS* serves as a linkage between the park *GMP* and strategic planning, where personnel and financial resources are allocated to implement resource stewardship activities.

Step 1: Confirm the Purpose of Your Park and its Forest Stewardship Goals

In order to understand exactly what a park's forest resource stewardship goals should be and, consequently, which direction its forest stewardship should take, park resource managers should review the purpose of their park, as found in their enabling legislation and in park-specific resource planning, *General Management Plan (GMP)* or *Foundation Document*. It should be remembered, however, that while the park's enabling legislation and *GMP* are important, they may not give a complete understanding of the park, or, in the case of *GMPs*, could be outdated. You may also find guidance regarding forest resource management in one of the park's *Cultural Landscape Reports (CLR)*, as one may exist for each cultural landscape within the park, or within a *Vegetation Management Plan* or *Forest Management Plan*. These documents, together with the consensus of the park's superintendent and staff, provide the desired conditions or direction needed to determine what the park's forest resource stewardship goals should be.

If no clear direction is given, a determination can be made based on the answer to the following questions:

- 1) Was the park established *primarily* to protect, conserve, and interpret unique *natural* resources (particularly if forests are stated as a primary feature) with no or minimal cultural resources present? Be sure to look beyond the park's enabling legislation, however, since cultural resources may be present within the park, but not identified within the enabling legislation. These must still be identified and managed according to the standards of the Organic Act of 1916, as amended, the National Historic Preservation Act, and *NPS Management Policies 2006*. If so, then the park's forest resources are a functional component of the greater surrounding *natural* ecosystem, and need to be managed within that context (to the extent practicable) for that purpose.
- 2) Was the park established *primarily* to commemorate, protect, conserve, and interpret an *historical or cultural* event, feature, or purpose, but the park has significant remnant *native* forest parcels present that still require appropriate forest stewardship within the context of the cultural landscape? If so, then the park's forest component *may* need to be managed as a *natural* system within a *cultural* context.

- 3) Was the park established *primarily* to commemorate, protect, conserve, and interpret an *historical or cultural* event, feature, or purpose and its landscape is composed of *native and/or non-native* specimen trees that contribute to the historical or cultural story or features (as defined in the park's *GMP*, *Cultural Landscape Inventory* or *Cultural Landscape Report*), or that are simply aesthetic elements in the park's larger cultural landscape design and purpose (e.g., a human-designed landscape)? If so, then the park's forest resources should be managed as components of the *cultural* and aesthetic landscape, but are still subject to – and need to be managed for – tree-related pests and diseases, as well as for routine maintenance. If the resource includes non-native species, a plan must be in place to manage that resource. According to the National Park Service (NPS) *Management Policies 2006*, a “*cultural landscape*” is:

“A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with an historic event, activity, or person, or exhibiting other cultural or esthetic values. There are four non-mutually exclusive types of cultural landscapes: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.” (NPS Management Policies 2006; Glossary, p. 157)

It is important to remember that the *IFS* strategy is intended to be applied to forest resources along a continuum that ranges from natural forest ecosystem components to individual trees in a human-designed landscape. In each situation described above, the forest resources may require management actions and resource stewardship emphases that are quite different, but, nevertheless, appropriate to their purpose within the park.

Step 2: Take Account of Your Park's Forest Resources

NPS Management Policies 2006 call for the protection of both natural and cultural resources wherever they are found. To do this effectively, it is also necessary to search out or conduct resource inventories. Much useful information about a park's resources can be gleaned from inventories conducted through the NPS's *Inventory and Monitoring Program (I&M)*, or through inventories conducted by the park or by outside researchers through the *Research Permit and Reporting System (RPRS)*, or from work conducted by the nation-wide network of university-based *Cooperative Research Study Units (CESUs)*. In addition, recent air-photos, satellite imagery, LiDar (Light Detection and Ranging) electronic imagery, and other types of forest mapping for parks may be available from the US Forest Service or other land management agencies.

An effective method for determining the type and condition of a park's forest resources for planning and management purposes is to conduct a *Natural Resource Condition Assessment (NRCA)*. *NRCA* projects evaluate and report current conditions, identify critical data gaps, and selected threat and stressor condition influences relative to a subset of important park natural resources and indicators. To accomplish this, they gather and interpret existing scientific data from a variety of NPS and non-NPS sources. *NRCAs* assist park-based natural resource stewardship planning and decision making activities. They can also help parks report to natural “resource condition status” accountability measures as may be established by the Department of the Interior and the Office of Management and Budget.

NRCAs represent a relatively new type of resource assessment project for the NPS, one that departs from the types of literature reviews and issue scoping reports that park managers are more likely to be familiar with. Among their defining characteristics, all *NRCAs*:

- Assess indicator-level conditions and summarize overall condition findings by park areas.
- Emphasize geospatial (map) products in addition to narrative condition summaries.
- Apply a set of reference conditions (reference values) as the comparative basis for reaching current condition judgments.
- Use assessment frameworks to help guide the project work and report study findings.
- Document the data and methods used, and communicate critical data gaps along with uncertainties or levels of confidence associated with the study findings.

NRCAs contribute to strategic natural resource stewardship. Because they are multi-disciplinary and emphasize condition reporting by park areas, they support a “systems level” approach to resource management and planning. Because they evaluate and report conditions relative to logical and documented forms of reference conditions and values, they contribute to ongoing efforts to describe and quantify a park’s desired resource conditions.

A complete description of the *NPS Natural Resource Condition Assessment Program* can be found at: [http://www.nature.nps.gov/water/NRCondition Assessment Program/Index.cfm](http://www.nature.nps.gov/water/NRCondition%20Assessment%20Program/Index.cfm)

In addition, it should be noted that resource condition assessments are also conducted for the following cultural resource inventories: *Cultural Landscape Inventory (CLI)*, the *Ethnographic Resources Inventory (ERI)*, and the *Archeological Sites Management Information System (ASMIS)*.

Step 3: Consider Landscape-Scale Linkages and Thinking Beyond Park Boundaries

Some of the greatest threats to the long term preservation of forest health and ecological integrity in national parks come from outside of park boundaries, and frequently, from “over-the-horizon,” both literally and figuratively speaking. Many of these threats aren’t always obvious. External threats can include invasive native and non-native species of forest insects and diseases; potential impacts from global climate change; habitat fragmentation and problems resulting from parkland ownership fragmentation; genetic isolation; and pressures from adjacent (sometimes incompatible) park/rural/urban interfaces, as well as from the ramifications of human development in the surrounding geographic region. Many NPS parks are rather limited in their geographic size and relatively few NPS units can claim to contain a complete forest ecosystem, biome, or ecological community. By being “cut off,” or at least severely limited, in their active linkage to the surrounding landscape and its ecosystem components, processes, and flow of genetic materials, the result is a loss to the park’s ecological integrity over time.

According to NPS Management Policies 2006:

“Science has demonstrated that few if any park units can fully realize or maintain their physical and biological integrity if managed as biogeographic islands. Instead, park units must be managed in the context of their larger ecosystems. The ecosystem context for some species and processes may be relatively small, while for others this context is vast. In any

case, superintendents face the challenge of placing each of the resources they protect in their appropriate ecosystem context and then working with all involved and affected parties to advance their shared conservation goals and avoid adverse impacts on these resources.” (NPS Management Policies 2006; Section 4.1, General Management Concepts; p. 36).

Realizing these threats and stressors, parks need to prepare to take a similar comprehensive and “over-the-horizon” view of trends concerning forest insects and diseases, changing climatic trends and their ecological implications, as well as the ongoing pattern of human development within the greater surrounding landscape and at the local, regional, and, sometimes, national scales. These realities need to be considered within, and can be most effectively addressed through, a park’s *General Management Plan (GMP)* and/or its *Foundation Document*, and its *Resource Stewardship Strategy (RSS)* as they are developed.

Noting this reality, the *IFS* approach could be the basis to help parks raise public awareness for the need to voluntarily establish a seamless system of ecosystem connections to and from parks. This could be accomplished through a network of linked corridors and patches, in coordination with public and private landholders, across the greater regional landscape. Its purpose would be to promote the flow of genetic material across the landscape in order to promote long term, regional *ecological integrity* and *ecological resilience* that ultimately would lead to resource health and sustainability. In this scenario, parks would serve not only as sources for native genetic biodiversity to the surrounding region, but also as recipients of this genetic flow through the system. Such a system would also possess an enhanced ability to respond to disturbance from exotic, human, and climatic factors.

In support of parks looking beyond their boundaries to determine their place within the greater landscape and its ecosystems, *NPS Management Policies 2006* provides the following guidance for

“Cooperative Conservation Beyond Park Boundaries” (refer to the entire section for complete guidance on this topic): *“Cooperative conservation beyond park boundaries is necessary as the National Park Service strives to fulfill its mandate to preserve the natural and cultural resources of parks unimpaired for future generations. Ecological processes cross park boundaries, and park boundaries may not incorporate all of the natural resources, cultural sites, and scenic vistas that relate to park resources or to the quality of the visitor experience. Therefore, activities proposed for adjacent lands may significantly affect park programs, resources and values. Conversely, NPS activities may have impacts outside park boundaries.*

Recognizing that parks are integral parts of larger regional environments, and to support its primary concern of protecting park resources and values, the Service will work cooperatively with others to

- *Anticipate, avoid, and resolve potential conflicts.*
- *Protect park resources and values.*
- *Provide for visitor enjoyment.*
- *Address mutual interests in the quality of life of community residents, including matters such as compatible economic development and resource and environmental protection.”*

(*NPS Management Policies 2006*; Section 1.6, Cooperative Conservation Beyond Park Boundaries; p. 13-14).

Parks are authorized to undertake such agreements outside of park lands through the May 8, 2008 authorization of Public Law 110-229 Consolidated Natural Resources Act of 2008. The key section for the purpose of the *IFS* is Title III, National Park Service Authorization; Subtitle A Cooperative Agreements, Sec 301. Cooperative Agreements for National Park Natural Resource protection:

SEC. 301. COOPERATIVE AGREEMENTS FOR NATIONAL PARK NATURAL RESOURCE PROTECTION.

- (A) *General: The Secretary of the Interior (referred to in this section as the 'Secretary') may enter into cooperative agreements with State, local, or tribal governments, other Federal agencies, other public entities, educational institutions, private nonprofit organizations, or participating private landowners for the purpose of protecting natural resources of units of the National Park System through collaborative efforts on land inside and outside of National Park System units.*
- (B) *Terms and Condition: A cooperative agreement entered into under subsection (a) shall provide clear and direct benefits to park natural resources and—*
- (1) *Provide for:*
- (a) *The preservation, conservation, and restoration of coastal and riparian systems, watersheds, and wetlands.*
 - (b) *Preventing, controlling, or eradicating invasive exotic species that are within a unit of the National Park System or adjacent to a unit of the National Park System.*
 - (c) *Restoration of natural resources, including native wildlife habitat or ecosystems.*
- (2) *Include a statement of purpose demonstrating how the agreement will:*
- (a) *Enhance science-based natural resource stewardship at the unit of the National Park System.*
 - (b) *benefit the parties to the agreement.*
- (3) *Specify any staff required and technical assistance to be provided by the Secretary or other parties to the agreement in support of activities inside and outside the unit of the National Park System that will:*
- (a) *Protect natural resources of the unit of the National Park System.*
 - (b) *Benefit the parties to the agreement.*
- (4) *identify any materials, supplies, or equipment and any other resources that will be contributed by the parties to the agreement or by other Federal agencies;*
- (5) *describe any financial assistance to be provided by the Secretary or the partners to implement the agreement;*

- (6) *ensure that any expenditure by the Secretary pursuant to the agreement is determined by the Secretary to support the purposes of natural resource stewardship at a unit of the National Park System; and*
- (7) *include such other terms and conditions as are agreed to by the Secretary and the other parties to the agreement.*
 - (a) *Limitations: The Secretary shall not use any funds associated with an agreement entered into under subsection (a) for the purposes of land acquisition, regulatory activity, or the development, maintenance, or operation of infrastructure, except for ancillary support facilities that the Secretary determines to be necessary for the completion of projects or activities identified in the agreement.*
 - (b) *Authorization of Appropriations: There are authorized to be appropriated such sums as are necessary to carry out this section.*

The essence of this bill is that it allows the NPS to spend Operation of the National Park System (ONPS) funds working outside of parks so long as the work is being done cooperatively under the aegis of what the legislation calls a "cooperative agreement." For the purposes of implementing this legislation, the NPS interprets the term "cooperative agreement" to encompass both an memorandum of Understanding (MOU, under which the NPS might assign personnel and/or equipment to work outside the park but not transfer anything to the cooperator) and a Cooperative Agreement (under which the NPS would assist the partner by a transfer of funds to the partner).

Step 4: Apply the “Resource Stewardship Strategy” to Forest Stewardship

A valuable tool for promoting “*Strategic Thinking*” in NPS forest stewardship and the principal source for parks in identifying their own comprehensive strategies for their forest resources – in balance with other park resources – is through the development of a *Resource Stewardship Strategy* (RSS). While some parks may need to develop a specific plan (or part of another park plan) to manage their forests due to their particular natural or cultural resource significance and needs, or perhaps due to their size, the majority of parks should find that the RSS is the primary *ecosystem management* tool they will need to provide the necessary strategic guidance to put them on the pathway toward achieving long-term sustainable forests that have *ecological integrity* and *ecological resilience*. By completing Steps 1 through 3 above, a park is prepared to develop their RSS.

According to information in the link below, the RSS is the preferred tool for parks to identify and develop long-term, science and scholarship-based comprehensive strategies that are designed to achieve and maintain the policy-based conditions of a park’s natural and cultural resources (in the absence of any other more specific plan), as established in its General Management Plan (GMP) and/or Foundation Document, that directly contribute to the implementation of sustainable forest management in the park. Furthermore, the RSS serves as a link between the park’s GMP and/or Foundation Document, and strategic park planning, where personnel and financial resources are allocated to implement resource stewardship activities. Information that captures the successes and challenges from parks that have completed RSSs can be found at: <http://www1.nrintra.nps.gov/planning/6RSSPilotReview/2011>.

These comprehensive strategies also help to *integrate* active forest resource stewardship with other park resources and programs and establish long-term target goals for forest resources. In addition, an RSS will inform park resource managers and the park's administration of those actions that will be needed – along with their general sequencing – to reach the park's identified long-term resource stewardship goals. These comprehensive strategies can be periodically adjusted through the application of "*Adaptive Management*" over time in order to keep them on track for achieving the established policy-based conditions for priority resources. This information is useful for the park's planning and resource allocation, particularly when they seek supplemental funding support.

Adaptive Management is a system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and, if not, facilitating management changes that will ensure that outcomes are met or to re-evaluate the outcomes. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain and is the preferred method for management in these cases." (Department of the Interior Manual 516 DM 4.16).

By taking a systems approach to park resources, including its forest resource stewardship, the RSS encourages park resource managers to consider their park's forest resource management both within *and* outside the park in a regional landscape and connectivity context. With this comprehensive systems approach to forest health, parks can raise awareness of their forest resource stewardship needs amongst the park's staff and park neighbors, and balance those needs with other park resources, programs, and management actions.

While developing an RSS, a park may want to consider incorporating two additional supporting tools to aid in climate change planning: "*Scenario Planning*" and "*Vulnerability Assessments*."

Scenario Planning is not a technique for predicting the most probable future. Rather, the objective is to develop and test decisions under a variety of plausible futures. Doing this proactively, essentially rehearsing for multiple futures, strengthens an organization's ability to recognize, adapt to, and take advantage of changes over time (Global Business Network, 2009. *Using Scenarios to Explore Climate Change*. June, 2009. Monitor Group, L.P., San Francisco, CA). An NPS guidance document on climate change scenario planning will soon be available for park managers to use when applying this planning technique.

Vulnerability Assessments are a key tool for informing adaptation planning and enabling resource managers to make such judgments and for determining the extent of ecosystem stress on a park's natural and cultural resources. Information on this tool can be found in the "*Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment*" which can be found at: <http://www.nwf.org/vulnerabilityguide>. This document is designed to assist fish and wildlife managers and other conservation and resource professionals to better plan, execute, and interpret climate change vulnerability assessments.

Climate change vulnerability assessments provide two essential contributions to adaptation planning. Specifically, they help in.

- Identifying which species or systems are likely to be strongly affected by projected changes; and

- Understanding why natural and cultural resources are likely to be vulnerable, including the interaction between climate shifts and existing stressors.

Determining which resources are most vulnerable enables managers to better set priorities for conservation action, while understanding why they are vulnerable provides the basis for developing appropriate management and conservation responses.

Step 5: Implement the RSS Comprehensive Strategies

As park resource managers implement the comprehensive strategies set forth in their park's *RSS* for achieving the park's policy-based conditions, a program should be simultaneously established to apply these strategies to the ongoing process of sustainable forest stewardship.

As implementation of the comprehensive strategies identified within the *RSS* takes place over time, it is important to remember that, to meet its goals, the *IFS* integrates a wide variety of pertinent forest and forest-component (*i.e.*, "tree") stewardship guidance (ecology, pest control, fire management, hazardous trees, *etc.*), technical assistance contacts, and forest management-related information from multiple sources. Ultimately, the *IFS*'s web-based "toolbox" of information and contacts will not only provide park resource managers with a raised awareness of forest stewardship information. This, together with the *IFS*'s *systems approach methodology*, will help them to *integrate their management actions* with other programs and partners, as appropriate, to best achieve excellence in comprehensive forest stewardship within their parks.

How to Take Action!

If a park HAS already completed an *RSS*, please proceed to Section III (see below) of the *IFS*, "*Tools, Programs and Contacts for Achieving Healthy Forests*". Here can be found links to information, technical assistance, funding, and contacts that parks can use to help them to meet their long-term forest health and stewardship goals. It is strongly recommended, however, that parks commit to investing in the establishment of long-term forest stewardship goals through the development of an *RSS* up front rather than later, if possible, in order to maximize the efficiency and effectiveness of their forest stewardship efforts and program.

If a park HAS NOT already completed an *RSS*, park resource managers should contact their Regional *RSS* Coordinator for information, guidance, and technical assistance on developing an *RSS* for their park. More detailed information on the *RSS* can be found at:

<http://www1.nrintra.nps.gov/planning>. *By completing an *RSS*, parks will be in an excellent position to take advantage of personnel and financial resources that could be allocated to implement *RSS*-identified resource stewardship activities. Lack of an *RSS* does not prevent a park from accessing Section III: *Implementation Tools for Achieving Healthy Forests* for forest health and technical assistance information, however.*

Section III – Tools, Programs, and Contacts for Achieving Healthy Forests



The Namekagon River as part of a northern mixed hardwood and coniferous forest ecosystem near Cable, Wisconsin. Saint Croix National Scenic River. Credit: National Park Service

Tools, Programs and Contacts for Achieving Healthy Forests provides parks with the information, technical assistance, and contacts they need to help them meet their immediate and long-term forest stewardship goals (see *Section II: Strategic Thinking to Promote Excellence in Forest Health and Management*). It offers resources to help parks to effectively detect and manage forest insects and diseases through the application of Integrated Pest Management (IPM), often in coordination with the *US Forest Service's (USFS) State & Private Forestry Assistance Program*, to meet immediate and long-range forest stewardship goals. Also included within this section are links to the *ANSI A300 Standards for Tree Care Practices* and the *International Society of Arboriculture (ISA)*. Both sources address threats to forest resources whether they are found in natural settings or in character-defining features within a developed or cultural landscape, while also offering *critical contacts* and potential *funding resources*.

“Where Should I Begin?”

Section III presents brief descriptions of and links to many other sources of information from public and private sources that support an *integrated* approach to achieving and maintaining forest health and stewardship. Priority is given to the NPS *Integrated Pest Management (IPM) Program* and the US Forest Service's *State & Private Forestry Assistance Program*. Both

programs offer technical assistance in managing forest insects and diseases. In addition, weblinks to a wide variety of information, technical assistance, and contacts that support forest stewardship efforts are presented in alphabetical order according to general topical headings. These links present information that will help to raise awareness of forest health management issues, provide sources of assistance to stimulate thinking about forest resource stewardship and linkages to promote more holistic ecosystem and landscape-scale conservation context for forest management.

It is essential to keep your NPS Regional IPM Coordinator apprised of your park's forest insect and disease protection needs. The combined expertise of NPS Regional Offices and the US Forest Service technical assistance regarding IPM and forest insect and disease protection is an excellent aid in addressing forest health. The regional and WASO staffs also have experience in pulling together collaborative teams of subject matter experts to address your forest insect and disease problems. Key contacts include:

Biological Resources Management Division (WASO)

- Restoration and Vegetation Branch (Peter Budde) 970-225-3559 (o)
- Servicewide IPM Coordinator (Carol DiSalvo) 202-513-7183 (o)
- Servicewide Restoration Ecologist (Greg Eckert) 970-225-3594 (o)
- Servicewide Invasive Animal Coordinator (Glenn Plumb) 970-513-7183 (o)

Cultural Landscape Management

NPS Cultural Landscape Program

http://www.nps.gov/cultural_landscapes/index.html

This program is part of the WASO service-wide cultural resources program. This recently launched website is available to the NPS and public and content will continue to be added over time.

Park Cultural Landscapes Program

Susan Dolan, Program Manager 206-220-2132

Olmstead Center for Landscape Preservation OLCE

Charlie Pepper, Deputy Director, NPS Olmstead Center for Landscape Preservation
617-241-6954 ext. 260

Integrated Pest Management Assistance

National Park Service Integrated Pest Management Program

<http://www1.nrintra.nps.gov/BRMD/ipm/>

Integrated Pest Management (IPM) is a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage by cost-effective means while posing the least possible risk to people, resources, and the environment (NPS Management Policies 2006, Glossary, p. 158).

The NPS conducts an IPM program to reduce risks to the public, park resources, and the environment from pests and pest-related management strategies. These include forest pests. “Pests” are living organisms that interfere with the purposes or management objectives of a specific site within a park or that jeopardize human health and safety. It also provides guidance on how to apply “Rapid Response Procedures to Protect Forest Integrity and Units of the National Park System within Eastern States” (Rapid Response Procedures) which provides guidance to managers of national park system units in the eastern United States (but with many applications to the Midwest Region) on how to respond to exotic forest insect pests and diseases invasions along with additional supplemental information. (http://www.nps.gov/nero/ipm/Forest-Insect-n-Disease-Rapid-Response-Plan_final-2010-08-05.pdf).

Additional resources oriented toward western forest stewardship can also be found within this section. Funding opportunities for IPM are announced in the NPS Service-wide Combined Call.

The primary NPS Integrated Pest Management (IPM) Program site supplements the information that can be found within the Rapid Response Procedures guide above. Both sources address forest resource threats, whether they are found in natural settings or in character-defining features within a cultural landscape. IPM is used to prevent, detect, identify and manage forest insect and diseases, including related “hot topic” forest pest issues involving emerging plant, animal and diseases pathways and threats; and special topics. The application of IPM is required under the Federal Insecticide, Fungicide and Rodenticide Act, and other regulations, including Executive Order 13514, “Federal Leadership in Environmental, Energy, and Economic Performance” by implementing elements of Section 2(e) regarding “...promote pollution prevention and eliminate waste”; ... implement integrated pest management and other appropriate landscape management practices.”

Decisions concerning whether or not to manage a pest or pest population will be influenced by whether the pest is an exotic or native species. Non-native species will be managed in accordance with applicable NPS Management Policies 2006 guidance. Native pests will be allowed to function unimpeded, except where noted in the IPM definition above and in accordance with NPS Management Policies 2006 (NPS Management Policies 2006, Section 4.4.5.1, Pests, p. 48).

NPS Integrated Pest Management Training

<http://www.1.nrintra.nps.gov/BRMD/ipm/>

This site presents IPM training information and announcements. IPM is a critically important tool for assisting resource managers to protect their forest resources and for promoting overall forest health.

NPS Regional IPM Coordinators

Alaska Region

Regional IPM Coordinator (Pat Owen) 907-683-9547 (o)

Intermountain Region

Regional IPM Coordinator (Myron Chase) 303-969-2863 (o)

Midwest Region

Regional IPM Coordinator (John Sowl) 402-661-1872 (o)

National Capital Region

Regional IPM Coordinator (Jil Swearingen) 202-342-1443 ext. 218 (o)

jil_swearingen@nps.gov

www.nps.gov/cue

www.nps.gov/plants/alien

www.invasiveplantatlas.org

Northeast Region

Regional IPM Coordinator (Wayne Millington) 814-863-8352 (o)

<http://www.nps.com/nero/ipm>

Pacific West Region

Regional IPM Coordinator (Erv Gasser) 206-220-4263 (o)

Southeast Region

Regional IPM Coordinator (Chris Furqueron) 404-507-5812 (o)

Pest Detection and Management Links

For the IFS, IPM is primarily accomplished through the on-line link to “Rapid Response Procedures to Protect Forest Integrity in Units of the National Park System within Eastern States.” Released as an electronic document, the Rapid Response Procedures provides quick assistance to field practitioners and decision-makers to identify, understand, and manage invasive insect, diseases and abiotic threats. While Rapid Response Procedures is focused upon invasive exotic species, it is important to note that exotic species may be the historically significant components within cultural landscapes and may be preserved. According to NPS Management Policies 2006, Sub-section 4.4.1.3, Definition of Native and Exotic Species: “Exotic species are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as nonnative, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem of that place. Genetically modified organisms exist solely due to human activities and therefore are managed as exotic species in parks.”

Generally, exotic species that have historic significance are not removed and replaced with compatible native species, unless they are invasive. However, even some invasive exotic plants with historic significance (e.g., olive trees in a historic orchard in California) are not removed, but are monitored and controlled within bounds. Several native and abiotic threats are also included to aid identification discernment. The text advocates monitoring and planning prior to pest outbreaks to improve management outcomes. It also emphasizes the importance of collaborating with outside agencies to increase knowledge, gain operational inertia, and obtain project funding. This document can be found at:

http://www.nps.gov/nero/ipm/Forest-Insect-n-Disease-Rapid-Response-Plan_final-2010-08-05.pdf

For Midwest Region-specific forest resource contacts please access the following link:
<http://www.nps.gov/nero/ipm/Contact-List-MWRO-Forest-Insect-and-Disease-Protection.pdf>

The Rapid Response Procedures document is most useful in its electronic format with hundreds of outside resources available through internet links, with internal hot links for fast navigation within the document. A few of the resource features include: (1) dichotomous key to determine likely pest problems; (2) robust appendix of pest descriptions and associated internet links; (3) summary of law and policy for pest management; (4) summarized process of integrated pest management; (5) checklist for setting up and implementing pest/ pathogen response plans; and (6) technical assistance contact lists and e-mail links.

Western states within the Midwest Region can find help through the US Forest Service's Field Guide to Insect & Diseases of the Rocky Mountain Region. This field guide is a forest management tool for field identification of biotic and abiotic agents that damage native trees in Colorado, Kansas, Nebraska, South Dakota, and Wyoming. This publication can be found at the following link:

http://www.fs.usda.gov/wps/portal/fsinternet!/ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6BdkOyoCAPkATIA!/?ss=1102&navtype=BROWSEBYSUBJECT&cid=null&navid=1400000000000000&pnavid=null&ttype=main&pname=Region%2520%2520-%2520Forest%2520&%2520Grassland%2520Health

The US Forest Service also publishes a series of Forest Insect and Disease Leaflets (FIDLs). Each FIDL provides information about one – or several closely related – insect or disease affecting forest trees in the United States. FIDLs describe their subject's distribution, appearance, life cycle, symptoms, and management. This series of over 170 leaflets has been produced under the auspices of the US Forest Service's Forest Health Protection staff. These leaflets cover both Eastern and Western species. The FIDLs can be found at
<http://www.fs.fed.us/r6/nr/fid/wo-fidls>

Pest Tracker, National Agricultural Pest Information System

<http://www.nps.gov/oclp.html>

This website, sponsored by Purdue University, in conjunction with the USDA and other partners, presents links to information on numerous pest species.

Management of Biological Invasions On-Line Journal

<http://www.managementofbiologicalinvasions.net/index.htm>

This is an open access, peer-reviewed, online journal focusing on real experiences in the field of biological invasion management. It admits worldwide contributions on the single (e.g. cells, taxonomy) or multilevel management of bio-invasions (e.g. species interactions, community, habitat and processes), provided they may contribute to a better diffusion of technical and scientific ideas, approaches and results throughout the World. The scope includes management of those non-invasive species, habitats or processes which help reduce the impact of invasive species. The journal is free to authors, institutions and readers. The authors retain copyrights. The languages of publication are English and Spanish.

Midwest Invasive Plant Network (MIPN)

<http://mipn.org/aboutMIPN.html>

The Midwest Invasive Plant Network (MIPN) is an organization dedicated to reducing the impacts of invasive plants in the Midwest, including Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. The MIPN website provides information on identification, early detection, mapping, and control of invasive plants, as well as providing a calendar of training opportunities and other upcoming events. Several educational materials are available for free download, and a searchable database of invasive plant control information will be available soon (expected Dec. 2011).

Funding Sources

PestWise: Grants for Innovative Approaches to Integrated Pest Management

<http://www.epa.gov/pesp/grants/index.html>

Each year, PestWise programs form dozens of new partnerships by awarding more than \$3.1 million in grants to growers and researchers across the country. These grants fund projects that are exploring innovative practices, technologies and regulatory solutions to promote Integrated Pest Management (IPM) adoption. The EPA's Office of Pesticide Programs (OPP) administers different grant programs that align with OPP's strategic goals and provide the platforms for their day-to-day work. These grants include:

- Pesticide Registration Improvement Renewal Act Partnership (PRIA2) Grants.
- School IPM Grants.
- Biopesticide Demonstration Program (BDP) Grants.
- Regional Agricultural IPM Grants.

In addition, several of these programs form broad-based partnerships with stakeholders across entire regions to further the adoption of promising technologies and practices demonstrated through grant projects. This site also contains the "Pesticide Stewardship Database," which is the public data repository for grants funded by PestWise partnership programs. Grants in each program database are searchable by EPA Region, pesticide, crop, state, and fiscal year funded.



Forest influenced by Lake Michigan. North Bar Lake Overlook, Sleeping Bear Dunes National Lakeshore, Michigan. Credit: National Park Service

U.S. Forest Service: State and Private Forestry Assistance Program

<http://mipn.org/aboutMIPN.html>

This technical assistance is authorized through a Memorandum of Understanding (MOU) between the USFS and the NPS titled Agreement Between the United States Department of Agriculture and the United States Department of the Interior for the Conduct of Forest Insect and Disease Management on Lands Administered by the U.S. Department of the Interior (1993, now being revised. Updated version expected to be released in Feb. 2012)

(<http://www.fs.fed.us/im/directives/fsm/1500/1531-1531.06h.txt>). This MOU states that the USFS will provide technical assistance and funding to assist the NPS in managing forest diseases and pathogens, with limited assistance on invasive plants – together with contacts from other applicable Federal and state forestry offices. In addition to their extensive forest management expertise, the USFS also manages the annual “Forest Health Protection” funding program which can provide significant assistance in the suppression of forest diseases and diseases to qualifying parks.

Several organizations can prove beneficial in obtaining technical expertise and funding assistance when challenged with insect and disease problems in the forested or urban landscape. The following sections describe the first best and subsequent contacts to help implement forest protection activities.

US Forest Service Forest Health Protection

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

The US Forest Service (USFS) is authorized by Congress to provide technical and funding assistance in Forest Health Protection to federal, state, and private land owners/managers. When considering general forest insect and disease issues (and after contacting NPS regional contacts), the USDA-FS Forest Health Protection program is the first best contact. This is true for technical assistance and essential for funding assistance.

Some examples of the technical assistance FS staff provide related to forest pests are insect and disease identification, general insect and disease training, training on evaluating and managing specific insects and diseases, hazard tree training, and on-site visits to evaluate and provide management recommendations for specific insects and diseases. Financial assistance is also available through the FS Forest Health program to suppress/manage insects and diseases when evaluations determine that there will be unacceptable resource impacts.

USFS Healthy Forests Initiatives-Tools

<http://www.fs.fed.us/projects/hfi/tools/shtml>

This site includes information and links on the following:

- [The Healthy Forests Initiative and Healthy Forests Restoration Act Interim Field Guide](#)
 - [Healthy Forests Initiative Administrative Changes Fact Sheet](#)
- Fuels Treatment and Restoration Projects Improving Forest Health
 - [Categorical Exclusions for Hazardous Fuels Reduction Rehabilitation Activities](#)
- Improving Endangered Species Act Process to Expedite Decisions
 - [ESA Net Benefit Guidance](#)
 - [ESA Alternative Approach Guidance](#)
 - [ESA Section 7 Counterpart Regulations](#)
- Improving Direction on Environmental Assessments
 - [Council on Environmental Quality Guidance on Improved and Focused EAs](#)
 - [Description of Pilot EA Projects](#)

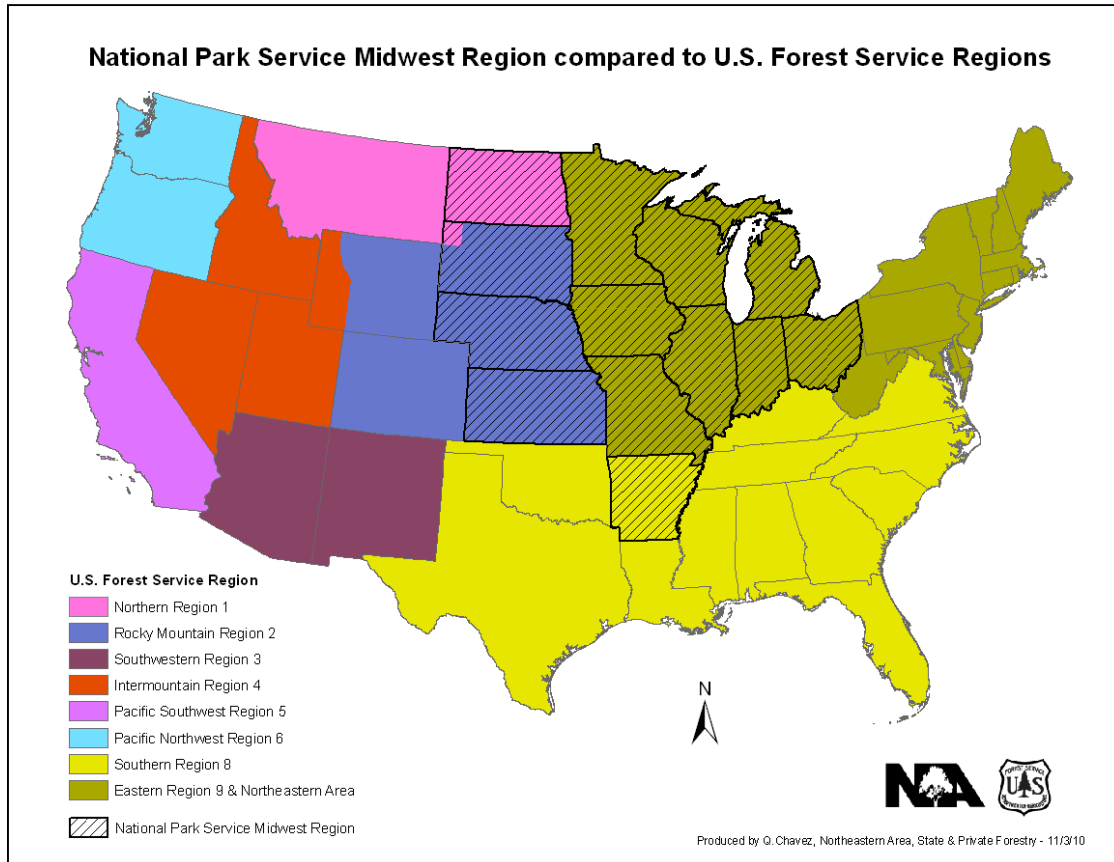
US Forest Service Regional & Local Contacts

The USFS Forest Health Protection National Staff Directory

http://www.fs.fed.us/foresthealth/publications/FHPSD_revised_2011.pdf

This site provides a detailed list of all Forest Health Staff.

Note: the NPS Midwest Region boundaries do not coincide with the boundaries of the various US Forest Service regions. For example, the map below shows the four FS Regions that include part of the NPS Midwest Region:



Map showing a comparison of the Midwest Region for the National Park Service and U.S. Forest Service Regions

Table 1. USFS Northeastern Area contact information (PA, WV, MD, DE, NJ, NY, CT, RI, MA, NH, VT, ME, MN, WI, IA, MO, IL, MI, IN, OH).

Northeastern Area Headquarters Office (Newtown Square, PA)				610-557-4139
Pesticide Coordinator	(Vacant)	Newtown Square, PA		610-557-4113
Forest Health and Economics, Assistant Director	Ralph Crawford	Newtown Square, PA	rcrawford01@fs.fed.us	610-557-4145
Morgantown Field Office (Ohio)	304-285-1541			
Forest Health Protection Group Leader	Dan Twardus	Morgantown, WV	dtwardus@fs.fed.us	304-285-1545
St. Paul [Minnesota] Field Office (Minnesota, Wisconsin, Michigan, Iowa, Missouri, Illinois and Indiana)	651-649-5244			
Forest Health Protection Group Leader	Mike Connor	St. Paul, MN	mconnor@fs.fed.us	651-649-5180

Table 2. USFS Region 8 Southern Region contacts (VA, GA, KY, NC, SC, TN, FL, AL, MS, LA, AR, OK, TX)

Headquarters Office (Atlanta, GA)				
Director	Wesley Nettleton	Atlanta, GA	wnettleton@fs.fed.us	404-347-2719
Pesticide Coordinator	Michelle Frank	Atlanta, GA	mfrank@fs.fed.us	404-347-2229
Alexandria/Pineville Field Office (Arkansas, etc.)				
Field Office Representative	Forrest Oliveria	Pineville, LA	foliveria@fs.fed.us	318-473-7294

Table 3. Region 1 Northern Region contacts (North Dakota, northwest corner of South Dakota)

Missoula [Montana] Field Office				
FHP Group Leader	Gregg DeNitto	Missoula, MT	gdenitto@fs.fed.us	406-329-3637
Regional Office (Ogden, UT)				
Invasive Plants Coordinator	Janet Valle	Ogden, UT	jvalle@fs.fed.us	801-625-5258

Table 4. Region 2 Rocky Mountain Region contacts (Nebraska, most of South Dakota, and Kansas)

Regional Office (Golden, CO)				
FHP, Assistant Director	Susan Gray	Golden, CO	susangray@fs.fed.us	303- 275-5061
Invasive Plants Coordinator	Tom McClure	Golden, CO	tmccclure@fs.fed.us	303-275-5100
Rapid City [South Dakota] Service Center (South Dakota, Nebraska)				
Service Center Leader and Entomologist	Kurt Allen	Rapid City, SD	kallen@fs.fed.us	605-716-2781
Lakewood [Colorado] Service Center (Kansas)				
Service Center Leader and Entomologist	Kelly Burns	Lakewood, CO	ksburns@fs.fed.us	303-236-8006

USDA Animal and Plant Health Inspection Service (APHIS)

<http://www.aphis.usda.gov/ests>

The USDA–Animal and Plant Health Inspection Service (APHIS) is directed by Congress to eradicate new exotic intruders. Typically, their work focuses at ports of entry but if funded by Congress they also operate in the heartland when new invasions get past those areas. When considering a newly introduced species, APHIS will be an important contact. APHIS can help with species identifications, reconnaissance, and eradication strategies.

USDA APHIS General Plant Protection and Quarantine Contacts

http://www.aphis.usda.gov/contact_us/ppq.shtml

Emergency and Domestic Programs

Emergencies (301) 734-8247

Pest Detection (301) 734-8717

USDA Agricultural Research Service National Identification Services

<http://www.ars.usda.gov/Services/docs.htm?docid=9353>

National Identification Services

USDA Agricultural Research Service, Insect and Mite Identification Service

(301) 734-5312, for remote pest identification

USDA Agricultural Research Service, Systemic Entomology Lab (arthropod identification)

<http://www.sel.barc.usda.gov/selhome/requests.htm>

USDA APHIS State Contacts

http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml

The State Plant Health Director is the primary contact for each State. APHIS keeps a current list of these individuals on their website.

USDA APHIS “idsource”

<http://idsource.colostate.edu/cwis438/websites/IDSource/Home.php?WebSiteID=11>

A collaborative federal/state effort (U.S./Colorado) recently introduced “**idsource**”, a specialized search tool for identifying the global maze of over 1,400 vetted websites that focus on identification of plant pest insects, diseases, and weeds. The objective is to help users rapidly find trustworthy websites for screening, detecting, and identifying one or more species among the multitude that comprise the plant pest universe.

At this website users can access the massive database by alphabetical order, by specific class of pest, or by key words. An interactive link is listed for each included item (website) for ease of use, along with the name of the originating organization, the site's contents, the nature of the material included (e.g., fact sheets, screening aid, images), individualized notes about the site, and any user reviews to date. This "gateway to pest identification" was and continues to be, as new sites are added, the joint result of the U.S. Dept. of Agriculture's Center for Plant Health Science and Technology Program within the Animal and Plant Health Inspection Service, and staff at Colorado State Univ. (U.S.). The original concept for “**idsource**” arose in 2006, and work was first launched at the Centre for Biological Information Technology at AUSTRALIA's Univ. of Queensland.

Additional USDA Links of Interest

Central States Forest Health Watch

<http://na.fs.fed.us/fhp.fhw/csfbw/>

The US Forest Service’s Northeastern Area’s “Forest Health Protection” field staff produces newsletters that provide information for forest land managers about current forest health issues in their areas, such as insect and diseases outbreaks, emerging information on invasive non-native insects and plants, and other potential threats to forest health. The primary states that this publication covers are **Iowa, Indiana, Illinois, and Missouri**.

USDA Early Detection and Rapid Response

<http://www.invasivespeciesinfo.gov/toolkit/detection.shtml>

This website provides general resources for detection methods for invasive species and coordinated responses to these threats. This includes information on aquatic species, plants, animals, and microbes. It also presents information on early pest detection, geotracking, and best prevention and management practices.

USDA Forest Health Aerial Survey Viewer for the Northeastern Area

<http://na.fs.fed.us/fhp/ta/av/index.shtml>

Forest health aerial surveys, along with other sources of remote sensing and ground-based data, are used by the US Forest Service and its cooperating agencies as part of an overall forest health monitoring (FHM) system.

The Forest Health Aerial Survey Viewer for the Northeastern Area displays maps of forest damage as reported annually through a cooperative effort between state and federal forestry agencies. Information contains polygonal delineations with attributes of cause, extent, severity and type of forest damages as observed from aircraft. Other associated attributes included host tree species and number of trees affected.

USDA Forest Health Mapping and Reporting

<http://foresthealth.fs.usda.gov/portal>

This USDA-Forest Service website helps you to explore forest insect and disease conditions in the United States using forest health technology Enterprise Team mapping and reporting tools.

USDA Forest Health Protection Publications & Other Information

<http://www.fs.fed.us/foresthealth/publications.shtml>

This US Forest Service site presents on-line publications that communicate Forest Service programs and services.

- Publications include, but are not limited to:
- National Strategy and Implementation Plan for Invasive Species Management
- Mapping Risk from Forest Insects and Diseases
- Yearly Forest Health Updates
- Assessment & Response to Bark Beetle Outbreaks in the Rocky Mountain Area
- Reports include, but are not limited to:
- Early Detection & Rapid Response Project for Non-Native Bark & Ambrosia Beetles
- Western Bark Beetle Initiative
- Sudden Oak Death Report
- Forest Insect and Disease Conditions in the United States (Yearly)
- Insect and Disease Detection Surveys
- Forms & Databases include, but are not limited to:
- Forest Pest Management Project Proposal
- North American Forest Commission Exotic Forest Pest Information System
- Gypsy Moth Digest
- Hemlock Woolley Adelgid – Related Bibliography
- Treesearch – USFS Research Publications

USDA Forest and Tree Health Publications

<http://www.na.fs.fed.us/pubs/howto.shtml>

This excellent website contains an extensive collection of “How to” articles on a wide variety of forest and tree health subjects.

USDA Hungry Pests

<http://www.aphis.usda.gov/hungrypests>

This APHIS website helps to raise awareness regarding invasive pests and includes pest identification information, pest images, pest management information and pest occurrence maps.

USDA National Insect and Disease Risk Mapping

<http://www.fs.fed.us/foresthealth/technology/nidrm.shtml>

Forest Health Protection provides technical assistance on forest health-related matters, particularly those related to disturbance agents such as native and non-native insects, diseases, and invasive plants. This program values and works through partnerships across lands of all ownerships. They work closely with land managers and resource staff with the National Forest System, the Department of the Interior, Department of Defense, and other federal agencies, tribes, all 50 states, U.S. territories, universities, private landowners and other countries. The National Insect and Disease Risk Map project (NIDRM) was driven by the 188 models which attempt to predict how individual tree species will react to various mortality agents. The models, in turn, are the interactions of predicted agent behavior with known forest parameters (criteria).



Mountain pine beetle damage at Rocky Mountain National Park Credit: US Forest Service

Risk Assessments for Pesticides

<http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>

Forest managers frequently make decisions regarding the use of pesticides on forest lands. These decisions must be based not only on the effectiveness of these tools, but also on an understanding of the risks associated with their use. For the pesticides commonly used by the Forest Service in its management activities, Human Health and Ecological Risk Assessments (HERAs) are prepared. In these documents, the process of risk assessment is used to quantitatively evaluate the probability (i.e. risk) that a pesticide use might pose harm to humans or other species in the environment. It is the same assessment process used for regulation of allowable residues of pesticides in food, as well as safety evaluations of medicines, cosmetics, and other chemicals. The Forest Service incorporates relevant information from the HERA into environmental

assessment documents prepared for pesticide projects, and are used to guide decision-making and to disclose to the public potential environmental effects.

Information on Specific Forest Insects and Diseases

“Common Insect Pests of Trees in the Great Plains”

<http://www.unl.edu/nac/morepublications.htm>

Scroll down this website until you find this publication, and then click on the PDF link to view. Identify and manage common insect pests of trees in the Great Plains. This publication is designed for those with no formal training in entomology and is not intended to summarize everything known about a particular insect. Information may be somewhat dated.

“Diseases of Trees in the Great Plains”

<http://www.unl.edu/nac/morepublications.htm>

Scroll down this website until you find this publication, then, click on the PDF link to view. This technical report provides assistance in the diagnosis and control of tree diseases encountered in the Great Plains. It contains 64 articles on tree diseases prepared by 31 authors.

Emerald Ash Borer (EAB)

[info http://www.emeraldashborer.info/](http://www.emeraldashborer.info/)

This website is part of a multinational effort in Michigan, Illinois, Indiana, Iowa, Kentucky, Maryland, Minnesota, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin, Ontario and Quebec to bring you the latest information about the emerald ash borer.

Emerald Ash Borer Program Manual

http://www.aphis.usda.gov/import_export/plants/manuals/domestic/downloads/emerald_ash_borer_manual.pdf (takes a few minutes to download, 107 colorful pages)

The Emerald Ash Borer Program Manual contains information to guide a management program for the emerald ash borer (EAB) beetle, *Agrilus planipennis* (Fairmaire). The guidelines are intended to assist Plant Protection and Quarantine field operations and states in implementing specific action plans to manage infestations and prevent the spread of EAB to other locations. This information provides strategies for detection and response to an infestation of EAB by presenting available information for implementing general and delimiting surveys, identification, regulatory, management, or containment procedures.

Emerald Ash Borer Five Year Plan for Biological Control 2010-2014

http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/downloads/eab-biocontrol-5yr-plan.pdf

This website presents a 5-year plan (FY2010-2014) that has been formulated to facilitate the development and field testing of biological control technologies for area-wide management of emerald ash borer.

Emerald Ash Borer Biological Control Release Guidelines

http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/downloads/EAB-FieldRelease-Guidelines.pdf

Insect Pests of Conifers: University of Minnesota

http://www.entomology.umn.edu/cues/dx/dec_pest.htm

This excellent website, a product of the University of Minnesota's "CUES: Center for Urban Ecology and Sustainability," presents an extensive list of information on insect pests of conifers within the Midwest.

Insect Pests of Deciduous Trees: University of Minnesota

http://www.entomology.umn.edu/cues/dx/dec_pest.htm

This excellent website, a product of the University of Minnesota's "CUES: Center for Urban Ecology and Sustainability," presents an extensive list of information on insect pests of deciduous trees within the Midwest.

State Specific Contacts for Forest Information

As mentioned in Section II, in order to effectively manage your forest or individual trees, on any scale, it is imperative to foster and maintain communication and a good working relationship with park neighbors. This will help to alert you of new pests, monitoring, and best management strategies.

National Association of State Foresters

http://www.stateforesters.org/about_nasf

Within each State, state governments provide forest health information and services to state and private lands. In most states, the forest health program is carried out by the Department of Natural Resources. Often the DNR will have forest health specialists that are familiar with the entire range of pest problems you are likely to encounter. This link to the National Association of State Foresters webpage will enable you to select your State and then navigate to the DNR webpage for that State.

National Association of State Foresters: Regional Partners

http://stateforesters.org/our_partners/regions

This organization works in concert with regional organizations – the Northeastern Area Association of State Foresters (NAASF), the Southern Group of State Foresters (SGSF), and the Council of Western State Foresters (CWSF) – to support forest management practices and policies unique to the regional characteristics and needs of our diverse forest resources in the United States.

In addition, as part of their "Joint Forestry Team," the NASF works with the US Forest Service, USDA Natural Resources Conservation Service, and the National Association of Conservation Districts to make recommendations that result in coordinated interagency delivery of forest and conservation assistance for working forests, farms, and ranches. Team participants seek to improve the sustainability of the nation's forests in order to provide optimum levels of public benefits and ecosystem services.

National Plant Board

<http://www.nationalplantboard.org/members/index.html>

Departments of Agriculture within the States often also have a significant role in forest health activities, particularly state regulatory activities. This link to the National Plant Board will take

you to a “clickable” map and lists of States that will connect you with contact information for the key regulatory officials in any particular State.

State Forest Action Plans

www.forestactionplans.org

The Forest Action Plans collectively represent the first-ever strategic plan for the nation's forests. These plans provide an analysis of forest conditions and trends and delineate priority forest landscape areas. They offer practical, long-term plans for investing state, federal, and other resources where they can be most effective in achieving national conservation goals. The Statewide Forest Resource Assessments and Strategies, or Forest Action Plans, can be found at this website for all 50 states and 8 territories. Review of these plans may raise awareness among park resource managers as to how forest management is addressed at the state level, as well as highlighting opportunities for potential collaboration.

USDA National Institute for Food and Agriculture: Cooperative Extension Systems Offices

<http://www.crees.usda.gov/Extension/>

Forestry Extension Services through the land grant universities provide information to land managers. Each State is organized somewhat differently, but this link to the directory of State extension websites should help you find the location most appropriate for you. These offices are staffed by one or more experts who provide useful, practical, and research-based information to agricultural producers, small business owners, youth, consumers, and others in rural areas and communities of all sizes.

USDA National Plant Diagnostic Network

<http://www.npdn.org/>

The National Plant Diagnostic Laboratories provide diagnostic services for insect and disease problems, usually for a fee. The National Plant Diagnostic Network provides a list and contact links for all of the NPDN (government) labs.

Central States Forest Health Watch

<http://na.fs.fed.us/fhp.fhw/csfhw/>

The US Forest Service's Northeastern Area's “Forest Health Protection” field staff produces newsletters that provide information for forest land managers about current forest health issues in their areas, such as insect and disease outbreaks, emerging information on invasive non-native insects and plants, and other potential threats to forest health. The primary states that this publication covers are Iowa, Indiana, Illinois, and Missouri.

Climate Change and Forest Stewardship

NPS Climate Change Response Program

<http://www.nps.gov/climatechange>

This is the primary website for the NPS Climate Change Response Program. It covers Climate Change, Climate Effects and Consequences for Parks, the NPS Response to Climate Change, How to Get Involved, in addition to presenting many useful resources.

NPS Climate Change Response Strategy

http://www.nps.gov/climatechange/docs/NPS_CCRS.pdf

The NPS Climate Change Response Strategy provides direction to our agency and employees for addressing and lessening the effects of climate change. It describes goals and objectives to guide our actions to protect the natural and cultural resources under our care through four integrated components: science, adaptation, mitigation, and communication.

Climate Change Vulnerability Assessments

<http://www.nwf.org/vulnerabilityguide>

[Please refer to: “Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment”]

Vulnerability assessments are a key tool for informing adaptation planning and enabling resource managers to make such judgments. “Scanning the Conservation Horizon” is designed to assist fish and wildlife managers and other conservation and resource professionals to better plan, execute, and interpret climate change vulnerability assessments.

Climate change vulnerability assessments provide two essential contributions to adaptation planning. Specifically, they help in:

- Identifying which species or systems are likely to be strongly affected by projected changes.
- Understanding why these resources are likely to be vulnerable, including the interaction between climate shifts and existing stressors.

Determining which resources are most vulnerable enables managers to better set priorities for conservation action, while understanding why they are vulnerable provides the basis for developing appropriate management and conservation responses.

Intergovernmental Panel on Climate Change Publications and Data

http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization ((WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. The UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC.

The IPCC is a scientific body. It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters.

Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, governments acknowledge the authority of their scientific content. The work of the organization is therefore policy-relevant and yet policy-neutral, never policy-prescriptive.

National Oceanic and Atmospheric Agency (NOAA) National Climatic Data Center

<http://www.ncdc.noaa.gov/oa/climate/regionalclimatecenters.html>

NOAA's Regional Climate Centers (RCCs) are a federal-state cooperative effort. The RCC Program is managed by the NOAA's National Climatic Data Center (NCDC). The six centers that comprise the RCC Program are engaged in the timely production and delivery of useful climate data, information and knowledge for decision makers and other users at the local, state, regional and national levels. The RCCs support NOAA's efforts to provide climate services while leveraging improvements in technology and collaborations with partners to expand quality data dissemination capabilities.

As presently configured, the RCCs support Climate activities in the State as identified by the postal codes below.

- Northeast: ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE, MD, WV
- Southeast: VA, NC, SC, GA, FL, AL, PR
- Midwest: OH, MI, IN, IL, WI, MN, IA, MO, KY
- Southern: TN, MS, LA, AR, TX, and OK
- High Plains: KS, NE, SD, ND, WY, CO
- Western: WA, OR, CA, NV, AZ, NM, UT, MT, AK

Past work has shown that analysis of weather and climate events, and assessment of their impacts, can lead to regionally-tailored adaptation and mitigation strategies that can minimize negative impacts as well as identify positive impacts. NCDC, the National Weather Service (NWS), and the RCCs created a new internet-based system to provide directed access for user-specified queries to climate data archives – the Applied Climate Information System (ACIS). ACIS is a part of NOAA's National Virtual Data System (NVDS).

The current configuration of RCCs includes six centers located at Cornell University in Ithaca, New York; the University of North Carolina at Chapel Hill; Louisiana State University at Baton Rouge; the University of Nebraska at Lincoln; the Illinois State Survey in Champaign, and the Desert Research Institute in Reno, Nevada.

User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems

http://awsassets.panda.org/downloads/buyingtime_unfe.pdf

This manual by the World Wildlife Foundation brings together assessments and potential initial adaptation strategies for various biomes, including forests. Written by experts, the manual addresses all major biomes with practical ideas – including reducing fragmentation, building corridors, reducing threats, and increasing resiliency in general terms – of how to begin increasing the resiliency of ecosystems and plan protected areas in response to the threat of climate change.

U.S. Department of the Interior Climate Change Centers

<http://www.doi.gov/whatwedo/climate/strategy/CSC-Map.cfm>

The U.S. Department of the Interior (DOI) operates a National Climate Change and Wildlife Center at the National Headquarters of the U.S. Geological Survey. Under Secretarial Order No. 3289, DOI expanded the scope and geographic reach of their climate-science efforts by establishing, in addition, eight regional Climate Science Centers (CSCs). These CSCs will provide scientific information, tools and techniques that land, water, wildlife and cultural resource managers and other interested parties can apply to anticipate, monitor and adapt to climate and ecologically-driven responses at regional-to-local scales.

US Forest Service: Northern Institute of Applied Climate Science

<http://nrs.fs.fed.us/niacs/climate/>

A cooperative response by forest research and land management organizations is required to understand and manage forests in the context of climate change. The Northern Institute of Applied Climate Science (NIACS) has been designed as a collaborative effort among the Forest Service, universities, and forest industry to provide information on managing forests for climate change adaptation, enhanced carbon sequestration, and sustainable production of bioenergy and materials. As a regional, multi-institutional entity, NIACS builds partnerships, facilitates research, and synthesizes information to bridge the gap between carbon and climate science research and the information and management needs of land owners and managers, policymakers, and member of the public.

US Forest Service: Pacific Northwest Research Station; Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector

<http://www.treesearch.fs.fed.us/pubs/42610/>

This report is a scientific assessment of the current conditions and likely future condition of forest resources in the United States relative to climatic variability and change. It serves as the U.S. Forest Service forest sector technical report for the National Climate Assessment and includes descriptions of key regional issues and examples of a risk-based framework for assessing climate change effects.

US Environmental Protection Agency (Climate Change)

<http://www.epa.gov/climatechange/>

This site presents information from the EPA on climate change for communities, individuals, businesses, states, localities and governments.

US Geological Survey (USGS) Office of Global Climate Change

http://www.usgs.gov/global_change

This site presents information on climate change topics and news; maps, imagery and publications; related hazards; frequently asked questions; and other links of interest.

Pursue Available Partnerships and Information for Transportation

The National Park Service [may/can] engage in the transportation planning process prior to the NEPA process in accordance with recent transportation legislation, the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) provisions that enhance the consideration of environmental issues and impacts within the transportation planning process. SAFETEA-LU Sections 3005, 3006, and 6001 require that:

- Transportation plans be developed in consultation with State, tribal, and local agencies responsible for land-use management, natural resources, conservation, environmental protection, and historic preservation;
- This consultation involves a comparison of transportation plans with State, tribal, and local conservation plans and maps, if available, and with inventories of natural and historic resources.

The success of these new provisions is dependent on the level of initiative, strategic vision and collaboration developed between the National Park Service, Metropolitan Planning Organizations (MPOs), State DOTs, and resource agencies to identify and develop actions and strategies that protect and enhance the environment.

Park Roads and Parkways Program within the Federal Lands Highway Program

The Department of Transportation's partnership with the National Park Service (NPS) dates back to 1926. This partnership was formalized in 1983 with the establishment of the Park Roads and Parkways Program. The US Department of Transportation, Federal Highway Administration (FHWA), Office of Federal Lands Highway (FLH) and NPS jointly administer the Park Roads and Parkways (PRP) Program, which is part of the Federal Lands Highway Program (FLHP). Further details are available on-line at: <http://flh.fhwa.dot.gov/programs/prp>. The FHWA Federal Lands Highway Program is comprised of 4 offices: Headquarters (Washington, DC), and 3 offices that are responsible for a geographic region including Eastern Federal Lands Highway Division (Sterling, VA), Central Federal Lands Highway Division (Lakewood, CO), and Western Federal Lands Highway Division (Vancouver, WA). Web site information is provided below as:

- FHWA Federal Lands Headquarters (Washington, DC) web link: <http://www.fhwa.dot.gov/flh>
- Eastern Federal Lands Highway Division (Sterling, VA) web link: <http://www.efl.fhwa.dot.gov/>
- Central Federal Lands Highway Division (Lakewood, CO) web link: <http://www.cflhd.gov/>
- Western Federal Lands Highway Division (Vancouver, WA) web-link: <http://www.wfl.fhwa.dot.gov/>

Coordinated Planning for National Parks, State, and Local Transportation Facilities

Federal Land Management Agencies (FLMAs) including the National Park Service, and states, and Metropolitan Planning Organizations conduct coordinated transportation planning efforts. A brief overview is provided on-line at: <http://flh.fhwa.dot.gov/programs/planning.htm>. A "Transportation Guidebook for Federal Land Managing Agencies" that is very useful can be accessed on-line at: <http://flh.fhwa.dot.gov/programs/planning.htm>. The Transportation Guidebook is designed to assist Federal land managers, staff, and partners in developing relationships and maximizing participation in transportation planning processes and projects underway by the Federal Highway Administration (FHWA) and the Federal Transit Administration along with state and local transportation agencies.

Existing and Planned Future State and Local Transportation Facilities

Each state has an FHWA Federal Aid Highway Division Office and state transportation agency that participates in state level transportation and coordinates with local transportation programs. Individual metropolitan areas, towns, counties, and local entities also conduct transportation planning and projects relevant to their jurisdiction.

Information about existing and future transportation projects and facilities that involve the efforts of state transportation agencies is accessible on-line at: <http://www.fhwa.dot.gov/webstate.htm>. Future planned transportation facilities in urbanized areas with a population of 50,000 or more are processed through Metropolitan Planning Organizations (MPOs) that exist across the nation. On-line information about MPOs in each state can be accessed on-line at: <http://www.ampco.org/directory/index.php>. Information about staff contacts within each FHWA Federal Aid Division Office in each state is available on-line at: <http://www.fhwa.dot.gov/hep/hepdivoff.cfm>.

Eco-logical: An Ecosystem Approach to Developing Infrastructure Projects

http://www.environment.fhwa.dot.gov/ecological/eco_index.asp

In 2006, after several years of collaboration, the Federal Highway Administration (FHWA) and eight agency partners signed and published Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects (Eco-Logical), which endorsed an “Eco-Logical approach.” The approach offered an alternative to the conventional practice of mitigating project impacts by replacing similar resources close to the impact site. The signatory agencies asserted that such on-site, project-by-project mitigation satisfied regulatory requirements but may not have led to the best environmental outcomes for the ecosystem. Instead, they contended, sustaining or restoring ecological systems and their functions and values on an ecosystem scale is possible when developing infrastructure projects if Federal, State, Tribal, and local partners use flexibility in regulatory processes.

To help agencies achieve this flexibility, Eco-Logical set forth a framework for integrating plans and data across disciplinary boundaries and identifying a region's ecological priorities through agency collaboration. The framework comprised eight key steps:

- 1) Build and Strengthen Collaborative Partnerships
- 2) Identify Management Plans
- 3) Integrate Plans
- 4) Assess Effects
- 5) Establish and Prioritize Opportunities
- 6) Document Agreements
- 7) Design Projects Consistent with Regional Ecosystem Framework
- 8) Balance Predictability and Adaptive Management

This report describes lessons learned from the Integrated Transportation and Ecological Enhancements for Montana (ITEEM) program and aligns these lessons with activities and outcomes from the FHWA Eco-Logical program. The assessment is intended to provide infrastructure and regulatory agencies with ideas on how to utilize the successes of ITEEM and

Eco-Logical in order to identify and address the greatest conservation needs while moving forward with needed infrastructure construction and improvements.

Wildlife-vehicle Collision Reduction Study: Best Practices Manual

<http://environment.fhwa.dot.gov/ecosystems/wvc/index.asp>

This handbook provides practitioners with information on the best tools currently available to reduce wildlife-vehicle collisions (WVCs). The manual covers the complete range of strategies for reducing WVCs from statewide and regional planning all the way through site-specific mitigations. This reference provides the best tools currently available to reduce wildlife-vehicle collisions, including guidelines for monitoring/evaluation to assess the performance of the mitigation measures and corridor planning and design on the regional or state-wide scale. This information is applicable to landscape-scale forest conservation and resource linkage actions.

Invasive Species Management

Invasive Plants

<http://www1.nrintra.nps.gov/BRMD/invasivespecies/>

The NPS has established Exotic Plant Management Teams (EPMT) to control exotic plants. Each EPMT serves multiple parks within a broad geographic area and provides highly trained, mobile strike force of plant management specialists who assist parks in the control of exotic plants.

Invasive Animals

http://www1.nrintra.nps.gov/BRMD/Wildlife_Health_Management/index.cfm

The goal of the NPS's Invasive Animal Program is to assure that populations of non-native animals in natural areas do not jeopardize or interfere with park or site objectives.

Landscape Scale Resource Management and Connectivity

Landscape Conservation Cooperatives

<http://www.fws.gov/science/shc/lcc.html>

Landscape Conservation Cooperatives (LCCs) are public-private partnerships that recognize that the challenge of protecting the nation's natural and cultural resources and landscapes is essential to sustaining our quality of life and economy. It is also recognized that these challenges transcend political and jurisdictional boundaries and require a more networked approach to conservation – holistic, collaborative, adaptive and grounded in science to ensure the sustainability of America's land, water, wildlife and cultural resources.

As a collaborative, LCCs seek to identify best practices, connect efforts, identify gaps, and avoid duplication through improved conservation planning and design. Partner agencies and organizations coordinate with each other while working within their existing authorities and jurisdictions.

The 21 LCCs collectively form a national network of land, water, wildlife and cultural resource managers, scientists and interested public and private organizations – within the U.S. and across our international borders – that share a common need for scientific information and interest in conservation.



Grassland-forest ecotone within a cultural landscape. Pea Ridge National Military Park, Arkansas Credit: National Park Service

National Association of University Forest Resources Programs

<http://www.naufp.org>

The National Association of University Forest Resources Programs (NAUFP) purpose is to advance the health, productivity, and sustainability of America's forests by providing university-based natural resource education, research, science, extension and international programs. Member institutions provide the most reliable, objective, and innovative research on forest ecology, management, utilization, and policy. NAUFP members create the curricula for today and future forest stewardship needs. Through natural resource research, member organizations create and disseminate new knowledge that spans the biological, physical, social, economic, and political sciences. The NAUFP also connects educators, professional managers, scientists, conservation leaders, policy makers, landowners, and forest users to jointly address diverse ecological and human challenges. Partner organizations include international, federal, state, and local governments, private companies, conservation organizations, professional societies, landowners, no-profits, and many more.

NPScape

<http://science.nature.nps.gov/im/monitor/npscape>

NPScape is a landscape dynamics monitoring project that provides landscape-level data, tools, and evaluations for natural resource management and planning at local, regional, and national scales. The target audience for NPScape spans the range from GIS specialists who will benefit from the geospatial data and tools, to ecologists and resource specialists who will be interested in

the landscape metrics presented in a local and regional context, to park superintendents and other land managers who can incorporate the maps and graphics into reports and briefings.

The Nature Conservancy

<http://www.nature.org>

The mission of The Nature Conservancy (TNC) is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. In the United States, the TNC works with federal government agencies, such as the Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Agency for International Development (USAID), the U.S. Department of the Interior (DOI), the National Park Service (NPS) and the Department of Defense (DoD) as well as agencies at the state and local levels.

Roundtable on Sustainable Forests

<http://www.sustainableforests.net>

The Roundtable on Sustainable Forests is an open and inclusive process committed to the goal of Sustainable Forest Management (SFM) on public and private lands in the United States.

Roundtable participants include public and private organizations and individuals committed to better decision-making through shared learning and increased understanding.

Center for Large Landscape Conservation

<http://www.climateconservation.org/>

The Center for Large Landscape Conservation creates strategies to solve nature's large scale challenges, such as climate change and habitat fragmentation. It was established in 2007 and is a non-profit corporation located in Bozeman, Montana. The exceptional scale and complexity of past and current cumulative impacts on the ecological integrity of the biosphere transcend traditional political and governmental boundaries, making it impossible for any single group to adequately address large scale conservation challenges. The Center acts to fill this organizational niche as it helps to connect, facilitate, and catalyze community-based groups, government, industry, universities, conservation organizations, and other interested stakeholders to meet these complex challenges by building broad-based support for large landscape conservation. Ultimately, these efforts will help sustain rural livelihoods and improve the biosphere's ecological integrity. The Center achieves its mission by:

- Connecting ideas, individuals and institutions
- Connecting conservation initiatives across various scales
- Developing conservation strategies
- Providing its knowledge, expertise and experience to other conservation groups
- Moving policy and science to on-the-ground implementation

EPA "Surf Your Watershed"

<http://cfpub.epa.gov/surf/locate/index.cfm>

This link helps you to identify the watershed in which you're situated as well as those within your region. While this web site was established primarily to protect water quality, it can be useful in junction with efforts to promote landscape-scale forest stewardship as well as for promoting ecosystem form and function. Links include "Citizen-based groups at work in this

watershed,” in addition to a listing of organizations that are working to protect water quality. You may wish to contact one of these groups to find out about cleanups, monitoring activities, restoration projects and other activities.

Geospatial One-Stop

<http://www.geodata.gov>

An intergovernmental project managed by the Department of the Interior in support of the President's Initiative for E-government, Geospatial One Stop builds upon its partnership with the Federal Geographic Data Committee (FGDC) to improve the ability of the public and government to use geospatial information to support the business of government and facilitate decision-making. Through the Geospatial One Stop portal (www.geodata.gov), anyone can access geospatial information from federal agencies and a growing number of state, local, tribal and private agencies through one comprehensive and comprehensible portal. Relevant data categories include, but are not limited to: Administrative Boundaries; Agriculture 7 Farming; Atmosphere & Climate; Biology & Ecology; Business 7 Economic; Cadastral; Cultural, Society & Demographic; Elevation & Derived Products; Environment & Conservation; Geological & Geophysical; Human Health & Disease; Imagery and Basemaps; Inland Water Resources; Locations & Geodetic Networks; Oceans & Coasts; Transportation Networks; and Utilities & Communications.

Healthy Watersheds Initiative: National Framework and Action Plan 2011

http://water.epa.gov/polwaste/nps/watershed/hwi_action.cfm

The Healthy Watersheds Initiative National Framework and Action Plan 2011 is a collaborative product of EPA headquarters and the regions and our State and federal partners with input from non-governmental organizations. State partners include both the Association of Clean Water Administrators Agencies and Association of Fish and Wildlife Agencies. The Action Plan presents a clear, consistent framework for action, both internally among EPA's own programs and externally in working with our partners. The Action Plan describes the HWI, including its vision, guiding principles, goals and objectives; and presents an implementation framework for actions by EPA headquarters, Regions, and States. This Action Plan is a living document that will guide EPA and our State partner efforts to meet EPA's Strategic Plan Goal 2 Objective of protecting and restoring watersheds and aquatic ecosystems.

Landscape Conservation Cooperatives

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Handbook for Developing Watershed Plans to Restore and Protect Our Waters

http://water.epa.gov/polwaste/nps/handbook_index.cfm

This handbook is intended to help communities, watershed organizations, and state, local, tribal and federal Government agencies develop and implement watershed plans to meet water quality standards and protect water resources. It was designed to help any organization undertaking a watershed planning effort, and it should be particularly useful to persons working with impaired or threatened waters. EPA intends for this handbook to supplement existing watershed planning guides that have already been developed by agencies, universities, and other non-profit organizations. The handbook is generally more specific than other guides with respect to guidance on quantifying existing pollutant loads, developing estimates of the load reductions required to meet water quality standards, developing effective management measures, and tracking progress once the plan is implemented.

International Stormwater Best Management Practices (BMPs) Database

<http://www.bmpdatabase.org/>

The International Stormwater Best Management Practices (BMPs) Database project website, which features a database of over 400 BMPs studies, performance analysis results, tools for use in BMPs performance studies, monitoring guidance and other study-related publications. The overall purpose of the project is to provide scientifically sound information to improve the design, selection and performance of BMPs. Continued population of the database and assessment of its data will ultimately lead to a better understanding of factors influencing BMPs performance and help to promote improvements in BMPs design, selection and implementation.

The National Map

<http://nationalmap.gov>

The National Map is a consistent framework for geographic knowledge needed by the Nation. It provides public access to high-quality, geospatial data and information from multiple partners to help support decision-making by resource managers and the public. The National Map is the product of a consortium of Federal, State, and local partners who provide geospatial data to enhance America's ability to access, integrate, and apply geospatial data at global, national, and local scales.

USDA Natural Resources Conservation Service (NRCS): NRCS Conservation Programs

[http://www.nrcs.usda.gov/wps/portal/nrcs/main/?ss=16&navtype=BROWSEBYSUBJECT&cid=null&navid=1000000000000000&pnavid=null&position=BROWSEBYSUBJECT&tttype=main&pname=Programs & Services | NRCS](http://www.nrcs.usda.gov/wps/portal/nrcs/main/?ss=16&navtype=BROWSEBYSUBJECT&cid=null&navid=1000000000000000&pnavid=null&position=BROWSEBYSUBJECT&tttype=main&pname=Programs%20%26%20Services|NRCS)

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty.

The NRCS could be a valuable partner for parks that are looking to promote landscape linkages and ecosystem conservation beyond park boundaries. Parks may also find some additional benefits when dealing with the control of invasive species and forest management. Please contact your local NRCS office or the Assistant State Conservationist in your state to review and describe their programs and services to find the best fit for your needs.

Within this website, please review the following sections in particular for applicability to your park and to outside partners. Several other resources may also apply (consult with your NRCS representative):

Environmental Improvement Programs

Environmental Quality Incentive Program

Stewardship Programs

Conservation Stewardship Program (This can apply to forest enhancements)

Easements

Healthy Forests Reserve Program

Technical Processes, Tools, and Other Technical Resources

- Conservation Planning (Area-Wide Planning)
- National Conservation Practice Standards
- Rapid Watershed Assessment
- Ecological Services Inventory

USDA Natural Resources Conservation Service (NRCS): NRCS Technical Resources

[http://www.nrcs.usda.gov/wps/portal/nrcs/main/?ss=16&navtype=BROWSEBYSUBJECT&cid=null&navid=1200000000000000&pnavid=null&position=BROWSEBYSUBJECT&tttype=main&pname=Technical Resources | NRCS](http://www.nrcs.usda.gov/wps/portal/nrcs/main/?ss=16&navtype=BROWSEBYSUBJECT&cid=null&navid=1200000000000000&pnavid=null&position=BROWSEBYSUBJECT&tttype=main&pname=Technical+Resources+|+NRCS)

NRCS uses science-based technology to provide conservation planning and assistance to land owners and operators and others to benefit the soil, water, air, plants, and animals for productive lands and healthy ecosystems.

Western Governors' Association

http://www.westgov.org/index.php?option=com_content&view=article&id=127:forest-health-and-wildfire&catid=102&Itemid=66

The Western Governors' Association (WGA) was formed to provide strong multistate leadership in an era of critical change in the economy and demography of the West. Through the WGA, Western Governors identify and address key policy issues in natural resources, the environment, human services, economic development, international relations, transportation and public management. The WGA helps the Governors develop strategies both for the complex, long-term issues facing the West and for the region's immediate needs. The WGA has its own "Initiative on Forest Health and Wildlife." Responsible fire management figures highly within this initiative. The website also showcases WGA resolutions, such as on Large Scale Forest

Health Restoration, State Assessment and Management of Western Forests, Invasive Species Management, and Improving Forest and rangeland Ecosystem health in the West.

The Yellow River Initiative, Iowa

<http://www.northeastiowarcd.org/yrrw/index.html>

Yellow River Initiative is a partnership for resource sustainability. Its purpose is to promote excellence in natural resource stewardship and ecosystem function at the small watershed scale in balance with the ongoing human needs of the area. The project offers the public appropriate, understandable information on natural resources within the watershed, together with an internet-based “toolbox” of related technical and programmatic assistance information. In addition, by promoting the establishment of a local watershed coordinator to provide long term guidance and continuity, the Yellow River Initiative hopes to empower people to voluntarily use this information – among local residents, landowners, and federal, state and local governments, as well as with non-governmental organizations – to help them achieve natural resource sustainability and stewardship within the within the Yellow River watershed. Once implemented, this approach is intended to be applied as a template to consecutive neighboring small watersheds until excellence in resource stewardship and sustainable natural resource form and function is achieved at the larger regional watershed scale. The Yellow River Initiative is one example of a strategic approach that can facilitate the establishment of a regional network of linked forest resources to promote the exchange of genetic materials while contributing to ecological integrity and resilience.

Ecosystem Management Links

Association of State Fish & Wildlife Agencies

<http://www.fishwildlife.org>

The Association of Fish & Wildlife Agencies represents North America’s fish and wildlife agencies to advance sound, science-based management and conservation of fish and wildlife and their habitats in the public interest.

Cooperative Ecosystem Studies Units (CESUs)

<http://www.cesu.psu.edu>

The Cooperative Ecosystem Studies Units (CESU) Network is a national consortium of federal agencies, academic institutions, tribal, state, and local governments, nongovernmental conservation organizations, and other partners working together to support informed public trust resource stewardship. The CESU Network includes nearly 300 partners, including 13 federal agencies, in 17 CESUs representing biogeographic regions encompassing all 50 states and U.S. territories. The CESU Network is well positioned as a platform to support research, technical assistance, education and capacity building that is responsive to long-standing and contemporary science and resource management priorities.

The 17 CESUs bring together scientists, resource managers, students, and other conservation professionals, drawing upon expertise from across the biological, physical, social, cultural, and engineering disciplines (from Anthropology to Zoology) to conduct collaborative and interdisciplinary applied projects that address natural and cultural heritage resource issues at multiple scales and in an ecosystem context. Each CESU is structured as a working collaborative

with participation from numerous federal and nonfederal institutional partners. CESUs are based at host universities and focused on a particular biogeographic region of the country.

Ecosystem Management and Restoration

<http://www1.nrintra.nps.gov/BRMD/Ecosystems/index.cfm>

The Ecosystem Restoration Program provides policy, tools, and technical guidance necessary to restore disrupted ecological processes and degraded ecosystems. This reflects the NPS goal to restore degraded areas as close as practicable to the pre-disturbance condition of biodiversity, ecosystem structure and function, such that subsequent successional and other naturally occurring dynamic processes will help sustain the desired pre-disturbance state.

Federal Highway Administration

<http://flh.fhwa.dot.gov/>

The Office of Federal Highway (FLH) provides program stewardship and transportation engineering services for planning, design, construction, and rehabilitation of the highways and bridges that provide access to and through federally owned lands. FHWA's initial partnership began with the US Forest Service in 1914 and expanded to the National Park Service in 1926. The primary purpose of the FLHP is to provide financial resources and technical assistance for the coordinated program of public roads that service the transportation needs of Federal and Indian lands.

This section guides you to opportunities for optimizing conservation planning and proactively identifying priority areas for ecological and economic investment while promoting forest resources at the landscape scale through FHWA transportation planning and programs.

US Geological Survey

USGS: Ecosystems

<http://ecosystems.usgs.gov/about.html>

The organization of the Ecosystems (Biological Resource Division - BRD) is an outgrowth of the BRD mission to work with others to provide the scientific understanding and technologies needed to support sound management and conservation of our nation's biological resources. This site includes information on contacts, regions, and partnerships.

USGS: Upper Midwest Environmental Sciences Center

<http://www.umesc.usgs.gov>

This center provides the scientific information needed by managers, decision makers, and the public to protect, enhance, and restore the ecosystems in the Upper Mississippi River basin, the Midwest, and worldwide.

USGS: Fort Collins Environmental Sciences Center

<http://www.umesc.usgs.gov>

This center provides the scientific information needed by managers, decision makers, and the public to protect, enhance, and restore the ecosystems in the Upper Mississippi River basin, the Midwest, and worldwide. Social & economic analysis

USGS: National Wildlife Health Center, Madison, Wisconsin

<http://www.umesc.usgs.gov>

This center provides the scientific information needed by managers, decision makers, and the public to protect, enhance, and restore the ecosystems in the Upper Mississippi River basin, the Midwest, and worldwide.

USGS: Water Science Center for each state

<http://www.umesc.usgs.gov>

This center provides the scientific information needed by managers, decision makers, and the public to protect, enhance, and restore the ecosystems in the Upper Mississippi River basin, the Midwest, and worldwide.

Fire and Forest Stewardship

Fire and Fire Surrogates Study

<http://www.frames.gov/ffs>

Compared to historic conditions, many forests in the U.S. are now denser and have more down fuels. For years, managers have recognized this problem and have acted to reduce stem density and fuels by thinning, burning, and/or fuel treatments.

Yet although silvicultural treatments can mimic the effects of fire on structural patterns of woody vegetation, virtually no comparative data exist on how these treatments mimic ecological functions of fire. For many, the long term goal of these treatments is to restore historic ecosystem structure and function. Thus while silvicultural treatments can create patterns of woody vegetation that appear similar to those that fire would create, the consequences for nutrient cycling, seed scarification, plant diversity, disease and insect abundance, and wildlife are mostly unknown. Similarly, although combining managed fire with silvicultural treatments adds the critical effects of combustion, we know little about ecological effects, economics, and fire hazard reduction of these methods.

The Fire-Fire Surrogate (FFS) study responds to this void in our knowledge.

The USDI-USDA “Joint Fire Science Program” has provided funding for a long-term study to assess how ecological components or processes may be changed or lost, if fire “surrogates” such as cuttings and mechanical fuel treatments are used instead of fire, or in combination with fire.

Firewise Communities

<http://www.firewise.org/About.aspx>

Brush, grass or forests fires don't have to be disasters. The National Fire protection Association's (NFPA) Firewise Communities program encourages local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in the effort to protect people and property from wildfire risks. The program is co-sponsored by the US Forest Service, the US Department of the Interior, and the National Association of State Foresters. To save lives and property, from wildfire, the NFPA's Firewise Communities program teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action now to prevent losses.

Forests and Rangelands

<http://www.forestsandrangelands.gov/>

Forests and Rangelands is a cooperative effort between the US Department of the Interior (DOI), the United States Department of Agriculture (USDA), and their land management agencies. Forests and Rangelands provides fire, fuels, and land management information to government officials, land and fire management professionals, businesses, communities, and other interested organizations and individuals.

Joint Fire Science Program

<http://www.firescience.gov/index.cfm>

The Joint Fire Science Program (JFSP) was created by Congress in 1998 as an interagency research, development, and applications partnership between the U.S. Department of the Interior and the U.S. Department of Agriculture. Funding priorities and policies are set by the JFSP Governing Board, which includes representatives from the Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, U.S. Geological Survey, and five representatives from the Forest Service. The JFSP:

- Provides credible research tailored to the needs of fire and fuel managers
- Engages and listens to clients and then develops focused, strategic lines of new research responsive to those needs
- Solicits proposals from scientists who compete for funding through a rigorous peer-review process designed to ensure the best projects are funded, and
- Focuses on science delivery when research is completed with a suite of communication tools to ensure that managers are aware of, understand, and can use the information to make sound decisions and implement projects.

National Cohesive Wildland Fire Management Strategy

<http://www.forestsandrangelands.gov/strategy/index.shtml>

In response to requirements of the Federal Land Assistance, Management, and Enhancement (FLAME) Act of 2009, the Wildland Fire Leadership Council (WFLC) directed the development of the National Cohesive Wildland Fire management Strategy (Cohesive Strategy). The Cohesive Strategy is a collaborative process with active involvement of all levels of government and non-government organizations; as well as the public, to seek national, all-lands solutions to wildland fire management issues.

National Wildland Fire Leadership Council

http://www.westgov.org/index.php?option=com_content&view=article&id=127:forest-health-and-wildfire&catid=102&Itemid=66

The Wildland Fire Leadership Council coordinates and implements wildland fire and fuels policies, goals and management activities. The WFLC is an intergovernmental committee of federal, state, tribal, county and municipal officials and is considered a model for collaboration and effective leadership. The WFLC emphasized the need for states and stakeholders to be partners in developing and implementing a new cohesive wildfire management strategy. Key elements include improved coordination and communication in preventing wildfires, creating fire-adapted communities, suppressing wildfires, and restoring and managing public lands at a landscape scale. The Secretaries of Interior, Agriculture and Homeland Security, who oversee the WFLC, collaboratively developed a report to Congress as a requirement to the FLAME Act and a companion document, "Phase 1 Cohesive Wildland Fire Management Strategy."

NPS Fire Program Ecology Contacts

http://www.nps.gov/fire/fire/fir_eco_contacts.cfm

The National Park Service manages wildland fire to protect the public, communities and infrastructure, conserve natural and cultural resources, and restore and maintain ecological health.

Western Governors' Association

http://www.westgov.org/index.php?option=com_content&view=article&id=127:forest-health-and-wildfire&catid=102&Itemid=66

The Western Governors' Association (WGA) was formed to provide strong multistate leadership in an era of critical change in the economy and demography of the West. Through the WGA, Western Governors identify and address key policy issues in natural resources, the environment, human services, economic development, international relations, transportation and public management. The WGA helps the Governors develop strategies both for the complex, long-term issues facing the West and for the region's immediate needs. The WGA has its own "Initiative on Forest Health and Wildlife." Responsible fire management figures highly within this initiative. The website also showcases WGA resolutions, such as on Large Scale Forest Health Restoration, State Assessment and management of Western Forests, Invasive Species Management, and Improving Forest and rangeland Ecosystem health in the West.

Forest Reconstruction and Restoration

Arbor Day Foundation

<http://www.arborday.org>

Arbor Day Foundation inspires people to plant, nurture, and celebrate trees. The NPS should soon have a formal agreement (MOU?) with the Arbor Day Foundation to provide funding reimbursement for trees purchased by parks to replace those that have been damaged by fire, insects and diseases as well as for forest ecosystem reconstruction.

Council of Western State Foresters

<http://www.wflcweb.org/council/>

Established in 1967, the Council of Western State Foresters (CWSF) is a non-partisan organization of state, territorial, and commonwealth foresters of the western United States and Pacific Islands. The responsibilities of State Foresters vary across the west, being primarily charged with providing forest management assistance to landowners, managing state trust lands and supplying wildlife and forest health protection services. The CWSF a partners with the US Forest Service and works closely with their counterparts who manage federal lands to administer State and Private Forestry programs. This unique partnership combines the CWSF with the Forest Service's western Regional Foresters, Western Research Station Directors, and the Forest Products Lab Director. This partnership is called the Western Forest Leadership Coalition.

Olmstead Center for Landscape Preservation (OCLP) (Cultural Landscape Management)

<http://www.nps.gov/oclp.html>

The Olmstead Center for Landscape Preservation strengthens the capacity of parks and historic properties to manage cultural landscapes as part of our national heritage. Working in partnership with parks, universities, government agencies and non-profit organizations, the Olmstead Center provides a full range of technical assistance in cultural landscape research, planning, stewardship and education.

NPS Ecosystem Management and Restoration Programs

<http://www1.nrintra.nps.gov/BRMD/Ecosystems/index.cfm>

The Ecosystem Restoration Program provides policy, tools and technical guidance necessary to restore disrupted ecological processes and degraded ecosystems. The reflects the NPS goal to restore degraded areas as close as practicable to the pre-disturbance condition of biodiversity, ecosystem structure and function, such that subsequent successional and other naturally occurring dynamic processes will help sustain the desired pre-disturbance state. The program coordinates with and integrates ecological issues into restoration efforts funded or conducted by the Disturbed Lands, Weed Management and other NRPC restoration programs. The program also works with Hazardous Materials, Fire, and facilities programs.

Northeastern Area Association of State Foresters

<http://www.northeasternforests.org/>

This website contains links to the Association's various committees:

- Forest Resource Planning Committee
- Cooperative Forest Management Committee
- Urban and Community Forestry Committee
- State Land Management Committee
- Forest Utilization Committee
- Forest Health Committee

Southern Group of State Foresters

<http://www.southernforests.org>

The goal of this organization is to ensure the growth of healthy forests, today and tomorrow. The organization provides leadership in sustaining the economic, environmental, and social benefits of the South's forests. They also work to identify and address existing and emerging issues and challenges that are important to southern forests and citizens. This organization uses extensive research, in-depth analysis, and cutting-edge technology to develop systems to assess and analyze forest resources, such as the "Southern Wildlife Risk Assessment" and the "Southern Forest land Assessment." These proactive tools enable users – whether they are landowners, legislators, or community decision-makers – to make more informed decisions. (For the NPS MWR, they include Arkansas).

Forest Stewardship Education

Don't Move Firewood

<http://www.dontmovefirewood.org>

Tree-killing insects and diseases can lurk in firewood. These insects and diseases can't move far on their own, but when people move firewood they can jump hundreds of miles. New infestations destroy our forests, property values, and cost large sums of money to control. This website raises awareness about the pest and disease-related hazards of moving firewood, or any wood, together with other information on what you can do to prevent this from happening.

National Association of Conservation Districts

<http://nacdnet.org>

For more than 50 years, the National Association of Conservation Districts (NACD) has sponsored a national program to encourage Americans to focus on stewardship. The program relies on locally-led conservation districts sharing and promoting stewardship and conservation activities. In addition to producing education materials for their Stewardship Program, the NACD provides additional educational tools to districts, including resources on forestry, habitat, soil, water and energy.

National Firewood Task Force Recommendations

<http://www.nd.gov/ndda/files/resource/NationalFirewoodTaskForceRecommendations.pdf>

The complexity of a national approach to mitigate the movement of forest pests led to the creation of the National Firewood Task Force. The Task Force focused on three primary areas of action: outreach, voluntary, and regulatory. For each of these areas, several strategies were developed to contribute to an overall effective and cohesive national response to the firewood pest pathway issue. The Task Force's recommendations are presented here.

Project Learning Tree

<http://www.plt.org>

Project Learning Tree is an award-winning environmental education program designed for teachers and other educators, parents, and community leaders working with youth from preschool through grade 12. A new "Exploring Environmental Issues: Focus on Forests" curriculum is available which is designed to foster student understanding of – and appreciation for – the forested lands throughout North America. The module's activities provide an opportunity for hands-on study of forest resources while addressing concepts in biology, civics, ecology, economics, forest management, and other subject areas. Through the activities found within this module, students examine ecological systems of a forest; analyze interdependencies within a forest ecosystem; and explore factors, such as fire, that shape the development of forests. In addition, they develop critical thinking skills and discover the importance of scientific analysis when making decisions about forest issues.

Promise Not to Move Firewood

<http://www.stopthebeetle.info>

This website, sponsored by the USDA-APHIS, raises public awareness as to why you should not move firewood together with information on the emerald ash borer.

Society of American Foresters

<http://www.safnet.org>

The Society of American Foresters (SAF) is the national scientific and educational organization representing the forestry profession in the United States. Founded in 1900 by Gifford Pinchot, it is the largest professional society for foresters in the world. The mission of the SAF is to advance the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish professional excellence; and, to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society. SAF is a nonprofit organization meeting the requirements of 501 © (3). SAF members include natural resource

professionals in public and private settings, researchers, CEOs, administrators, educators, and students.

TEL Broadcast - “Firewood: A Threat to Forest Resources”

<http://www.samo.nps.gov/videodownload>

This NPS website explains the dangers to forest pests that are associated with moving firewood., and was aired on April 20, 2010.

Inventory and Monitoring

CastNet

<http://epa.gov/castnet/javaweb/mapcharts.html>

This program is a data model showing national maps related to air deposition, which could also relate to climate change.

Enviromapper

<http://www.epa.gov/myenvironment/>

Environmapper is a tool that gives an overview of environmental data based on specific geographic areas.

LANDFIRE Geospatial Maps and Data

<http://www.landfire.gov/index.php>

LANDFIRE is the nation’s most collaborative source of geospatial maps and data offering consistent and comprehensive landscape-scale data layers. With LANDFIRE, you can view and download geospatial layers and data products that depict the nation’s major ecosystems, wildlife habitat, vegetation or canopy characteristics, landscape features, and wildland fire behavior, effects, and regimes. These data layers traverse jurisdictional land boundaries and provide the public free data products for numerous applications, including wildland fire management and landscape conservation. LANDFIRE is a shared effort between the US Department of Agriculture Forest Service and the US Department of the Interior.

NPS Cultural Landscape Program

http://www.nps.gov/cultural_landscapes/index.html

This program is part of the WASO service-wide cultural resources program. This recently launched website is available to the NPS and public and content will continue to be added over time.

NPS Inventory and Monitoring Division

<http://inside.nps.gov/waso/waso.cfm?prg=133&lv=2>

The Office of Inventory, Monitoring, and Evaluation documents the status and trends of natural resources in America’s national parks. As such, the branch oversees inventory and monitoring programs throughout the National Park Service, including assisting parks, regions, and other NPS offices in the acquisition of natural resource inventory and monitoring information and its application in management decision-making and resource protection. Areas addressed within this branch include: Natural Resource Inventories, Vital Signs Monitoring, Applications and Databases, Data Management, and Vital Signs Networks.

NPS Natural Resource Condition Assessment Program

[http://www.nature.nps.gov/water/NRCondition Assessment Program/Index.cfm](http://www.nature.nps.gov/water/NRCondition%20Assessment%20Program/Index.cfm)

This program was established within the Water Resources Division to provide project funding, technical assistance, and accountability oversight to assess watershed resource conditions within national park units.

NPS Vegetation Mapping Inventory

<http://science.nature.nps.gov/im/inventory/veg/index.cfm>

The NPS's Vegetation Mapping Inventory is an effort by the NPS to classify, describe, and map detailed vegetation communities in more than 280 national park units across the United States. The primary objective of this inventory is to produce high-quality, standardized maps and associated data sets of vegetation and other land-cover occurring within parks. This information fills and complements a wide variety of resource assessment, park management, and conservation needs. Vegetation species and communities are unique from park to park. The inventory of these resources helps park managers conserve plant biodiversity, manage challenges, such as exotic species, insect outbreaks, and diseases, and understand resources and processes, such as wildlife habitat relationships and wildland fires.

US Forest Service: Forest Inventory and Analysis National Program

<http://www.fia.fs.fed.us/> [www.nature.nps.gov/water/NRCondition Assessment Program/Index.cfm](http://www.nature.nps.gov/water/NRCondition%20Assessment%20Program/Index.cfm)

The Forest inventory and Analysis (FIA) program of the US Forest Service provides the information needed to assess America's forests. As the Nation's continuous forest census, this program projects how forests are likely to appear 10 to 50 years from now. This enables resource managers to evaluate whether current forest management practices are sustainable in the long run and to assess whether current policies will allow the next generation to enjoy America's forests as we do today. FIA reports on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and in forest land ownership.

USGS Vegetation Characterization Program

<http://biology.usgs.gov/npsveg/>

This program is a cooperative effort by the US Geological Service and the NPS Inventory & Monitoring – Vegetation Mapping Program to classify, describe, and map vegetation communities in more than 280 national park units across the United States.

Center for Large Landscape Conservation

<http://www.climateconservation.org/>

The Center for Large Landscape Conservation creates strategies to solve nature's large scale challenges, such as climate change and habitat fragmentation. It was established in 2007 and is a non-profit corporation located in Bozeman, Montana. The exceptional scale and complexity of past and current cumulative impacts on the ecological integrity of the biosphere transcend traditional political and governmental boundaries, making it impossible for any single group to adequately address large scale conservation challenges. The Center acts to fill this organizational niche as it helps to connect, facilitate, and catalyze community-based groups, government, industry, universities, conservation organizations, and other interested stakeholders to meet these complex challenges by building broad-based support for large landscape

conservation. Ultimately, these efforts will help sustain rural livelihoods and improve the biosphere's ecological integrity. The Center achieves its mission by:

- Connecting ideas, individuals and institutions
- Connecting conservation initiatives across various scales
- Developing conservation strategies
- Providing its knowledge, expertise and experience to other conservation groups
- Moving policy and science to on-the-ground implementation

EPA "Surf Your Watershed"

<http://cfpub.epa.gov/surf/locate/index.cfm>

This link helps you to identify the watershed in which you're situated as well as those within your region. While this web site was established primarily to protect water quality, it can be useful in junction with efforts to promote landscape-scale forest stewardship as well as for promoting ecosystem form and function. Links include "Citizen-based groups at work in this watershed," in addition to a listing of organizations that are working to protect water quality. You may wish to contact one of these groups to find out about cleanups, monitoring activities, restoration projects and other activities.

Geospatial One-Stop

<http://www.geodata.gov>

An intergovernmental project managed by the Department of the Interior in support of the President's Initiative for E-government, Geospatial One Stop builds upon its partnership with the Federal Geographic Data Committee (FGDC) to improve the ability of the public and government to use geospatial information to support the business of government and facilitate decision-making. Through the Geospatial One Stop portal (www.geodata.gov), anyone can access geospatial information from federal agencies and a growing number of state, local, tribal and private agencies through one comprehensive and comprehensible portal. Relevant data categories include, but are not limited to: Administrative Boundaries; Agriculture & Farming; Atmosphere & Climate; Biology & Ecology; Business & Economic; Cadastral; Cultural, Society & Demographic; Elevation & Derived Products; Environment & Conservation; Geological & Geophysical; Human Health & Disease; Imagery and Basemaps; Inland Water Resources; Locations & Geodetic Networks; Oceans & Coasts; Transportation Networks; and Utilities & Communications.

Healthy Watersheds Initiative: National Framework and Action Plan 2011

http://water.epa.gov/polwaste/nps/watershed/hwi_action.cfm

The Healthy Watersheds Initiative National Framework and Action Plan 2011 is a collaborative product of EPA headquarters and the regions and our State and federal partners with input from non-governmental organizations. State partners include both the Association of Clean Water Administrators Agencies and Association of Fish and Wildlife Agencies. The Action Plan presents a clear, consistent framework for action, both internally among EPA's own programs and externally in working with our partners. The Action Plan describes the HWI, including its vision, guiding principles, goals and objectives; and presents an implementation framework for actions by EPA headquarters, Regions, and States. This Action Plan is a living document that

will guide EPA and our State partner efforts to meet EPA's Strategic Plan Goal 2 Objective of protecting and restoring watersheds and aquatic ecosystems.

Landscape Conservation Cooperatives

<http://www.fws.gov/science/shc/lcc.html>

Landscape Conservation Cooperatives (LCCs) are public-private partnerships that recognize that the challenge of protecting the nation's natural and cultural resources and landscapes is essential to sustaining our quality of life and economy. It is also recognized that these challenges transcend political and jurisdictional boundaries and require a more networked approach to conservation – holistic, collaborative, adaptive and grounded in science to ensure the sustainability of America's land, water, wildlife and cultural resources.

As a collaborative, LCCs seek to identify best practices, connect efforts, identify gaps, and avoid duplication through improved conservation planning and design. Partner agencies and organizations coordinate with each other while working within their existing authorities and jurisdictions.

The 21 LCCs collectively form a national network of land, water, wildlife and cultural resource managers, scientists and interested public and private organizations – within the U.S. and across our international borders – that share a common need for scientific information and interest in conservation.

International Stormwater Best Management Practices (BMPs) Database

<http://www.bmpdatabase.org/>

The International Stormwater Best Management Practices (BMPs) Database project website, which features a database of over 400 BMPs studies, performance analysis results, tools for use in BMPs performance studies, monitoring guidance and other study-related publications. The overall purpose of the project is to provide scientifically sound information to improve the design, selection and performance of BMPs. Continued population of the database and assessment of its data will ultimately lead to a better understanding of factors influencing BMPs performance and help to promote improvements in BMPs design, selection and implementation.

The National Map

<http://nationalmap.gov>

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USDA Natural Resources Conservation Service (NRCS): NRCS Conservation Programs

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agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty.

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Conservation Stewardship Program (This can apply to forest enhancements)

Easements

Healthy Forests Reserve Program

Technical Processes, Tools, and Other Technical Resources

- Conservation Planning (Area-Wide Planning)
- National Conservation Practice Standards
- Rapid Watershed Assessment
- Ecological Services Inventory

USDA Natural Resources Conservation Service (NRCS): NRCS Technical Resources

[http://www.nrcs.usda.gov/wps/portal/nrcs/main/?ss=16&navtype=BROWSEBYSUBJECT&cid=null&navid=1200000000000000&pnavid=null&position=BROWSEBYSUBJECT&tttype=main&pname=Technical Resources | NRCS](http://www.nrcs.usda.gov/wps/portal/nrcs/main/?ss=16&navtype=BROWSEBYSUBJECT&cid=null&navid=1200000000000000&pnavid=null&position=BROWSEBYSUBJECT&tttype=main&pname=Technical+Resources+|+NRCS)

NRCS uses science-based technology to provide conservation planning and assistance to land owners and operators and others to benefit the soil, water, air, plants, and animals for productive lands and healthy ecosystems.

Western Governors' Association

http://www.westgov.org/index.php?option=com_content&view=article&id=127:forest-health-and-wildfire&catid=102&Itemid=66

The Western Governors' Association (WGA) was formed to provide strong multistate leadership in an era of critical change in the economy and demography of the West. Through the WGA, Western Governors identify and address key policy issues in natural resources, the environment, human services, economic development, international relations, transportation and public management. The WGA helps the Governors develop strategies both for the complex, long-term issues facing the West and for the region's immediate needs. The WGA has its own "Initiative on Forest Health and Wildlife." Responsible fire management figures highly within

this initiative. The website also showcases WGA resolutions, such as on Large Scale Forest Health Restoration, State Assessment and Management of Western Forests, Invasive Species Management, and Improving Forest and rangeland Ecosystem health in the West.

The Yellow River Initiative, Iowa

<http://www.northeastiowarcd.org/yrrw/index.html>

Yellow River Initiative is a partnership for resource sustainability. Its purpose is to promote excellence in natural resource stewardship and ecosystem function at the small watershed scale in balance with the ongoing human needs of the area. The project offers the public appropriate, understandable information on natural resources within the watershed, together with an internet-based “toolbox” of related technical and programmatic assistance information. In addition, by promoting the establishment of a local watershed coordinator to provide long term guidance and continuity, the Yellow River Initiative hopes to empower people to voluntarily use this information – among local residents, landowners, and federal, state and local governments, as well as with non-governmental organizations – to help them achieve natural resource sustainability and stewardship within the within the Yellow River watershed. Once implemented, this approach is intended to be applied as a template to consecutive neighboring small watersheds until excellence in resource stewardship and sustainable natural resource form and function is achieved at the larger regional watershed scale. The Yellow River Initiative is one example of a strategic approach that can facilitate the establishment of a regional network of linked forest resources to promote the exchange of genetic materials while contributing to ecological integrity and resilience.

Partnerships for Forest Stewardship

Partnerships for Within NPS Parks

American Chestnut Foundation

<http://www.acf.org/>

The goal of the American Chestnut Foundation is to restore the American chestnut tree to our eastern woodlands to benefit our environment, our wildlife, and our society.

American Forests

<http://www.americanforests.org>

American Forests, the oldest national nonprofit conservation organization in the country, advocates for the protection and expansion of America’s forests. Since 1990, they have planted nearly 40 million trees. Their goal is to work with their partners to plant an additional 25-30 million trees in forest restoration projects during the next five years. They restore watersheds to help provide clean drinking water. They also replant forests destroyed by human action and by natural disasters. In addition, American Forests helps to ensure the health of urban forests, restores forest ecosystems, educates the public, and advocates for sound forest policy.

Arbor Day Foundation

<http://www.arborday.org>

Arbor Day Foundation inspires people to plant, nurture, and celebrate trees. The NPS should soon have a formal agreement (MOU?) with the Arbor Day Foundation to provide funding

reimbursement for trees purchased by parks to replace those that have been damaged by fire, insects and diseases as well as for forest ecosystem reconstruction.

Partnerships for Outside NPS Parks

Alliance for Community Trees

<http://www.arborday.org>

The Alliance for Communities (ACT) trees is the only national organization solely focused on the needs of those engaged in urban forestry. Their purpose is to improve the environment where 80% of Americans live and work: our cities, towns, and villages. ACT awards grants and awards; conducts Neighbor Woods, a national campaign to protect and restore America's trees; advocate for public policy that supports trees; promotes tree planting; provides printed and electronic resources for improving urban forests; and provides training.

American Forest Foundation

<http://www.forestfoundation.org>

The American Forest Foundation (AFF) works on-the-ground with families, teachers, and elected officials to promote stewardship and protect our nation's forest heritage. This organization states that they ensure the sustainability of America's family forests for present and future generations in conjunction with their strategic partners. The AFF is committed to creating a future where North American forests are sustained by the public that understand and values the social, economic, and environmental benefits they provide to our communities, our nation, and the world.

American Tree Farm System

<http://www.treefarmssystem.org>

This organization sustains forests, watersheds, and healthy habitats through the power of private stewardship. It promotes stewardship, woodland conservation, and offers tools and resources.

Continental Dialogue on Non-Native Forest Insects & Diseases

<http://www.continentalforestdialogue.org/>

The Continental Dialogue on Non-Native Forest Insects and Diseases cultivates and catalyzes collaborative action among diverse interests to abate the threat to North American forests from non-native insects and diseases.

Pinchot Institute for Conservation

<http://www.pinchot.org>

The mission of the Pinchot Institute is to strengthen forest conservation thought, policy, and action by developing innovative, practical, and broadly-supported solutions to conservation challenges and opportunities. The Institute accomplishes this through nonpartisan research, education and technical assistance on key issues influencing the future of conservation and sustainable natural resource management.

The Trust for Public Lands

<http://www.tpl.org/about/mission/>

The Trust for Public Lands conserves land for people to enjoy as parks, gardens, and other natural places, ensuring livable communities for generations to come. Over the years, their work

has expanded to include projects from inner city to wilderness, and their broad experience has made them a national leader and innovator in city park creation, state and local conservation funding, and using GIS for conservation planning.

Western Forestry Leadership Coalition

<http://www.wflccenter.org>

The Western Forestry leadership Coalition is a unique state and federal partnership working with the people and resources of the West. The programs that this organization administers assist family forest-owners, rural and state fire organizations, and community forestry groups. The success of these programs helps to improve forest health, encourage land conservation, and stimulate community economic recovery.

The Wildlife Society

http://joomla.wildlife.org/index.php?option=com_content&task=view&id=12&Itemid=29
[/www.wflccenter.org](http://www.wflccenter.org)

The Wildlife Society (TWS) is a professional international non-profit scientific and educational association dedicated to excellence in wildlife stewardship through science and education. Society members are dedicated to sustainable management of wildlife resources and their habitats. Ecology is the primary scientific discipline of the wildlife profession, therefore, the interests of the Society embrace the interactions of all organisms with their natural environment.

Planning Tools for Promoting Forest Stewardship

Adaptive Management

<http://www.doi.gov/initiatives/AdaptiveManagement/TechGuide.pdf>

Adaptive management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances and scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a “trial and error” process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders.

EPA Nonpoint Source (NPS) Outreach Toolbox

<http://cfpub.epa.gov/npstbx/index.html>

The Nonpoint Source (NPS) Outreach Toolbox is intended for use by state and local agencies and other organizations interested in educating the public on nonpoint source pollution or storm water runoff. The Toolbox contains a variety of resources to help develop an effective and targeted outreach campaign. This page also includes the “Getting In Step Outreach Series” which is a nice instructional manual on engaging stakeholders. This link has an amazing collection of public service announcements as ideas and some can be used for free.

Great Lakes Regional Water Program: Social Indicators

<http://greatlakeswater.uwex.edu/social-indicators>

After understanding the local population and environmental concerns, this Social Indicator process is a good way to evaluate the human dimension as environmental impacts unfold. This link has a connection to the handbook and to the online system where surveys can be generated and data stored and analyzed.

Social indicators for nonpoint source (NPS) management provide information about human awareness, attitudes, constraints, capacity, and behaviors that are expected to lead to water quality improvement and protection. By measuring these indicators over time, water quality managers can target their project activities and assess whether their projects are accomplishing changes expected to improve and protect water quality. Monitoring social indicators, like monitoring environmental indicators, gives us valuable information about how well our management strategies are working. Social indicators complement other environmental and administrative indicators to present a complete picture of project effectiveness.

“Social Profile: Vermilion Watershed Task Force”, November 2005

<http://greatlakeswater.uwex.edu/sites/default/files/library/research-projects/vermilionreport.pdf>

The purpose of this report is to document socioeconomic issues of importance and citizens’ concerns for the Vermilion River watershed in east-central Illinois. The report provides data related to who lives in the watershed, how residents earn their livelihood, how residents use the natural resources in the watershed, how natural resource conditions impact residents, the vision that residents have for their watershed, residents’ opinions about best management practices, and environmental attitudes. This data is intended to assist the watershed planning committee with the development and implementation of a watershed management plan. The Illinois Department of natural Resources ecosystems Program and the Vermilion Watershed Task Force provided input on the creation of this report and collection of data.

Watershed Central’s “Watershed Plan Builder”: Companion to the Handbook for Developing Watershed Plans to Restore and Protect Our Waters

<http://java.epa.gov/wsplanner/#>

Provides an interactive map with which you can find various data sources associated with your watershed.

Tree Management

International Society of Arboriculture

<http://www.isa-arbor.com/about/index.aspx>

Through research, technology, and education, the International Society of Arboriculture (ISA) promotes the professional practice of arboriculture and fosters a greater worldwide awareness of the benefits of trees.

NPS Cultural Landscape Program

http://www.nps.gov/cultural_landscapes/index.html

This program is part of the WASO service-wide cultural resources program. This recently launched website is available to the NPS and public and content will continue to be added over time.

Olmstead Center for Landscape Preservation (OCLP)

<http://www.nps.gov/oclp.html>

The Olmstead Center for Landscape Preservation a program under the WASO service-wide cultural resources program, strengthens the capacity of parks and historic properties to manage cultural landscapes as part of our national heritage. Working in partnership with parks, universities, government agencies and non-profit organizations, the Olmstead Center provides a full range of technical assistance in cultural landscape research, planning, stewardship and education, including:

- Preservation Planning
- Preservation Maintenance
- Correct Tree Pruning
- Hazardous Tree Management Planning
- Education and Training
- Project Work

NPS Arborist Training Program (Under the Olmstead Center for Landscape Preservation)

<http://www.isa-arbor.com/about/index.aspx>

The Arborist Training Program provides a field-based educational opportunity for National Park Service landscape maintenance employees to develop specialized skills in sustainable tree care. The program is designed to provide career development while building the capacity of parks and historic properties to maintain and preserve important landscapes. The curricula consists of phases that progress in complexity over a period of time.

The Arborist Training Program includes:

- Classroom sessions that cover the scientific principles of arboriculture to introduce participants to tree biology, soil management, diagnostics, integrated pest management, tree nutrition, and fertilization
- Field training projects that teach participants about climbing techniques, pruning, tree identification equipment operation and safety, cabling, lightning protection systems, and pest identification
- Home study assignments that reinforce both classroom and field training programs through reading and self-evaluation

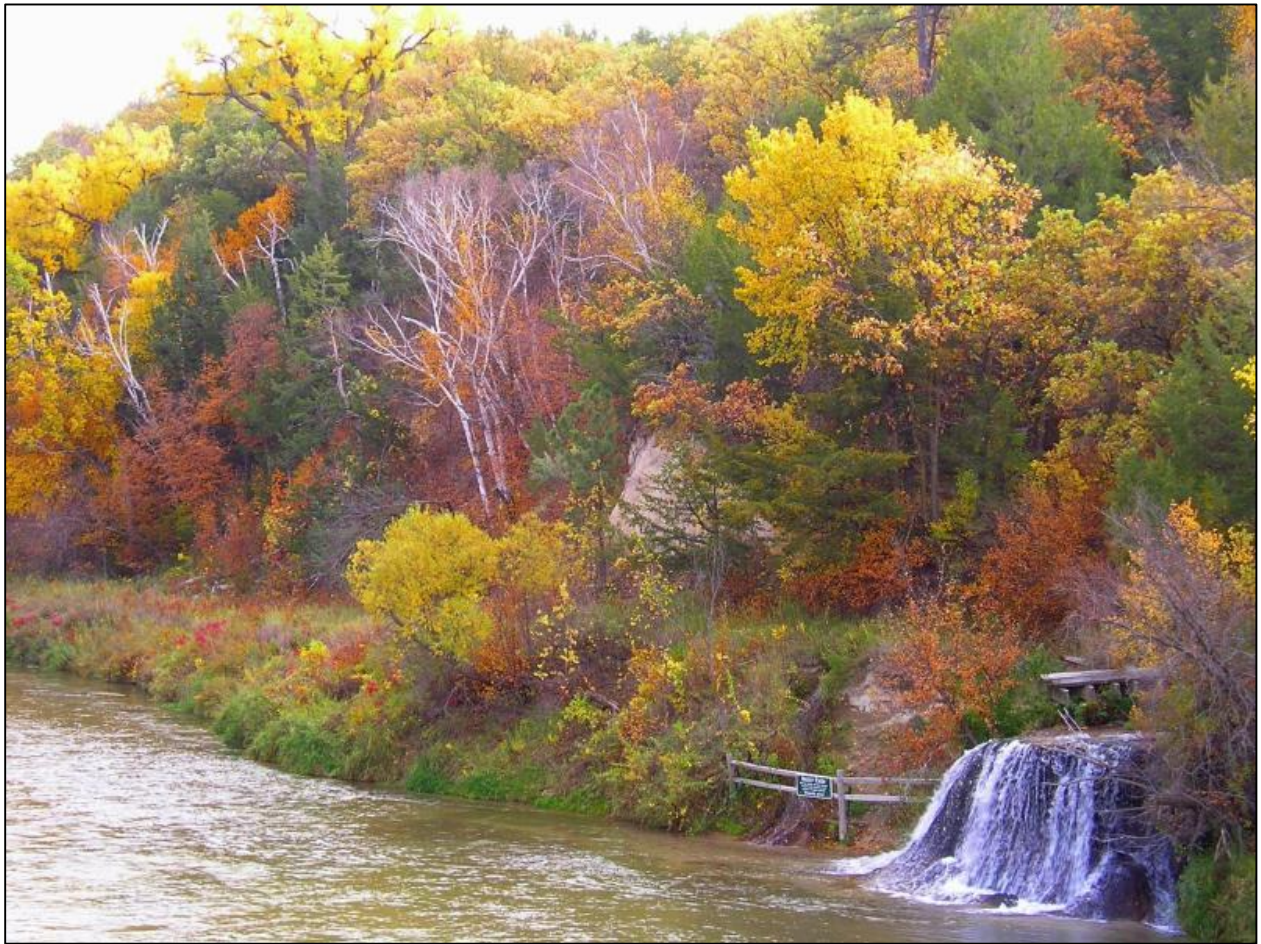
Successful completion of the program prepares participants for professional certification through the International Society of Arboriculture. Participants from parks throughout the National Park Service have successfully completed the program with nearly 80 percent having gone on to acquire professional certification and assist as instructors in the program. This program is only available to current employees of the National Park Service. For more information on arboriculture, please visit the International Society of Arboriculture's website at <http://www.isa-arbor.com>.

Tree Care Industry Association – ANSI A300 Standards

<http://www.tcia.org/business/ansi-a300-standards>

ANSI A300 standards are the generally accepted industry standards for tree care practices. They are voluntary industry consensus standards developed by the Tree Care Industry Association

(TCIA) and written by a committee called the Accredited Standards Committee (ASC) A300, whose mission is to develop consensus performance standards based on current research and sound practice for writing specifications to manage trees, shrubs, and other woody plants. ANSI A300 standards are divided into multiple parts, each focusing on a specific aspect of woody plant management (e.g., Pruning, Fertilization, etc.) and are used to develop written specifications for work assignments, not to be used as specifications in and of themselves.



Jewel toned autumn colors of a riparian forest blaze on the riverbank above Berry Falls Niobrara National Scenic River, Nebraska Credit: National Park Service

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
U.S. Department of the Interior



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