

An email request was sent out in February of 2006 asking field stations in Regions 3 & 5 to identify their adaptive management and research needs.

These needs were put into an Access database and classified by need type. The following classifications were used.

AM = Adaptive Management  
Research = Research  
BMP = Best Management Practices  
Stakeholder/Mtg = Stakeholder Meeting

This document is an Access summary report listing all the field station needs identified through this request.

Contact Todd Sutherland @ (608) 781-6263 if you would like the entire Access database.

## Refuge needs sorted by habitat and class

| Habitat  | Need Class | Mgmt_Action                                | Need  |
|--|------------|--|---|
| Coastal Zones (beaches, dunes, ocean habitats) |            |  |   |
|  | AM         | Animal Control                             | How can we control avian or mammal predation on least tern colonies, aversive conditioning, etc.  |
|  | AM         | Animal Control                             | When is it important to remove piping plover exclosures to reduce adult mortality? What is the impact of increased adult mortality upon the long term viability of these populations?   |
|  | AM         | Animal Control                             | Ongoing need to improve the effectiveness, efficiency, and documentation of predator management within tern and plover nesting sites.   |
|  | AM         | Consumptive and Non-consumptive Public Use | Horseshoe Crabs. Impact of horseshoe crab harvesting conducted on refuges. Shoreline hardening projects and their impact on horseshoe crabs.  |
|  | AM         | Monitoring Activities                      | Factors that influence length-of-stay by shorebirds during both spring and fall migration periods.  |
|  | AM         | Monitoring Activities                      | Feeding/Invertebrate study on piping plover breeding grounds. Is food type/availability/abundance a determining factor in nest site selection for breeding plovers.   |
|  | AM         | Vegetation Manipulation and Removal        | Long-lasting (2+ years) vegetation control strategies to improve the quality of habitat for breeding terns and plovers  |
|  | AM         | Vegetation Manipulation and Removal        | Impact of native beach grass species ( <i>Scripus</i> spp., <i>Spartina</i> spp., <i>Juncus</i> spp.) on migrating shorebirds, and methods to control invading plant species on shorebird feeding/nesting areas.  |
|  | AM         | Vegetation Restoration                     | Vegetation/Habitat manipulation on plover breeding grounds. Do plovers select breeding sites dependant upon vegetative cover percentage or does it matter? If a high vegetative cover area was manipulated (sprayed, disced, burned, etc.) to open up sand areas, will this have a positive effect on breeding numbers/success? |
|  | BMP        | Animal Control                             | Evaluate the effectiveness of predator and gull control program for nesting American oystercatchers and herons. Determine at what point to discontinue or alter program if birds are not responding with increased productivity.  |

| Habitat         | Need Class     | Mgmt_Action             | Need  |
|-----------------|----------------|-------------------------|---|
|                 | BMP            | Monitoring Activities   | Shoreline erosion. What is effectiveness of biologists?   |
|                 | BMP            | Vegetation Restoration  | Restoration of wading bird colonies: Aside from deer control, predator management, invasive plant control, and limiting human disturbance, how should habitat be managed for colonial wading birds?   |
|                 | Research       | Monitoring Activities   | Baseline data on the distribution and relative abundance of turtles to address critical management needs on the UMRNW&FR. (This has been proposed for two years as a USGS Science Support Partnership Program through Walt Sadinski. It is intended to collect data on turtles impacted by recreational use on beaches and Corps of Engineers dredge material placement sites.) |
|                 | Research       | Monitoring Activities   | Baseline data on the distribution and relative abundance of turtles to address critical management needs on the UMRNW&FR. (This has been proposed for two years as a USGS Science Support Partnership Program through Walt Sadinski. It is intended to collect data on turtles impacted by recreational use on beaches and Corps of Engineers dredge material placement sites.) |
| <b>Cropland</b> |                |                         |   |
|                 | StakeholderMtg | Agricultural Management | Evaluate the effectiveness of refuge cropland management efforts to provide for needs of migrating/wintering waterfowl. Identify the priority of cropland management and contributions relative to other potential use of that landbase.  |
|                 | StakeholderMtg | Agricultural Management | Scientific analysis of the amount of agricultural land (crop, pasture, and hay) that is required/appropriate to support populations of trust species expected for the foreseeable future.   |

| Habitat           | Need Class | Mgmt_Action                         | Need  |
|-------------------|------------|-------------------------------------|---|
| Floodplain Forest |            |                                     |   |
|                   | AM         | Fire Management                     | What are cost-efficient methods of restoring bottomland hardwood forests; how should planting, removal of invasives (e.g., autumn olive), and fire be integrated in returning agriculture fields to forest?   |
|                   | AM         | Hydrologic/Geomorphic Restoration   | Identify best methods for floodplain forest regeneration, specifically in hydrologically altered systems such as the Upper Mississippi River. Include control of invasives, particularly reed canary grass. (HIGHEST PRIORITY)  |
|                   | AM         | Monitoring Activities               | Included in Region 3&5 NWR Adaptive Management Study Needs as #12 under Forest Management. How should forests be managed to support migrating landbirds? (size, tree species composition, age class & structure, edges, landscape spatial distribution) On Upper Miss would be particularly interested in how this relates to floodplain forest.  |
|                   | AM         | Monitoring Activities               | How should forests be managed to support migrating landbirds? Is size important? Tree species composition? Age class, structure? Edges, String of pearls concept (landscape spatial distribution)   |
|                   | AM         | Monitoring Activities               | How can we best use data from long-term monitoring, permanent plots to provide trigger points for needed floodplain forest management actions - - investigate best way to locate sampling plots and best types of data to collect for correlating condition to management needs.  |
|                   | AM         | Monitoring Activities               | Included in Region 3&5 NWR Adaptive Management Study Needs as #12 under Forest Management. How should forests be managed to support migrating landbirds? (size, tree species composition, age class – structure, edges, landscape spatial distribution) On UMRNW&FR we would be particularly interested in how this relates to floodplain forest. |
|                   | AM         | Monitoring Activities               | Identify appropriate bioindicators of forest restoration: Neotropical birds (breeding and migrating) Red-headed Woodpeckers, Red-shouldered hawk, Indiana bat, Amphibians, reptiles, Invertebrates, Lichens as bioindictors? Understory plants in savannas, Forest ecosystem itself (large floodplain forests = rare ecosystem                    |
|                   | AM         | Vegetation Manipulation and Removal | What are cost-efficient methods of restoring bottomland hardwood forests; how should planting, removal of invasives (e.g., autumn olive), and fire be integrated in returning agriculture fields to forest?   |

| Habitat | Need Class | Mgmt_Action                                | Need   |
|---------|------------|--|--|
|         | AM         | Vegetation Manipulation and Removal        | Identify methods to control invasive species in forested management units: reed canary grass, garlic mustard, aspen (in savanna restorations)  |
|         | AM         | Vegetation Manipulation and Removal        | Identify the best methods for maintaining forests to support target species (Neotropical migrant birds, Red-headed Woodpeckers, Red-shouldered hawk, Indiana bat). Maintenance intervals, timber stand improvement, structural diversity, achieving or maintaining, what forest sizes and shapes support the highest biodiversity? Is tree species composition important to birds? |
|         | AM         | Vegetation Manipulation and Removal        | Identify best methods for floodplain forest regeneration, specifically in hydrologically altered systems such as the Upper Mississippi River. Include control of invasives, particularly reed canary grass. (HIGHEST PRIORITY)   |
|         | AM         | Vegetation Restoration                     | How can we promote the return of native herbs, invertebrates, etc to pre-disturbance conditions when converting farmland to forests (or wetlands) in order to recreate a fully functional community?   |
|         | AM         | Vegetation Restoration                     | What are cost-efficient methods of restoring bottomland hardwood forests; how should planting, removal of invasives (e.g., autumn olive), and fire be integrated in returning agriculture fields to forest?  |
|         | AM         | Vegetation Restoration                     | Identify best methods for floodplain forest regeneration, specifically in hydrologically altered systems such as the Upper Mississippi River. Include control of invasives, particularly reed canary grass. (HIGHEST PRIORITY)   |
|         | AM         | Vegetation Restoration                     | Floodplain forest restoration and impact of reed canary grass.   |
|         | AM         | Vegetation Restoration                     | Identify best methods for floodplain forest regeneration, specifically in hydrologically altered systems such as the Upper Mississippi River. Include control of invasives, particularly reed canary grass.  |
|         | AM         | Wetland Management                         | Identify best management practices with regard to water level management and maintaining floodplain forests.   |
|         | BMP        | Consumptive and Non-consumptive Public Use | Comparison of habitat and wildlife use between research natural areas and surrounding refuge lands that are influenced by management. (Related to #14 under Forest Management in R3&% Adaptive Management Study Needs: Monitoring permanent plots to document change over time.)   |

| Habitat | Need Class     | Mgmt_Action                         | Need  |
|---------|----------------|-------------------------------------|---|
|         | BMP            | Monitoring Activities               | Comparison of habitat and wildlife use between research natural areas and surrounding refuge lands that are influenced by management. (Related to #14 under Forest Management in R3&% Adaptive Management Study Needs: Monitoring permanent plots to document change over time.)  |
|         | BMP            | Other                               | How should we be managing early successional forests?   |
|         | BMP            | Vegetation Manipulation and Removal | Complete an invasive plant inventory with the goal of a achieving a 10 percent reduction in acres affected by 2010.   |
|         | Research       | Fire Management                     | Fire History of the Dismal Swamp Ecosystem.   |
|         | Research       | Monitoring Activities               | Assess the health of the refuge's black bear population in relationship to adjacent populations. Is the species isolated from other breeding populations?   |
|         | Research       | Monitoring Activities               | Determine abundance, species composition, and timing of spring passerine bird migration in floodplain and upland forests in the Upper Mississippi River corridor. Link habitat use patterns with habitat variables including local and landscape structural variables and food abundance indices. Link habitat use patterns with indices of bird body and metabolic condition, sex and age ratios, and food choice and foraging observations. Determine important migration stopover areas. |
|         | Research       | Vegetation Restoration              | Identify the best methods for re-establishing new forests: Planting techniques, Seedling survival, Controlling deer browse, Controlling invasives that might delay or prevent restoration, What are the least cost methods for restoring or establishing forests (planting vs. natural regeneration)?   |
|         | StakeholderMtg | Other                               | Evaluate various forest management options with respect to the response of target organisms in the forest: Planting, flooding, burning, Selective thinning, Timber harvest, timing and spatial distribution, Buy more land, convert from agriculture, Mowing, Dredge spoil deposition (navigable rivers), Mechanically damage trees (to create dead wood)   |

| Habitat | Need Class     | Mgmt_Action                         | Need   |
|---------|----------------|-------------------------------------|--|
|         | StakeholderMtg | Other                               | How should diversity be defined as a target of forest restoration?   |
|         | StakeholderMtg | Vegetation Manipulation and Removal | What are the best methods of maintaining dead/dying wood in forest management? How much dead/dying wood is needed in a stand or management unit?   |
|         | StakeholderMtg | Wildlife Structures                 | Should we continue the existing wood duck box program? The refuge supports (through volunteers), 150+ woodduck boxes. Personal observation is that we produce very few broods. Some concerns: are we a sink for waterfowl, is dump nesting a problem and should boxes be adjusted, fisher now occur on the refuge on a regular basis - should this change cause us to eliminate boxes, should a trapping program be initiated? |

| Habitat          | Need Class | Mgmt_Action                                | Need  |
|------------------|------------|--|---|
| Freshwater Marsh |            |  |   |
|                  | AM         | Consumptive and Non-consumptive Public Use | Assess impacts of trapping/harvest program on refuge furbearer populations. Data needed beyond what trappers report in annual mandatory fur catch reports. Species of interest: muskrat, beaver, otter, mink, and raccoon.  |
|                  | AM         | Fire Management                            | Can we use fire to manage pocosin habitat for the restoration of an endangered species, the Red-cockaded Woodpecker?  |
|                  | AM         | Monitoring Activities                      | Comparative monitoring of beaver ponds to determine productivity of nesting black ducks. Are there factors (size, surrounding habitat type, age, proximity to other ponds, etc) that increase the attractiveness of the ponds to black ducks, increase or limit productivity? |
|                  | AM         | Monitoring Activities                      | Marshbird Monitoring (secretive marshbirds and sparrows) that includes the success of breeding birds (not just presence and absence) to help identify if management actions could improve success (create more high marsh to reduce flooding events, control predators, etc). |
|                  | AM         | Monitoring Activities                      | Invasive species detection and control.   |
|                  | AM         | Monitoring Activities                      | Factors that influence length-of-stay by shorebirds during both spring and fall migration periods.  |
|                  | AM         | Vegetation Manipulation and Removal        | Need effective long-term management strategies to control Phragmites.   |
|                  | AM         | Vegetation Manipulation and Removal        | Long term management of Phragmites  |
|                  | AM         | Vegetation Manipulation and Removal        | What management actions will prevent the invasion of flowering rush? What are the most efficient and cost effective methods for controlling flowering rush once it becomes established?   |
|                  | AM         | Vegetation Manipulation and Removal        | Complete work on the development of the biological control methodology for Phragmites and develop an action plan to prioritize key treatment areas. (Substantial work done at Cornell which we need to bring to completion and implement.)                                    |

| Habitat | Need Class | Mgmt_Action                                | Need  |
|---------|------------|--|---|
|         | AM         | Vegetation Manipulation and Removal        | Need effective long-term management strategies to control Phragmites.   |
|         | AM         | Vegetation Manipulation and Removal        | Control of Reed Canary Grass within shallow wetlands and wetland edges (Control options on operational scale as opposed to experimental.)   |
|         | AM         | Vegetation Restoration                     | How should we restore wetlands that have been altered by prior land uses? Wetlands were restored and control structures rendered unusable, but historic wetland characteristics have not been achieved. Hydrology, vegetation, and fish occupancy are all issues.                                   |
|         | AM         | Wetland Management                         | Develop strategies to use under various conditions in order to optimize food production for wildlife in impounded wetlands.   |
|         | AM         | Wetland Management                         | Process/method to identify optimum hydrological regime within managed wetlands to achieve refuge objectives (Barnegat Impoundments). Long-term hydrological regime that might be annual or multi-year. Short-term seasonal hydrological manipulations to enhance waterbird use of managed wetlands. |
|         | AM         | Wetland Management                         | Effective options to control hybrid cattail within wetlands.  |
|         | AM         | Wetland Management                         | Process/methods to identify optimum hydrological regime within managed wetlands to achieve refuge objectives. Long-term hydrological regime which might be annual or multi-year. Short-term seasonal hydrological manipulations to enhance waterbird use of managed wetlands.                       |
|         | BMP        | Consumptive and Non-consumptive Public Use | Comparison of habitat and wildlife use between research natural areas and surrounding refuge lands that are influenced by management. (Related to #14 under Forest Management in R3&% Adaptive Management Study Needs: Monitoring permanent plots to document change over time.)                    |
|         | BMP        | Vegetation Manipulation and Removal        | Complete an invasive plant inventory with the goal of achieving a 10 percent reduction in acres affected by 2010.   |
|         | BMP        | Vegetation Restoration                     | Restoration and establishment of a mosaic of open marshes and canebrakes throughout the Refuge.   |

| Habitat | Need Class | Mgmt_Action            | Need   |
|---------|------------|------------------------|--|
|         | BMP        | Vegetation Restoration | Measuring secretive marshbird habitat quality? Is abundance sufficient or should we also measure productivity?   |
|         | BMP        | Wetland Management     | Develop effective guidelines for management and maintenance of greentree reservoirs.   |
|         | BMP        | Wetland Management     | Methods/techniques to address sedimentation/nutrient issues within refuge impoundments. Extent of problem within impoundments at present time. Influence of nutrient inputs on refuge impoundments.  |
|         | Research   | Fire Management        | Organic soil moisture and water table to timing of Rx Burns and relationship to vegetation moisture.   |
|         | Research   | Monitoring Activities  | Determine differences in invertebrate numbers and species associated with varying emergent and submergent vegetation, water depth and water temperatures. Also document any differences between marsh units that have dynamic (at least annual) nutrient and water exchange and those that are less dynamic. |
|         | Research   | Monitoring Activities  | Diamondback terrapins. What influence does nest predation have on terrapin populations?  |
|         | Research   | Monitoring Activities  | Impact of fish populations on quality of waterfowl habitat within shallow wetlands.  |
|         | Research   | Monitoring Activities  | Management strategies within wetlands to minimize disease/parasite impacts on waterfowl. Can predictive models be developed to identify potential problem sites?   |
|         | Research   | Other                  | Effect of habitat work to trust species listed by Partners in Flight that occur on the refuge. 24 of 51 species of interest are present on the refuge.   |
|         | Research   | Vegetation Restoration | Wetland restoration of fresh and brackish marshes  |
|         | Research   | Wetland Management     | Importance of partially drained wetlands to waterbirds.  |
|         | Research   | Wetland Management     | Impact of impoundment management practices on use/distribution of secretive marshbirds on a refuge.  |

| Habitat | Need Class     | Mgmt_Action             | Need   |
|---------|----------------|-------------------------|--|
|         | Research       | Wetland Management      | Identification of Private landowner incentives and benefits to holding water for period of time during Spring on private lands. (Value of holding the water for breeding waterfowl). |
|         | StakeholderMtg | Agricultural Management | What are the effects of aquaculture (raising walleye fingerlings) on invertebrates in managed wetlands?  |
|         | StakeholderMtg | Animal Control          | How can we curb the excessive herbivory and its resulting substrate erosion caused by overabundant snow geese when we can't control the population level of those geese?             |
|         | StakeholderMtg | Animal Control          | Beaver impacts to upland areas, management practices, and if control of the species is necessary.  |
|         | StakeholderMtg | Vegetation Restoration  | Evaluating success of wetland restoration efforts. How do we know when we are successful?  |
|         | StakeholderMtg | Wetland Management      | Should sediment be removed from a basin undergoing wetland restoration? Is sediment removal desirable and cost effective?  |

| Habitat    | Need Class | Mgmt_Action                         | Need  |
|------------|------------|-------------------------------------|---|
| Grasslands |            |                                     |   |
|            | AM         | Fire Management                     | When should fire be introduced to new prairie plantings, and what are the triggers to indicate prescribed fire should be initiated?   |
|            | AM         | Monitoring Activities               | Develop digital multi-spectral imaging (remote sensing) methods to detect reed canary grass invasion of grasslands.   |
|            | AM         | Monitoring Activities               | How important are cool and warm season grasslands on the refuge for obligate and facultative grassland birds during spring and fall migration?  |
|            | AM         | Vegetation Manipulation and Removal | What is optimum "rotation" to manage cold season grass hay fields to maximize years before succession of woody vegetation starts to take over? How do we maximize nesting productivity for grassland nesting birds over time without "losing" the field? Three years of one mowing after July 15 followed by a year of three cuts (lose birds for a year, but set back woody vegetation)?   |
|            | AM         | Vegetation Manipulation and Removal | Does tree, shrub and fence removal result in improved grassland bird nesting success? Is there a critical patch size for tree cutting that makes a significant difference in success of grassland bird nesting success?   |
|            | AM         | Vegetation Manipulation and Removal | What are the most effective decision pathways in exotic species management that lead to successful elimination or control of exotic species while maximizing success of prairie or savanna restoration/reconstruction? Considerations in making best management choices involve choice of treatment, timing of treatment, and identifying triggers to applying management techniques. Triggers could include physical features of plant species, populations, or communities. Other triggers involve management goals and objectives, degree of exotic species persistence, the amount of time allowed to detect changes in populations, or decisions about the degree that an exotic species can be tolerated before treatment is necessary. |
|            | AM         | Vegetation Manipulation and Removal | How can we control invasive species in a sedge meadow? (Cattail, phragmites)  |
|            | AM         | Vegetation Restoration              | What are the most successful techniques to control or eliminate reed canary grass in prairies and sedge meadows and to favor development of a self-sustaining native plant community?   |

| Habitat | Need Class | Mgmt_Action            | Need  |
|---------|------------|------------------------|---|
|         | AM         | Vegetation Restoration | What combination of factors would optimize establishment success of diverse plantings of prairie species in grasslands? Season of planting, timing of planting, soil conditions, moisture, nutrients, temperature, texture, compaction, micro-biota, seed bank, weed root stock, species of weed species exerting pressure, residual agricultural chemicals or their influence on soil characteristics  |
|         | AM         | Vegetation Restoration | What is optimum "rotation" to manage cold season grass hay fields to maximize years before succession of woody vegetation starts to take over? How do we maximize nesting productivity for grassland nesting birds over time without "losing" the field? Three years of one mowing after July 15 followed by a year of three cuts (lose birds for a year, but set back woody vegetation)?   |
|         | AM         | Vegetation Restoration | What are the best methods to introduce forb diversity into dense stands of highly competitive, warm season grass species? Possible practices to accomplish these goals during the process of forb introduction include: Burn timing, Disking, Chemical treatment, Mowing timing and frequency, Introduction of particular species to provide openings or change the matrix such that forb diversity begins to thrive: Keystone species, Early successional or opportunistic native species.<br>Which of these or other treatments, or combinations of treatments are likely to best result in successful conversion from warm season grass stands to diverse prairie plantings? |
|         | AM         | Vegetation Restoration | Are there initial mixes or important species to include in mixes to maximize success of successional interseedings in maturing prairie plantings? Are such mixes or critical species planted on former cropland different than those used to reconstruct prairie in a cool season exotics grass matrix such as those found in pasture or old CRP land? What is the best season/method to interseed? Are there triggers to indicate a sequence of treatments to optimize success of interseeding?  |

| Habitat | Need Class | Mgmt_Action                         | Need  |
|---------|------------|-------------------------------------|---|
|         | AM         | Vegetation Restoration              | Evaluate 24,000 acres of restored prairie. We need to know how successful the restoration efforts has been, where we need to interseed to reflect a diversity that represents true prairie. Patch-burn-grazing is being planned - grazing - cattle or buffalo? Effects of grazing/ burning of ES species (western fringed prairie orchid and Dakota skipper) are questions. Marble godwits are common to the area along with other migratory shorebirds as well as other grassland species- what adaptations are needed as grassland management begins? |
|         | BMP        | Agricultural Management             | Can cattle be used to effectively emulate historic grazing in prairies and savannas? What sort of grazing regime should be used? How does cattle grazing compare with bison/elk grazing in prairies in Region 3? Could patch burn/grazing techniques be beneficial in emulation of landscape scale influences, even though current application is on much smaller scales than the historic prairie landscape, and is more highly manipulative?  |
|         | BMP        | Monitoring Activities               | Baseline monitoring of a new refuge should be a priority.   |
|         | BMP        | Vegetation Manipulation and Removal | What are effective means of woody plant control on the scale of hundreds or thousands of acres, when heavy equipment cannot be used for mechanical control methods? (In some circumstances, woody species control is especially difficult due to wet soil conditions, or presence of highly invasive, clonal woody species such as black locust ( <i>Robinia pseudoacacia</i> ) or European poplar ( <i>Populus alba</i> .)<br>In these conditions, what can be used to control highly invasive, clonal species?  |
|         | BMP        | Vegetation Manipulation and Removal | Evaluate the effects of removing 2,000 to 3,000 acres of aspen from this prairie ecosystem, cause and effect removal techniques need monitoring and changes made as needed.   |
|         | BMP        | Vegetation Manipulation and Removal | Woody plant control on Waterfowl Production Areas (WPA's). Litchfield and Morris Wetland Management Districts (WMA) are collaborating with HAPET office (Granfors) on a 3-yr study. Would like to extend project to get better data on bird responses.  |
|         | BMP        | Vegetation Restoration              | Identify methods and strategies to support succession of grasslands to scrub/shrub to upland forest.  |

| Habitat | Need Class | Mgmt_Action                                | Need   |
|---------|------------|--|--|
|         | BMP        | Vegetation Restoration                     | What practices or combination of practices could be used to maintain prairie plantings with a high diversity of native plant species? Are there trigger mechanisms such as plant appearance, species presence, or phenology that could be used to indicate need for particular treatments? mowing frequency and timing and height; fire frequency, timing, and intensity; grazing frequency, timing and intensity; weather patterns; timing of plantings; type of seed mixes; successional planting; soil nutrient load  |
|         | Research   | Consumptive and Non-consumptive Public Use | Landscape wide implications of the emerging bio-fuel industry and its impact on conserved and reserved lands. Are we likely to lose grasslands, wetlands, and other lands that have been "set aside" as part of various Farm Bill activities as these set asides come up for renewal ? What are the potential impacts to wildlife, wind/water erosion, etc.  |
|         | Research   | Consumptive and Non-consumptive Public Use | Are the goals and objectives on biofuel production using prairie species, and of prairie reconstruction/restoration compatible? What species are the best choices for ethanol production? Can a diverse prairie reconstruction be used for efficient biofuel production, and for maintenance of high quality wildlife habitat/prairie preservation? Could large tracts of land support smaller units with rotating management practices to maximize overall benefits to both biofuel production and natural land management  |
|         | Research   | Vegetation Restoration                     | What combination of native cool season plant species should be used in prairie reconstructions? (Cool season native species are rarely used in prairie plantings but they were an important component of historic native prairies and may offer significant benefits to wildlife, to weed suppression, and to ecosystem function and sustainability.)<br>What are the wildlife responses to prairie plantings replete with cool season native plant species?<br>How does ecosystem function change?<br>Is the success of exotic species reduced?<br>How does the invertebrate species response change? |

| Habitat   | Need Class     | Mgmt_Action                         | Need  |
|---|----------------|-------------------------------------|---|
|   | StakeholderMtg | Vegetation Restoration              | In some areas, no remnant prairies exist to use as models for prairie reconstructions. Land use history, soil characteristics, topography, aspect, presence of drainage tiles, utilities, watershed characteristics, and context within the larger land base all affect the degree of prairie planning success in the short- and long-term. Political factors also affect success. How could negative factors in the list above be mitigated to best accomplish development of high quality prairie reconstructions? Are there circumstances that would necessarily restrict success of prairie reconstructions such that they should not be attempted, or not expected to be highly diverse, functional plantings with good wildlife habitat potential? How do we develop cost/benefit analyses to make decisions about management investments? How do we best decide on seed mixes to meet particular site needs? |
| <b>Lacustrine (lakes and associated terrestrial habitats)</b> |                |                                     |   |
|   | AM             | Animal Control                      | Develop alternative control strategies for lamprey to minimize chemical application. (Work has been conducted in the Great lakes with some work focused on Lake Champlain which needs to be completed.)   |
|   | AM             | Monitoring Activities               | Factors that influence length-of-stay by shorebirds during both spring and fall migration periods.  |
|   | AM             | Vegetation Manipulation and Removal | Control of Eurasian water milfoil in shallow wetlands and lake littoral zones to allow natural vegetation to re-establish.  |
|   | BMP            | Vegetation Manipulation and Removal | What forest management practices will support bald eagle nesting trees?   |
|   | Research       | Hydrologic/Geomorphic Restoration   | What are the effects of naturally occurring historical drawdown events on Lake Drummond on the surrounding habitats and ditches flowing into and out of the lake. Lake Drummond is 1 of only 2 natural lakes in VA.   |
|   | Research       | Monitoring Activities               | There may be many research opportunities for Refuges to contribute to fisheries conservation. Generally speaking, considerably more inventory and monitoring information will be needed before Refuges can determine their potential to contribute to fisheries conservation. Research priorities are expected to arise once better I&M information is obtained.  |

| Habitat                        | Need Class | Mgmt_Action                         | Need  |
|--------------------------------|------------|-------------------------------------|---|
| Oak Savanna or Woodland Forest |            |                                     |   |
|                                | AM         | Fire Management                     | What is the appropriate timing of burning to restore savanna ecosystems? What triggers the decision to burn?  |
|                                | AM         | Monitoring Activities               | Identify appropriate bioindicators of forest restoration: Neotropical birds (breeding and migrating) Red-headed Woodpeckers, Red-shouldered hawk, Indiana bat, Amphibians, reptiles, Invertebrates, Lichens as bioindicators? Understory plants in savannas, Forest ecosystem itself (large floodplain forests = rare ecosystem   |
|                                | AM         | Vegetation Manipulation and Removal | Identify methods to control invasive species in forested management units.  |
|                                | AM         | Vegetation Manipulation and Removal | What are the most effective decision pathways in exotic species management that lead to successful elimination or control of exotic species while maximizing success of prairie or savanna restoration/reconstruction? Considerations in making best management choices involve choice of treatment, timing of treatment, and identifying triggers to applying management techniques. Triggers could include physical features of plant species, populations, or communities. Other triggers involve management goals and objectives, degree of exotic species persistence, the amount of time allowed to detect changes in populations, or decisions about the degree that an exotic species can be tolerated before treatment is necessary. |
|                                | AM         | Vegetation Manipulation and Removal | Identify the best methods for restoring and maintaining savanna ecosystems  |
|                                | AM         | Vegetation Manipulation and Removal | Identify methods to control invasive species in forested management units: reed canary grass, garlic mustard, aspen (in savanna restorations)   |
|                                | BMP        | Agricultural Management             | Can cattle be used to effectively emulate historic grazing in prairies and savannas? What sort of grazing regime should be used? How does cattle grazing compare with bison/elk grazing in prairies in Region 3? Could patch burn/grazing techniques be beneficial in emulation of landscape scale influences, even though current application is on much smaller scales than the historic prairie landscape, and is more highly manipulative?  |

| Habitat | Need Class     | Mgmt_Action            | Need  |
|---------|----------------|------------------------|---|
|         | BMP            | Vegetation Restoration | Does our refuge (Rydell) have a contribution to make to conservation of oak savanna? The majority of old farm fields were reseeded to a prairie grassland mix, the question is what do we have and how to we need to improve on what has resulted?  |
|         | StakeholderMtg | Vegetation Restoration | What are the triggers that indicate that in situ seed/plant sources inadequately represent historic savanna conditions, and that introduction of species via seeds or plants should begin? What are the appropriate plant species/germplasm sources for introduction to a remnant savanna in any given area/savanna type? |

| Habitat | Need Class | Mgmt_Action                                | Need  |
|---------|------------|--|---|
| Other   | AM         | Consumptive and Non-consumptive Public Use | How can we manage the level of disturbance to wildlife caused by our management activities? One simple and common example is a Refuge employee driving to and from a pump station, and the noise of operating a pump when waterfowl are using a wetland unit. Another simple example is the presence of people conducting surveys and inventories of a variety of wildlife  |
|         | AM         | Consumptive and Non-consumptive Public Use | How should the refuge system address social/political issues associated with increasing urbanization adjacent to refuges? St. Croix, Minnesota Valley, Sherburne, and Litchfield NWRs are facing rapid urbanization issues.   |
|         | AM         | Consumptive and Non-consumptive Public Use | What technology is available to help wildlife with road crossings (blandings turtles, salamanders, NEC)?  |
|         | AM         | Fire Management                            | Timing and hydrological influences on controlling shrub/scrub invasion into sedge meadows with use of Rx Fire.  |
|         | AM         | Hydrologic/Geomorphic Restoration          | Hydrologic Assessment of the Great Dismal Swamp National Wildlife Refuge (a draft proposal is attached). REFUGE PRIORITY  |
|         | AM         | Hydrologic/Geomorphic Restoration          | Identify ecological principles that influence establishment and perpetuation of selected invasive species. Simple herbicide control of invasives at a site seldom works (long-term), since the invasive species is already the best adapted plant to compete at a site, given site conditions. Information is needed relative to life history and ecology of selected species, so that site conditions may be altered, or conditions suitable for establishment of a selected invasive species are avoided. Additionally, some invasive species may naturally be eliminated from a site if successional processes are allowed to proceed. This information is required to allow FWS staff to make informed decisions relative to invasive species management. |
|         | AM         | Monitoring Activities                      | Evaluate the ecological impacts of wind turbines used to produce energy for refuge operations (green energy). Perhaps a servicewide protocol to collect data on bird and bat strikes and mortality could be produced.   |
|         | AM         | Monitoring Activities                      | Invasive species detection. Development of digital multi-spectral imaging methods to detect invasive species.   |

| Habitat | Need Class | Mgmt_Action                         | Need  |
|---------|------------|-------------------------------------|---|
|         | AM         | Monitoring Activities               | Assess potential impacts of climate change on algific slope habitat, determine how to monitor this for the long term.   |
|         | AM         | Monitoring Activities               | Identification of key neotropical bird habitats and migratory routes. Identify key migration stop-over sites. Develop habitat model for important stop-over sites, incorporating geography, patch sizes, habitat variables, and other criteria. This migratory bird stop-over habitat model will then be applied to refuge lands during the CCP or HMP process to identify which refuges may make an important contribution toward migrating landbirds. |
|         | AM         | Monitoring Activities               | Expand bird migration radar research to analyze NexRad Doppler radar data that has been collected along the Atlantic Coast from Virginia to Maine.  |
|         | AM         | Monitoring Activities               | Create a monitoring network as an early warning system to detect and allow eradication of new exotic introductions. (See NWR proposal to map/monitor invasives and IPANE model.)  |
|         | AM         | Monitoring Activities               | Invasive species detection  |
|         | AM         | Vegetation Manipulation and Removal | Adaptive management study framework for the control of invasive plants and a database to share methods and results across the region (SBM target species: multiflora rose, swallowworts, garlic mustard, autumn olive, honeysuckle, bittersweet, Japanese knotweed).  |
|         | AM         | Vegetation Manipulation and Removal | Evaluate treatment regimes for eliminating Japanese honeysuckle and European fennel in a variety of habitat types.  |
|         | AM         | Vegetation Restoration              | Determine sun/shade impacts on algific slopes, particularly related to Northern monkshood (this relates to habitat restoration options adjacent to algific slopes).   |
|         | AM         | Vegetation Restoration              | What are the most successful techniques to control or eliminate reed canary grass in prairies and sedge meadows and to favor development of a self-sustaining native plant community?   |
|         | AM         | Vegetation Restoration              | How to restore wetland habitat (Sedge Meadows) without creating reed canary grass problems. Identification of seed bank that would replace reed canary grass after control effort.  |

| Habitat | Need Class | Mgmt_Action             | Need  |
|---------|------------|-------------------------|---|
|         | BMP        | Agricultural Management | What size and type of buffer do we need between our farmlands and our waterbodies to ensure that our water bodies are not being contaminated from pesticide/fertilizer rich runoff from the farmlands? Are grassy or wooded buffers better to protect water quality and improve habitat conditions in the waterbodies for waterbirds? Where are they needed, where are they adequate?   |
|         | BMP        | Animal Control          | What are efficient means of feral cat control at a refuge with high visitation rates near an urban area?  |
|         | BMP        | Monitoring Activities   | Evaluate Northern monkshood monitoring data (14 years worth).   |
|         | BMP        | Monitoring Activities   | Determine specific habitat needs of high priority birds and develop management recommendations based on this information.   |
|         | Research   | Agricultural Management | How much farmland do we need to provide adequate forage for the anticipated population of migratory Canada geese over the next 10-15 years, given the unpredictable competition from snow geese in the farm fields?   |
|         | Research   | Monitoring Activities   | Extensive FWS resources (staff time and funds) are expended each year to control invasive species. However, the FWS has relatively little information about the threat/impact of selected invasive species on achievement of FWS objectives. It is therefore imperative to measure how selected invasives are impacting wildlife/native plant populations. It is suspected that some invasive provide little threat to these resources while others have a significant impact. Only with this information can the FWS make informed decisions about prioritizing which invasive species to control. |
|         | Research   | Monitoring Activities   | Determine function and association of sinkholes to cold air flow and hydrology of algific slopes (basically we need to understand more about how algific slopes work).  |
|         | Research   | Other                   | Our issues are covered under the workshop topics.   |
|         | Research   | Other                   | Impacts of commercial, residential, golf course and retail store development near refuges and ways to mitigate those impacts on water quality, water quantity, fish, invertebrates, birds and other trust resources.  |

| Habitat | Need Class     | Mgmt_Action             | Need   |
|---------|----------------|-------------------------|--|
|         | Research       | Wetland Management      | Effect of waterlevel within ditches (over 100 miles and 34+ water control structures) on the adjacent organic soils and habitats   |
|         | StakeholderMtg |                         | Inventory snail, plant, and insect species on select algific slopes. (There could be other endemic species on this habitat that we don't know about. We also should document what's there in case of future loss of this habitat from climate change.)   |
|         | StakeholderMtg | Agricultural Management | What is the importance of the farm lands on the refuge for migratory birds (especially non-game) and other wildlife species in different seasons?  |
|         | StakeholderMtg | Monitoring Activities   | Identify feasibility and value of coordinated management among refuges to accomplish a larger landscape resource objective. Management across agencies, across programs within FWS. Incorporation of need within CCP or HMPs.  |
|         | StakeholderMtg | Monitoring Activities   | Identification of strategic land acquisition needs within NWRS to achieve higher contribution to identified larger landscape resource objective.   |
|         | StakeholderMtg | Monitoring Activities   | What is the best strategy to evaluate whether we are meeting the habitat objectives spelled out in the CCP? At what intervals do we need to evaluate those objectives? If there are objectives we are failing to meet, how can we best meet those objectives without introducing problems (ie drawdowns increasing the number of invasives such as purple loosestrife, phragmites, flowering rush, etc)? |
|         | StakeholderMtg | Monitoring Activities   | Should we be monitoring permanent plots in floodplain forests to document change over time?  |
|         | StakeholderMtg | Other                   | Landscape-scale land management and acquisition - how to decide priorities?  |
|         | StakeholderMtg | Vegetation Restoration  | What should be done if original refuge purposes are not targeting species or habitats that are now considered to best serve the Biological Integrity, Diversity and Ecological Health mandates? In other words, current ecological information and practices indicate that the refuge conservation targets should be changed.  |

| Habitat   | Need Class | Mgmt_Action                                | Need  |
|---|------------|--|---|
| Riverine (rivers and associated terrestrial habitats) |            |  |   |
|   | AM         | Animal Control                             | Determine impacts of Asian carp on habitat, mussels, fish, and wildlife of the UMRNW&FR   |
|   | AM         | Animal Control                             | Determine effective methods of control of Asian carp on the UMRNW&FR, including commercial fishing, exclosures, barriers, chemicals, and others.  |
|   | AM         | Animal Control                             | Investigate areas where high levels of trematode transmission are occurring to define possible management actions aimed at lessening the impact of these parasites on waterbirds. Since 2002, an estimated 20,300 to 24,370 waterbirds, including 6,630 to 7,875 lesser scaup have died as a result of trematodiasis, many on Lake Onalaska (Navigation Pool 7). HIGHEST PRIORITY |
|   | AM         | Animal Control                             | Determine effective methods of control of Asian carp on the Upper Miss River NW&FR, including commercial fishing, exclosures, barriers, chemicals, and others.  |
|   | AM         | Animal Control                             | Determine impacts of Asian carp on habitat, mussels, fish, and wildlife of the UMRNW&FR   |
|   | AM         | Consumptive and Non-consumptive Public Use | Determine the effectiveness of slow/no wake zones in reducing the rate of shoreline erosion caused by boat wave action on unprotected shorelines.   |
|   | AM         | Consumptive and Non-consumptive Public Use | Determine effectiveness of slow-no wake areas and electric motor only areas in reducing disturbance to fish and wildlife particularly nesting and roosting birds on the UMRNW&FR (large floodplain refuges.)  |
|   | AM         | Consumptive and Non-consumptive Public Use | Assess impacts of trapping/harvest program on refuge furbearer populations. Data needed beyond what trappers report in annual mandatory fur catch reports. Species of interest: muskrat, beaver, otter, mink, and raccoon.  |
|   | AM         | Consumptive and Non-consumptive Public Use | Determine the effectiveness of providing secure resting and feeding habitat for waterfowl during the fall migration through use of Closed Areas. The CCP of the Upper Miss River NW&FR includes modifications and additions to 22 closed areas.   |

| Habitat | Need Class | Mgmt_Action                                | Need  |
|---------|------------|--|---|
|         | AM         | Consumptive and Non-consumptive Public Use | Determine impacts of fishing tournaments on fish, wildlife, and habitats of the UMRNW&FR. The Refuge will be working with states to dovetail refuge and state permits to achieve goals.   |
|         | AM         | Consumptive and Non-consumptive Public Use | Determine the effectiveness of providing secure resting and feeding habitat for waterfowl during the fall migration through use of Closed Areas. The CCP of the Upper Miss River NW&FR includes modifications and additions to 22 closed areas.   |
|         | AM         | Consumptive and Non-consumptive Public Use | Determine impacts of fishing tournaments on fish, wildlife, and habitats of the UMRNW&FR. The Refuge will be working with states to dovetail refuge and state permits to achieve goals.   |
|         | AM         | Disease Management                         | Investigate areas where high levels of trematode transmission are occurring to define possible management actions aimed at lessening the impact of these parasites on waterbirds. Since 2002, an estimated 20,300 to 24,370 waterbirds, including 6,630 to 7,875 lesser scaup have died as a result of trematodiasis, many on Lake Onalaska (Navigation Pool 7). HIGHEST PRIORITY |
|         | AM         | Hydrologic/Geomorphic Restoration          | Continue monitoring the response of vegetation, wildlife, mussels, and fish to poolwide drawdowns. Develop standardized methodology across all pools. Use vegetation monitoring results to document change in the availability and distribution of foods important to migratory waterfowl.  |
|         | AM         | Hydrologic/Geomorphic Restoration          | How can 'natural' meandering be efficiently restored over time in historically channellized waterways to reduce sedimentation/silting problems in streams and wetlands?   |
|         | AM         | Monitoring Activities                      | Quantity and quality of water coming into and leaving refuge system lands. Need to have a monitoring system in place to identify problems. At this point in time, little to no information to address water quantity and quality is available.  |
|         | AM         | Monitoring Activities                      | Continue monitoring the response of vegetation, wildlife, mussels, and fish to poolwide drawdowns. Develop standardized methodology across all pools. Use vegetation monitoring results to document change in the availability and distribution of foods important to migratory waterfowl.  |

| Habitat | Need Class | Mgmt_Action                                | Need  |
|---------|------------|--|---|
|         | BMP        | Consumptive and Non-consumptive Public Use | Determine effectiveness of slow-no wake areas and electric motor only areas in reducing disturbance to fish and wildlife particularly nesting and roosting birds on the UMRNW&FR (large floodplain refuges.)  |
|         | BMP        | Hydrologic/Geomorphic Restoration          | Determine the cost effectiveness in constructing/managing sediment traps in the lower reach of tributaries versus removing sediment from backwaters.  |
|         | BMP        | Monitoring Activities                      | Investigate the Black River Bottoms (Navigation Pool 7) for the presence of eastern massasauga rattlesnakes and develop habitat management strategies. Land cover/use and additional vegetation/hydrology mapping are available.  |
|         | BMP        | Vegetation Manipulation and Removal        | What forest management practices will support bald eagle nesting trees?   |
|         | Research   | Consumptive and Non-consumptive Public Use | Impact of land development around perimeter of refuge. Influence on water quantity and quality. Sedimentation influences? Stormwater discharge impacts on refuge resources? Stormwater/sedimentation input into refuge and changing vegetation communities as a result.   |
|         | Research   | Monitoring Activities                      | Baseline data on the distribution and relative abundance of turtles to address critical management needs on the UMRNW&FR. (This has been proposed for two years as a USGS Science Support Partnership Program through Walt Sadinski. It is intended to collect data on turtles impacted by recreational use on beaches and Corps of Engineers dredge material placement sites.) |
|         | Research   | Monitoring Activities                      | There may be many research opportunities for Refuges to contribute to fisheries conservation. Generally speaking, considerably more inventory and monitoring information will be needed before Refuges can determine their potential to contribute to fisheries conservation. Research priorities are expected to arise once better I&M information is obtained.                |
|         | Research   | Monitoring Activities                      | Management strategies within wetlands to minimize disease/parasite impacts on waterfowl. Can predictive models be developed to identify potential problem sites?  |
|         | Research   | Monitoring Activities                      | American Eel. What are the management opportunities on refuges, and what are the habitats most used by eels?  |

| <b>Habitat</b> | <b>Need Class</b> | <b>Mgmt_Action</b>    | <b>Need</b>  |
|----------------|-------------------|-----------------------|--|
|                | Research          | Wetland Management    | Investigate the use of low level sheet pile either metal or composite to create "plugs" along existing naturally occurring riverbank and river oxbows to slow the retreat of spring melt water making water available to wildlife for longer periods. Can incorporate a water control structure into the piling to fine tune water management. |
|                | StakeholderMtg    | Monitoring Activities | How should we address the quantity and quality of water coming into and leaving refuge system lands?   |

| Habitat   | Need Class | Mgmt_Action                         | Need  |
|-----------|------------|-------------------------------------|---|
| Saltmarsh | AM         | Monitoring Activities               | Expand salt marsh obligate nesting bird research, particularly Salt Marsh Sharp-tailed sparrows.  |
|           | AM         | Monitoring Activities               | Marshbird Monitoring (secretive marshbirds and sparrows) that includes the success of breeding birds (not just presence and absence) to help identify if management actions could improve success (create more high marsh to reduce flooding events, control predators, etc).                                   |
|           | AM         | Monitoring Activities               | Develop Index of Biological Integrity (IBI) to rank discrete saltmarshes on NWRs throughout the Region. Index will be used to identify relative integrity of saltmarshes, where restoration efforts may be most effectively implemented, and identify factors which are adversely impacting saltmarsh habitats. |
|           | AM         | Monitoring Activities               | Maintaining health of our salt marshes (for salt marsh sharp tailed sparrow) and coastal wetlands.  |
|           | AM         | Monitoring Activities               | Why do saltmarsh sharptailed sparrows have such high levels of Hg in their blood and what is the impact of that at a population level?  |
|           | AM         | Monitoring Activities               | What is importance of saltmarsh habitats to migrating shorebirds. What would be appropriate management actions to enhance saltmarsh for shorebirds?   |
|           | AM         | Monitoring Activities               | How are refuge marshes keeping pace with sea level rise? How does tidal flow restoration impact these changes? Are there ways to manage our marshes to prevent drowning in place?   |
|           | AM         | Vegetation Manipulation and Removal | Long-term Phragmites management strategies  |
|           | AM         | Vegetation Manipulation and Removal | Need effective long-term management strategies to control Phragmites.   |
|           | AM         | Vegetation Manipulation and Removal | Long term management of Phragmites  |
|           | AM         | Vegetation Manipulation and Removal | Need effective long-term management strategies to control Phragmites.   |

| Habitat | Need Class | Mgmt_Action                         | Need  |
|---------|------------|-------------------------------------|---|
|         | AM         | Vegetation Manipulation and Removal | Phragmites Control. Some patches of phrag develop within middle of saltmarsh veg communities. What are factors that contribute to this, and what are best control methods?  |
|         | AM         | Vegetation Restoration              | What is the impact of tidal marsh restoration processes (flow restoration, OMWM) on sharptailed sparrow populations?  |
|         | AM         | Vegetation Restoration              | Develop Index of Biological Integrity (IBI) to rank discrete saltmarshes on NWRs throughout the Region. Index will be used to identify relative integrity of saltmarshes, where restoration efforts may be most effectively implemented, and identify factors which are adversely impacting saltmarsh habitats. |
|         | AM         | Vegetation Restoration              | Subsequent to, or during development of Saltmarsh IBI, also measure composition and abundance of obligate saltmarsh bird community, at range of IBI values. Information will be used to evaluate impact of impaired saltmarshes on saltmarsh birds, and help to prioritize saltmarsh restoration needs.         |
|         | AM         | Vegetation Restoration              | Maintaining health of our salt marshes (for salt marsh sharp tailed sparrow) and coastal wetlands.  |
|         | AM         | Wetland Management                  | Impact of impoundment management practices on use/distribution of secretive marshbirds on a refuge.   |
|         | AM         | Wetland Management                  | Process/methods to identify optimum hydrological regime within managed wetlands to achieve refuge objectives. Long-term hydrological regime which might be annual or multi-year. Short-term seasonal hydrological manipulations to enhance waterbird use of managed wetlands.                                   |
|         | BMP        | Agricultural Management             | Mosquito production and appropriate sampling techniques to measure mosquitoes. Develop valid sampling methods. Identify alternate methods if appropriate. Data mine existing information from Mosq Control Agencies.  |
|         | BMP        | Hydrologic/Geomorphic Restoration   | What is the best way to restore a ditched marsh to its former hydrology, vegetation, peat, and habitat functions and values?  |

| Habitat | Need Class | Mgmt_Action                                | Need  |
|---------|------------|--|---|
|         | BMP        | Monitoring Activities                      | Identify priority salt marsh locations within the region that provide important habitat for migrating landbirds. Additionally, identify potential management strategies which may enhance these areas for migrant bird use.       |
|         | BMP        | Monitoring Activities                      | Develop/incorporate a wetland restoration monitoring system for Refuge salt marshes (to include habitat and wildlife) to help determine the success of restoration/enhancement projects and help guide future management actions. |
|         | BMP        | Vegetation Restoration                     | Measuring secretive marshbird habitat quality? Is abundance sufficient or should we also measure productivity?  |
|         | BMP        | Vegetation Restoration                     | What is the best way to restore a ditched marsh to its former hydrology, vegetation, peat, and habitat functions and values?  |
|         | Research   | Consumptive and Non-consumptive Public Use | What is the impact of shellfish aquaculture on migrating shorebirds.  |
|         | Research   | Fire Management                            | Impact of fire on saltmarsh communities. What is natural fire return rate within a saltmarsh.   |
|         | Research   | Hydrologic/Geomorphic Restoration          | What is the effect of OMWM activities, including ditch plugging, on marsh accretion rates and processes?  |
|         | Research   | Hydrologic/Geomorphic Restoration          | What are the effects of impoundment dikes on seaward salt marsh structure and habitat value? What are the best means for restoring diked salt marshes and surrounding impacted areas?   |
|         | Research   | Monitoring Activities                      | What is causing sudden tidal wetland dieback in the Northeast, in other regions? What is the extent of sudden wetland dieback in the NE? What are long-term ramifications? What are potential restoration options?                |
|         | Research   | Monitoring Activities                      | Non-adaptive management research needed: understand the causes of wetland dieback and if it can be reversed. (This has not yet been documented on the refuge)   |
|         | Research   | Monitoring Activities                      | What is the natural fire interval for tidal wetlands in the eastern US?   |

| Habitat      | Need Class     | Mgmt_Action                         | Need   |
|--------------|----------------|-------------------------------------|--|
|              | Research       | Monitoring Activities               | What is the "health" status of eastern tidal marshes?  |
|              | Research       | Vegetation Restoration              | Wetland restoration of fresh and brackish marshes  |
|              | Research       | Vegetation Restoration              | Initiate Salt Marsh Vegetation Dieback Research ....unknown reasons at this time   |
|              | Research       | Vegetation Restoration              | Eel Grass restoration. What are appropriate methods and wildlife benefits?   |
|              | Research       | Wetland Management                  | Importance of partially drained wetlands to waterbirds.  |
|              | StakeholderMtg | Animal Control                      | How can we restore the overgrazed and eroded salt marsh acres when the cause of that erosion (namely snowgeese) returns to winter on the refuge each year, and recently replanted/restored acres are probably the most attractive areas for these birds to feed? |
| Sedge Meadow |                |                                     |  |
|              | AM             | Fire Management                     | Identify reed canary grass control combinations using grass-specific herbicides along with fire and other tools in an effort to improve habitat for the suite of bird species that utilize low prairie and wet meadows.  |
|              | AM             | Vegetation Manipulation and Removal | Identify reed canary grass control combinations using grass-specific herbicides along with fire and other tools in an effort to improve habitat for the suite of bird species that utilize low prairie and wet meadows.  |

| Habitat    | Need Class | Mgmt_Action                         | Need  |
|------------|------------|-------------------------------------|---|
| Shrublands |            |                                     |   |
|            | AM         | Monitoring Activities               | Are habitats being used by migrant and wintering American Woodcock providing enough fuel and protection from predation? How can we evaluate our habitat for migrant/wintering woodcock?   |
|            | AM         | Monitoring Activities               | How should forests be managed to support migrating landbirds? Is size important? Tree species composition? Age class, structure? Edges, String of pearls concept (landscape spatial distribution)   |
|            | AM         | Monitoring Activities               | How should forests and shrublands be managed to support migrating landbirds?  |
|            | AM         | Vegetation Manipulation and Removal | How do we manage shrublands to get the structure necessary to support New England cottontail and shrubland nesting birds?   |
|            | AM         | Vegetation Manipulation and Removal | How do we manage for shrublands without managing for invasives? How can we mechanically or manually remove invasive plants and prevent their re-establishment? Have soil characteristics/chemistry changed and need to be restored?   |
|            | AM         | Vegetation Restoration              | Management of coastal / maritime shrublands for migrating landbirds and the New England Cottontail (proposed for T&E listing). Management of shrub communities without stimulating invasives (Bittersweet, Honeysuckles, multiflora rose, etc).   |
|            | AM         | Vegetation Restoration              | The FWS expends significant resources on creation/maintaining early successional habitats. In doing this, we often are fighting natural successional processes at great cost. However, some sites conditions are conducive to the maintenance of early successional habitats, either as a result of hydrology, soil, or other site specific conditions. Information is required for staff to evaluate potential sites and determine the site's natural capacity for maintaining these important habitats. |
|            | BMP        | Other                               | How should we be managing early successional forests?   |

| Habitat | Need Class | Mgmt_Action                         | Need   |
|---------|------------|-------------------------------------|--|
|         | BMP        | Vegetation Restoration              | Maintain and increase native shrub-dominated cover (e.g., bayberry, chokeberry, sumac, viburnum) and nectar-producing forbs (e.g., pokeweed, goldenrod) on the existing mid-successional management units to increase the availability of feeding and resting habitat for shrub-dependent migratory birds, including raptors, that rely on these resources.  |
|         | BMP        | Vegetation Restoration              | Identify methods and strategies to support succession of grasslands to scrub/shrub to upland forest.   |
|         | BMP        | Vegetation Restoration              | For selected sites, determine the spatial and temporal scale of natural processes that set back forest succession and create early successional habitats. With this information, determine the natural % composition of early successional habitats relative to mature forests. This information would help guide refuges during CCP and HMP development to identify extent of each habitat which should be managed for. |
|         | BMP        | Vegetation Restoration              | Identify how early successional habitats should be incorporated into the landscape on a watershed or larger scale to achieve maximum effectiveness.  |
|         | BMP        | Vegetation Restoration              | Evaluate all the techniques used to maintain or create early successional habitat and identify techniques and/or modification that are environmentally sound and cost effective.   |
|         | Research   | Monitoring Activities               | Little information is available relative to the minimum patch size requirements for wildlife that use early successional habitats. This information is needed for both breeding birds, as well as for birds during migration or wintering periods. To effectively contribute toward wildlife that use early successional habitat patches, this information is needed.  |
|         | Research   | Vegetation Manipulation and Removal | What is the role of invasive plants in providing cover and food resources for New England cottontail (negative? positive?).  |

| Habitat       | Need Class | Mgmt_Action           | Need   |
|---------------|------------|-----------------------|--|
| Upland Forest |            |                       |  |
|               | AM         | Animal Control        | Impacts of forest fragmentation from mountaintop mining and timber operations on the planning and implementation of the Appalachian Bird Conservation Region (Canaan Valley NWR).  |
|               | AM         | Animal Control        | What are the impacts of excessive moose browse on forest ecology. At what point do they need to be controlled to protect herbaceous rare plants? Regenerating trees?   |
|               | AM         | Animal Control        | Determine appropriate hardwood management techniques for neotropical and temperate migratory birds, including the number and variety of trees to be planted, planting location and schedule, and evaluation of deer impacts.   |
|               | AM         | Animal Control        | Habitat based study to identify when population control of white-tailed deer is needed and to document the success of population management actions.   |
|               | AM         | Fire Management       | Should fire be used to restore and manage Atlantic White Cedar forest?   |
|               | AM         | Monitoring Activities | How should forests be managed to support migrating landbirds? Is size important? Tree species composition? Age class, structure? Edges, String of pearls concept (landscape spatial distribution)  |
|               | AM         | Monitoring Activities | Identify appropriate bioindicators of forest restoration: Neotropical birds (breeding and migrating) Red-headed Woodpeckers, Red-shouldered hawk, Indiana bat, Amphibians, reptiles, Invertebrates, Lichens as bioindicators? Understory plants in savannas, Forest ecosystem itself (large floodplain forests = rare ecosystem) |
|               | AM         | Monitoring Activities | Habitat use (particularly breeding and nesting activities) of waterfowl, mainly upland nesting species like mallards and blue-winged teal, in a forested landscape.  |
|               | AM         | Monitoring Activities | How should forests be managed to support migrating landbirds? Is size important? Tree species composition? Age class, structure? Edges?  |
|               | AM         | Monitoring Activities | How should forests and shrublands be managed to support migrating landbirds?   |

| Habitat | Need Class | Mgmt_Action                         | Need  |
|---------|------------|-------------------------------------|---|
|         | AM         | Vegetation Manipulation and Removal | Identify the best methods for maintaining forests to support target species (Neotropical migrant birds, Red-headed Woodpeckers, Red-shouldered hawk, Indiana bat). Maintenance intervals, timber stand improvement, structural diversity, achieving or maintaining, what forest sizes and shapes support the highest biodiversity? Is tree species composition important to birds?                  |
|         | AM         | Vegetation Manipulation and Removal | Identify methods to control invasive species in forested management units: multiflora rose  |
|         | AM         | Vegetation Manipulation and Removal | Identify methods to control invasive species in forested management units: reed canary grass, garlic mustard, aspen (in savanna restorations)   |
|         | AM         | Vegetation Manipulation and Removal | Identify methods to control invasive species in forested management units.  |
|         | AM         | Vegetation Manipulation and Removal | How can we control Japanese stiltgrass invasion?  |
|         | AM         | Vegetation Restoration              | What are the impacts of excessive moose browse on forest ecology. At what point do they need to be controlled to protect herbaceous rare plants? Regenerating trees?  |
|         | AM         | Vegetation Restoration              | What are the best ways to increase the density and abundance of the forest understory in closed canopy pine stands (i.e., stands 20-80 years old) to provide forage for frugivorous and insectivorous neotropical and temperate migrants? Determine the specific management practices necessary to create optimum fruit and insect abundance for birds throughout the migration and winter seasons. |
|         | AM         | Vegetation Restoration              | Restoration of Pine/Oak Habitat along the scarp on the western boundary of the Dismal Swamp.  |
|         | AM         | Vegetation Restoration              | Determine appropriate hardwood management techniques for neotropical and temperate migratory birds, including the number and variety of trees to be planted, planting location and schedule, and evaluation of deer impacts.  |
|         | BMP        | Fire Management                     | Management of pine barrens for sensitive species. How to apply fire to maintain habitat values and protect neighboring landowners.  |

| Habitat | Need Class | Mgmt_Action                         | Need   |
|---------|------------|-------------------------------------|--|
|         | BMP        | Fire Management                     | Identify methods to reduce fuel loads within forested uplands.   |
|         | BMP        | Monitoring Activities               | Develop a monitoring plan that outlines protocols for monitoring fruit production of forbs (pokeweed), shrubs and saplings (black cherry, viburnum), and vines (greenbrier, Virginia creeper, poison ivy). The monitoring plan will outline pre- and post-management monitoring to measure understory response to management.  |
|         | BMP        | Monitoring Activities               | How can we monitor and maintain pollination service by native insects to ensure spring ephemerals in our forests maintain viable populations?  |
|         | BMP        | Monitoring Activities               | Identify methods for maintaining forests for target species  |
|         | BMP        | Monitoring Activities               | Optimal forest management regimes for NABCI priority birds in BCR 14.  |
|         | BMP        | Vegetation Manipulation and Removal | Identify methods to reduce fuel loads within forested uplands.   |
|         | BMP        | Vegetation Restoration              | Identify methods and strategies to support succession of grasslands to scrub/shrub to upland forest.   |
|         | BMP        | Vegetation Restoration              | Forest management conservation targets, BMP's for forest management, early successional forest, forest composition and structure, etc.   |
|         | BMP        | Vegetation Restoration              | For selected sites, determine the spatial and temporal scale of natural processes that set back forest succession and create early successional habitats. With this information, determine the natural % composition of early successional habitats relative to mature forests. This information would help guide refuges during CCP and HMP development to identify extent of each habitat which should be managed for. |

| Habitat | Need Class | Mgmt_Action            | Need  |
|---------|------------|------------------------|---|
|         | BMP        | Vegetation Restoration | Evaluate the success of forest restoration (We started last year with the first major forest restoration effort, 10,000 sugar maple and American basswood seedlings were planted. Another 10,000 will be planted this spring and funding was secured for a third planting in the spring of 2007.) All aspects of this restoration effort need monitoring.   |
|         | BMP        | Vegetation Restoration | Identify the best methods for re-establishing new forests:<br>Accelerating alder & other woody encroachment into old fields   |
|         | Research   | Monitoring Activities  | Studying Indiana bat maternity habitat at Great Swamp NWR (Basking Ridge, NJ.)<br>This project seeks to increase the understanding of the summer ecology of the Indiana bat in the northeast, specifically by locating and characterizing roost trees and defining foraging areas within the GSNWR and the surrounding area. Special interest will be given to differentiating use patterns between the managed and wilderness portions of the refuge and in studying the habitat selection by adult females, both in roosting and in foraging behavior. Mist nets will be used to capture bats; radio telemetry will be used to identify foraging areas and roost trees; habitat analysis and visual observations will characterize those areas and the number of bats using them. Habitat selection patterns will be examined using appropriate sampling design and statistical analysis. |
|         | Research   | Monitoring Activities  | What is the impact of forest thinning on non-target species (inverts, amphibians, reptiles)   |
|         | Research   | Monitoring Activities  | Determine abundance, species composition, and timing of spring passerine bird migration in floodplain and upland forests in the Upper Mississippi River corridor. Link habitat use patterns with habitat variables including local and landscape structural variables and food abundance indices. Link habitat use patterns with indices of bird body and metabolic condition, sex and age ratios, and food choice and foraging observations. Determine important migration stopover areas.   |

| Habitat | Need Class     | Mgmt_Action                         | Need  |
|---------|----------------|-------------------------------------|---|
|         | Research       | Vegetation Restoration              | Identify the best methods for re-establishing new forests: Planting techniques, Seedling survival, Controlling deer browse, Controlling invasives that might delay or prevent restoration, What are the least cost methods for restoring or establishing forests (planting vs. natural regeneration)?   |
|         | StakeholderMtg | Monitoring Activities               | Potential conservation targets in forests   |
|         | StakeholderMtg | Monitoring Activities               | Develop long-term monitoring plots to: assess the health and diversity of forests and evaluate the current and potential suitability of forest habitats for target species.   |
|         | StakeholderMtg | Other                               | How should diversity be defined as a target of forest restoration?  |
|         | StakeholderMtg | Other                               | Work with other agencies (Forest Service) that have more experience with forest management. They may have ideas or experience with forest management tools.   |
|         | StakeholderMtg | Other                               | Evaluate various forest management options with respect to the response of target organisms in the forest: Planting, flooding, burning, Selective thinning, Timber harvest, timing and spatial distribution, Buy more land, convert from agriculture, Mowing, Dredge spoil deposition (navigable rivers), Mechanically damage trees (to create dead wood) |
|         | StakeholderMtg | Vegetation Manipulation and Removal | What are the best methods of maintaining dead/dying wood in forest management? How much dead/dying wood is needed in a stand or management unit?  |
|         | StakeholderMtg | Vegetation Restoration              | Managing to support migrant landbirds, concerns about deer over-browse, invasive species, earthworms, how to maintain understory? Managing the forest to restore the long term health of the system and the suitability for nesting birds and other taxa.   |