State Fish and Wildlife Agencies
Information Management and Geospatial Systems

Status and Needs for Addressing Development of
Comprehensive Wildlife Conservation Strategies

Report to the International Association of Fish and Wildlife Agencies
Teaming with Wildlife Committee

Prepared by:

Organization of Fish and Wildlife Information Managers
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BACKGROUND

Federal appropriations for the Wildlife Conservation and Restoration Program funds in fiscal year 2001 and for the State Wildlife Grants in fiscal years 2002-2004 include a requirement that state fish and wildlife agencies develop a Comprehensive Wildlife Conservation Strategy (CWCS) and submit it to the U. S. Fish and Wildlife Service by October 1, 2005. As outlined in the legislation, the final document must provide information about the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; their habitats, threats to these resources, and strategies for their conservation. The document will also include strategies for monitoring the effectiveness of these conservation strategies and integrate mechanisms for adapting these actions to respond to new information or changing conditions. The document will provide a description of procedures to review the document at least once every ten years. The CWCS requirements also emphasize the importance of interagency and inter-organizational collaboration on the development, implementation, review and revision of the plan and clearly identify the essential role of public participation.

The assembly, manipulation and interpretation of a wide array of information, both spatial and tabular, are critical elements in the development and implementation of the CWCS. The "Guiding Principles" developed by the International Association of Fish and Wildlife Agencies (IAFWA) provide several excellent recommendations in that regard, including:

- "Make full and effective use of relevant existing information; in particular, integrate appropriate elements of other plans and initiatives (such as Partners-in-Flight and the many regional and other plans), databases, GIS layers, records, reports, other information sources, and management information systems that overlap or complement these Plans-Strategies.

- Identify knowledge gaps, as well as areas of knowledge, to help focus future efforts to improve understanding and planning, but do not allow a lack of information to inappropriately limit necessary short-term application of the best available science and good judgment in decision-making.

- Make the Plan-Strategy spatially explicit, to the extent feasible and appropriate, with a full complement of GIS and other maps, figures, and other graphics, as well as appropriate text to provide sufficient detail and consistency in describing species and habitat conditions, conservation needs, conservation recommendations, and other issues/actions, so it can be used effectively by all partners.

- Develop an updatable information system to monitor Plan-Strategy implementation and the status and trends of wildlife and habitat."

In 2003, regional workshops were conducted by IAFWA and the U.S. Fish and Wildlife Service to assist States with preparing their CWCS. During the course of these workshops, state coordinators and members of the national IAFWA Teaming with Wildlife (TWW) Committee's State Wildlife Grants (SWG) Work Group indicated a need for "minimal guidelines for wildlife-related information and geospatial systems to be used in such plans to facilitate regional implementation and national reporting."

The Organization of Fish and Wildlife Information Managers (OFWIM), an IAFWA affiliate, has offered to provide technical assistance on this issue to the IAFWA TWW Committee. This offer was made via a facilitated discussion and other information-gathering mechanisms at the OFWIM annual meeting on 24-29 September 2003 in Rapid City, South Dakota.

The OFWIM membership consists primarily of individuals from state and provincial fish/wildlife agencies, regional wildlife-related agencies/organizations (e.g. regional marine fisheries commissions), and federal or national agencies and organizations with fish/wildlife or natural resource responsibilities and interests. Many of the members are biologists by training, working in wildlife-related information management (IM) and/or geographic information system (GIS) and remote sensing programs. They bring a high level of knowledge and understanding to many of the technical issues that must be addressed in completing state CWCS. OFWIM's 2003 annual meeting featured information management and GIS applications in conservation planning (Appendix A).

In September, 2003, Director Duane Shroufe, Chair of the IAFWA TWW Committee, approved the SWG Work Group's recommendation to request assistance from OFWIM, with an associated list of deliverables and a timeframe to meet this national need. The SWG Work Group will evaluate OFWIM's products, and forward information to the states, as appropriate.

REQUEST

The IAFWA TWW Committee asked OFWIM to:
- address the feasibility and reasonableness of states to use information management and geospatial systems that facilitate regional implementation and support national summaries through the integration of data sets and the use of minimal common data standards and/or elements;
- propose minimal interim guidelines for CWCS-related information management and GIS;
- evaluate how states/jurisdictions can use their CWCS to take steps in that direction;
- identify the current status of IM/GIS tools in agencies;
- recommend methods for documenting data deficiencies and reporting accomplishments in the CWCS; and
- address the feasibility of OFWIM serving as a clearinghouse for IM/GIS resources, on behalf of the states/IAFWA and recommend possible mechanisms, if feasible.

In addressing this request, the IAFWA TWW Committee asked that OFWIM provide the following products:

1. Recommendations resulting from facilitated discussion at OFWIM meeting
2. A list of representatives participating in discussion and meeting and their involvement in the CWCS process.
3. A synopsis of the current state of IM/GIS tools in place in fish and wildlife agencies for use in the CWCS processes
4. A targeted list of references related to wildlife information management and mapping/use of GIS in conservation planning

STRATEGY

In preparation for its annual meeting in 2003, and to facilitate discussion of the various elements in the IAFWA request, OFWIM developed an Internet-based questionnaire (Appendix B) and asked conference attendees to complete the survey prior to the meeting. The document addressed six key areas relevant to the IAFWA request, including information management software systems; geospatial software applications; standards for cataloging wildlife and habitat-related information; use of existing state, regional, or national wildlife or habitat-related datasets; habitat classification systems; and wildlife-habitat relationships. Members were also asked to provide information about publications and Web sites related to the use of GIS in conservation planning that they use or with which they had familiarity.

Attendees received a copy of the preliminary results of the survey at the OFWIM meeting and participated in a 2-hour facilitated discussion to address further the items outlined in the IAFWA TWW Committee request. A list of attendees, most of whom are providing IM/GIS support to their state CWCS process, is included in Appendix C.

RESULTS

Survey responses were received from 28 states from around the country, including Arkansas, Arizona, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Kansas, Kentucky, Maryland, Michigan, Missouri, Montana, North Carolina, North Dakota, Nebraska, New Jersey, Nevada, Oklahoma, Pennsylvania, South Dakota, Utah, Virginia, Washington, West Virginia, and Wyoming.

Current State of IM/GIS Tools

Survey responses indicate that state fish and wildlife agencies use a wide variety of tools and are at varying degrees of currency with computer technologies. Twenty-seven of the responding states noted that they are using Microsoft Access or SQL to manage wildlife-related information, which would facilitate inter-state information sharing; however, almost every state documented numerous key legacy systems that are being managed in outdated or non-industry standard software systems. The integration of this information into the CWCS process could prove challenging. Several states also noted that their agencies allow individual program or project managers to select and utilize software that they deem most appropriate to their needs, but without any apparent direction or standards to facilitate information exchange or compilation within the agency.

Twenty-seven of the responding states documented their use of ESRI-based software products for geospatially-referenced data, with most using ArcView or ArcGIS. Approximately half of these states also indicated that they are acquiring ArcIMS for its interactive Internet mapping capabilities. Eleven states responded that they are also using ERDAS for the management and manipulation of satellite imagery and other remotely sensed data. Significantly less variation exists within this software group within and between agencies, likely the result of the more significant expense associated with the acquisition and maintenance of GIS software and training opportunities available. This consistency should facilitate the sharing and integration of spatially explicit data for the CWCS.

State fish and wildlife agencies are clearly struggling with the use and implementation of standards of cataloging wildlife and/or habitat information. Only a few national standards exist, including "Procedures for Describing Fish and Wildlife" (developed by the U.S. Fish and Wildlife Service Eastern Energy Land Use Team in 1976) and Natural Heritage Program Biological Conservation Datasystems (or Biotics). Six states are actively maintaining comprehensive systems following the "Procedures" format or modifications to this format and 21 states are using or have regular access to information managed by the state Natural Heritage Program. In most cases, agencies indicated that they have developed their own minimum standards, or that no standards exist within the agency. This issue is clearly one of the most critical and will likely be one of the greatest challenges faced in compiling data for use in the CWCS and in any initial efforts to regionalize or nationalize CWCS information.

State fish and wildlife agencies are using and managing an array of systems cataloging the distribution and abundance of wildlife. Specific systems include:
- Collection-based systems (19 states)
- Breeding Bird Surveys (24 states)
- Heritage or Biotics databases (24 states)
- Reach-based systems for aquatic species (12 states)
- Christmas Bird Counts (14 states)
- State-level breeding bird atlases (23 states)

At least nine states indicated that they intend to develop new systems as part of the CWCS process through which they will attempt to centralize and/or computerize distribution and abundance information. Clearly, those fish and wildlife agencies with existing computerized systems developed with consistent application of standards are better prepared to accommodate the CWCS information needs; these agencies are in the minority of the total.

Lastly, as of September 2003, only seven states had selected a habitat classification system to use in addressing Element 2 of the CWCS eight required elements ("descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified"). There was also considerable confusion about the applicability of existing national vegetation standards (e.g., the National Vegetation Classification System [NVCS] or the derivative Community Classification System of The Nature Conservancy) to biologically-meaningful habitat classifications for wildlife. Under previous guidance, the IAFWA TWW Committee has recommended the use of Bailey's Ecoregions for reporting purposes. Several states indicated they expect to use ecoregions as their habitat classification system, which is not an appropriate application of this ecological classification system. Most states have determined that they will have to create some modified habitat classification system via the integration of a variety of systems (e.g., state Gap Analysis Project habitats, NVCS, Anderson land use/land cover, etc.). This will be one of the most time-consuming tasks for many wildlife agencies and could potentially cause significant delays in the CWCS process. Concurrently, most states are in the process of defining and developing wildlife-habitat association crosswalks. Again, inconsistencies within and between states will make regional and national CWCS reporting a challenge.

IM/GIS References

A targeted list of references related to wildlife information management and mapping/use of GIS in conservation planning is provided in Appendix D. This list is the result of recommendations provided through the OFWIM survey and independently by OFWIM members.

Facilitated Discussion

During the OFWIM 2003 annual meeting, attendees participated in a 2-hour facilitated discussion to address the balance of items identified in the IAFWA request. The following information represents a summary of participant comments.

Accomplishments
- Informal information sharing is occurring already between many neighboring states, creating local "consistency" discussions and system modifications to facilitate data integration.
- Most states are aware of and pursuing regional and national data (e.g., Breeding Bird Survey) and using those datasets to supplement state-level information collection and computerization
- States have recognized the availability of applicable state-specific information from other agencies and organizations and are continuing to collaborate with these partners.

Challenges
- Many state fish and wildlife agency IM/GIS personnel are just learning about the CWCS and their roles in the states' processes, resulting in a very limited start-up time (September 2003).
- Information critical to address the CWCS required elements exists in a variety of formats that will require some integration.
- State fish and wildlife agencies are pressed to compile and integrate species and habitat databases for their own CWCS within the existing timeframe, leaving little time for reformatting or integrating data into a national system.
- Twenty percent of states attending the OFWIM conference indicated that they are developing brand new systems to address CWCS requirements or totally revamping existing systems. Many agencies also expressed interest in moving directly to a Web-based interface for new or redesigned systems.
- Many state fish and wildlife agencies are trying to address system protocol topics (.e.g., internal standardized data collection and reporting) beyond the scope of the CWCS as they identify shortcomings in existing applications or processes.
- A number of state fish and wildlife agencies are subject to state-level information management policies or requirements that may limit their flexibility in system software or architecture.
- Existing systems described as "comprehensive" applications are often selective by nature (e.g., state Natural Heritage Program systems are often limited to rare species; state wildlife agency applications are often limited to game wildlife, sportfish, etc.).
- Limited detailed distribution and state-specific life history information exists for many major taxonomic groups (e.g., reptiles, amphibians, invertebrates).

- Many state, regional and national data sets do not document population or habitat health or trends, precluding specific or quantitative measures of these trends.
- Standardization of techniques and reporting to the degree necessary to facilitate and support full regional implementation of CWCS conservation strategies and national summaries will require considerable time and effort.

RECOMMENDATIONS

OFWIM offers the following recommendations for consideration:
- CWCS Document
  - Ensure that information management and data analysis processes and methodologies are well documented and are summarized in an "Information Management Processes and Needs" section of the document.
  - At a minimum, describe the distribution of species of greatest conservation need by ecoregional unit to facilitate national reporting and spatial representation (see "National Synopsis recommendation for future statistics).
  - Use the CWCS to clearly document data deficiencies in an "Information Management Processes and Needs" section:
    - Lack of available information (e.g., surveys not conducted)
    - Lack of computerization of existing information
    - Need for data system development or re-engineering
    - Need for standard data collection (survey) protocols
    - Need for data standards (in data compilation, computerization, and reporting)
    - Need for mechanisms for data and information transfer and communication among states (.e.g., interstate work groups, participation in OFWIM).
  - Commit to allocating SWG or related funding to address data deficiencies, particularly the lack of computerized information and need for system development and/or re-engineering, and adequate staffing needed to correct these deficiencies.
  - Use the most current digital version of Bailey's Ecoregions to support regional and national reporting.
- Communication with Partners/States
  - Use OFWIM as a vehicle for information sharing, technical assistance, and IM/GIS coordination between state fish and wildlife agencies and key partners involved in CWCS (using the OFWIM Web site, OFWIM-sponsored FWIM-L listserv, regional collaboration facilitated by OFWIM Regional Coordinators, OFWIM annual meeting, and OFWIM committees).
- Data Standards
  - Consider adopting existing national standards when developing new or modifying existing databases or GIS applications; identify opportunities for collaboration with neighboring states.
    - At a minimum, develop a crosswalk between the state species list and national taxonomic system (Integrated Taxonomic Information System) to facilitate national reporting. (State Natural Heritage Programs can assist with this task since their systems are based on ITIS taxonomy.)
  - Ensure that metadata are developed for CWCS applications (e.g., data sets, GIS coverages) and made available to other states and partners to facilitate data-sharing (this could be accomplished via the NBII Metadata Clearinghouse)

- National Synopsis
  - Collect the following metrics to report to IAFWA for the development of a national synopsis of the state of wildlife in the nation:
    - List of species of greatest conservation need (by scientific name, using ITIS)
    - Percent of indigenous fauna considered to be species of greatest conservation need
    - Percent of species of greatest conservation need that are:
      - Undergoing severe decline
      - Undergoing moderate decline
      - Stable
      - Increasing
        (these would be qualitative assessments)
    - Percent of total land area considered to be "key habitats" for species of greatest conservation need
    - Percent of "key habitats" that are:
      - Undergoing severe decline
      - Undergoing moderate decline
      - Stable
      - Increasing
        (these would be qualitative assessments)
    - Top five threats to species and habitats, in decreasing order of severity (by taxon)
    - Top five most important strategies for dealing with threats (by taxon)
    - Top five research needs for species (by taxon)
    - Top five research needs for habitats
    - Top five research needs on threats/strategies
    - Top five information management needs
    - Top five monitoring strategies
    - Top five recommendations for future CWCS development
- Long-term Information Management and GIS Goals
  - Upgrade systems to current industry standards to reduce reliance on dated applications and legacy systems.
  - When selecting or developing new wildlife related data applications, confer with and standardize to the degree possible with other fish and wildlife agencies and partners to maximize the ability to share data.

NEXT STEPS

OFWIM is committed to the following steps in this effort:
- On-going and continued discussion with the IAFWA TWW Committee and SWG Work Group, via the SWG Work Group's Information Management Subgroup, to address and articulate IM/GIS needs and related final products (especially with respect to the national synopsis) (on-going with discussions at the Work Group's semi-annual meetings);
- Ensuring that each state fish and wildlife agency is aware of OFWIM, its mission, and ability to facilitate IM/GIS discussions throughout the CWCS development and implementation process (by May 31, 2004);

- Establishing a dedicated section on its Web site (www.ofwim.org) to support IM/GIS discussions throughout the CWCS development and implementation process (by March 31, 2004);
- Posting a list and links to available CWCS resources on the OFWIM Web site (by March 31, 2004);
- Continuing to assess the state of wildlife information management and geographic information systems using existing and new OFWIM survey tools (updates provided to the Committee at the annual September meeting of IAFWA);
- Collaborating with partners (e.g., NatureServe and NBII) to recommend more comprehensive, non-proprietary data and reporting standards for automated wildlife information systems and GIS applications after October 1, 2005, for use and consideration by agencies as they address identified data deficiencies (on-going with more specific milestones to be identified by the group of OFWIM and partner members); and
- Assisting IAFWA and other partners with the development of a national synopsis, perhaps through use of a survey collecting standardized information from each state as suggested above (within the timeframe adopted by the Committee).

Appendix A – OFWIM 2003 Annual Meeting Presentations

Thursday, September 25, 2003 – Session I

Conservation Planning: Setting the Stage
- Comprehensive Wildlife Conservation Plans: Opportunities for Leadership (Becky Wajda, Virginia Department of Game and Inland Fisheries)
- Conservation Planning Overview (Jeff Lerner, Defenders of Wildlife)
- Biotics 4: A New Tool for the Comprehensive Wildlife Planning Process (Lori Scott, NatureServe)

Thursday, September 25, 2003, and Friday, September 26, 2003

Identifying and Mapping Species and Habitats of Greatest Conservation Need
- A Process for Selecting Species of Greatest Conservation Need (Shelly Miller and Adam Phelps, Virginia Department of Game and Inland Fisheries)
- A Method for Digital Submission of Scientific Collection Permit Reports (Daniel Vichitbandha, Kentucky Department of Fish and Wildlife Resources)
- Strategic Habitats for Biodiversity Conservation in Florida (Beth Stys, Florida Fish and Wildlife Conservation Commission)
- Estimating the Population and Range of Minnesota's Wolves (Steve Benson, Minnesota Department of Natural Resources)
- GIS Algorithms Useful for Producing "Fuzzy" Rare Species Locations (Greg Krakow, Georgia Department of Natural Resources)
- Mapping and Ranking Conservation Opportunity Areas for the Lower Midwest Using GIS (David Diamond, C. Diane True, and Taisia M. Gordon, Missouri Resource Assessment Partnership, University of Missouri, and Walter E. Foster, Environmental Protection Agency
- Using GIS to Develop a Conservation Plan for the Central Hardwoods Bird Conservation Region (C. Diane True, Missouri Resource Assessment Partnership, University of Missouri, and Jane Fitzgerald, American Bird Conservancy)
- The Role of GAP Data and GIS Modeling Techniques in Developing a Comprehensive Plan for State and Tribal Wildlife Grants (M. Keith Wethington, Kentucky Department of Fish and Wildlife Resources)
- Development of a Multi-level Aquatic Habitat Classification in Virginia and Its Use in Aquatic Gap and Conservation Planning (Shelly Miller, Virginia Department of Game and Inland Fisheries)
- Retrieving Little Tennessee Watershed Data for Conservation Use (Shelaine Curd-Hetrick, National Biological Information Infrastructure)
- Minnesota Wildlife Management Area GIS Program (Steve Benson, Minnesota Department of Natural Resources)
- GIS Analysis of Spatial Pattern of Skylark Territories in an Organic Farmland Landscape (Non Hong, Ariena H.C. Van Bruggen and John Stuiver, North Carolina State University)
- Overview of Terrestrial Habitat Classification Systems (Becky Wajda and Dave Morton, VA, and Don Schrupp, CO)
- Virginia CWCP Habitat Analysis (Dave Morton, Virginia Department of Game and Inland Fisheries)

Friday, September 26, 2003
 Federal Aid and the Comprehensive Plans
- Federal Aid Involvement in Comprehensive Wildlife Conservation Plans (Mike Sweet, U.S. Fish and Wildlife Service)
- How to Write Federal Aid Documents – Question and Answer Session (Mike Sweet, U.S. Fish and Wildlife Service)

Sunday, September 28, 2003
  Strategies for Species and Habitat Conservation and Monitoring
- Biodiversity Management Rating and Plan Implementation (Jeff Lerner, Defenders of Wildlife)
- Data Management for Ecoregional Planning: TNC's New Approach (Aliya Ercelawn, The Nature Conservancy)
- Strategies and Performance Measures for Comprehensive Conservation Plans (Jon Haufler, Environmental Management Research Institute)
- Gap Analysis Program: A Course for Natural Resource Professionals (Andy Rosenberger and Scott Klopfer, Conservation Management Institute) (Concurrent Session)

Sunday, September 28, 2003
  Information Management and GIS Tools and Techniques
- Making Data More Valuable (Vivian Hutchison, U.S. Geological Survey – National Biological Information Infrastructure)
- Connecting the NBII Nodes: Map Services Registry to Support Data Discovery and Interoperability Through Open GIS (Lee Graham, U.S. Geological Survey – National Biological Information Infrastructure)
- Direct Benefits of Information Systems to Endangered Species (Bruce Schmidt, Pacific States Marine Fisheries Commission)
- Information Management for Comprehensive Wildlife Conservation Plans: Recommendations to the International Association of Fish and Wildlife Agencies (Becky Wajda, Virginia Department of Game and Inland Fisheries)

Links to the presentations made at the OFWIM 2003 Annual Meeting may be found online directly at http://www.ofwim.org/docs/2003/O2K3Summary.html.

Links to the OFWIM 2003 Annual Meeting Proceedings may be found online directly at: http://www.ofwim.org/docs/2003/2003_WorkshopSessions_Proceedings.pdf.

Appendix B – OFWIM Questionnaire

Organization of Fish and Wildlife Information Managers
September 2003

Wildlife Information Management/GIS Survey

The Organization of Fish and Wildlife Information Managers (OFWIM) has been asked by the International Association of Fish and Wildlife Agencies (IAFWA) to provide technical assistance related to wildlife information management and geospatial systems associated with the development and implementation of state Comprehensive Wildlife Conservation Plans. On 28 September, attendees of the annual OFWIM meeting will be discussing the specifics of the request and making recommendations to the IAFWA. We want to gather some information from you in advance that we think will be useful in that process.

The following survey should only take 15-20 minutes to complete. Most of it can be completed in about 5 minutes. Even if you can't complete all questions or fields, please respond anyway! Please return the completed survey by **23 September** to ensure that we can complete a summarization prior to the OFWIM meeting. An example of a completed survey is provided as a reference (follow the link to: http://www.ofwim.org/docs/IO_Example.pdf). If you have any questions, please send Becky Wajda an e-mail at WajdaB@dgif.state.va.us or call her at (804) 367-8351. OFWIM appreciates your participation in this effort; we look forward to an informative discussion on the 28th.

1. What database management software system(s) does your agency use to manage information about wildlife, habitats, and related resources (check all that apply)?

☐ Oracle   ☐ PostgreSQL
☐ MS-SQL   ☐ Informix
☐ MS-Access   ☐ MySQL
☐ Sybase   ☐ dBase
☐ IBM-DB2   ☐ Other (please indicate in Comments)

Additional Comments:

2. What software system(s) does your agency use for mapping, analyzing or manipulating geospatial information (check all that apply)?

☐ ArcINFO   ☐ GRASS
☐ ArcView   ☐ PCI
☐ ArcGIS   ☐ ERDAS
☐ Intergraph   ☐ ERMapper
☐ MapInfo   ☐ IDRISI
☐ TNTMips   ☐ ENVI
☐ Other (please indicate in Comments)

Additional Comments:

3. What specific standard or system for the cataloging of information about wildlife or habitats does your agency use (check all that apply)?

- ☐ Procedures for Describing Fish and Wildlife
- ☐ Heritage Data Management System
- ☐ Partners In Flight Database
- ☐ Biotics
- ☐ Other (please indicate in Comments)

Additional Comments:

4. What existing wildlife-related information or geospatial systems is your agency using to determine distribution and abundance of wildlife in the development of the Comprehensive Wildlife Conservation Plan (please check all that apply)?

- ☐ Collection-based system (terrestrial and/or aquatic)
- ☐ Breeding Bird Survey
- ☐ Heritage Data Management System
- ☐ Biotics
- ☐ North American Anuran Monitoring Program (frog/toad routes)
- ☐ Reach-based system (aquatics)
- ☐ Christmas Bird Count
- ☐ state breeding bird atlas
- ☐ Gap Analysis Program predicted species distribution models
- ☐ Other (please indicate in Comments)

- ☐ None; we do not have computerized information systems currently available

- ☐ We are computerizing some or all of our data as part of our plan development process (please indicate types of data being computerized in Comments)

Additional Comments:

5. Has your agency selected a habitat classification system to use in the development of the Comprehensive Wildlife Conservation Plan?

Habitat Classification System

- ☐ Yes, we have selected a habitat classification system:
  - ☐ Community Classifications (as developed by The Nature Conservancy and/or state Natural Heritage Program)
  - ☐ U.S. National Vegetation Classification System
  - ☐ Ecoregions
  - ☐ State-developed system
  - ☐ Combination of systems (please indicate in Comments)
  - ☐ Other (please indicate in Comments)

☐ No, we have not finalized selection of a habitat classification system or we are not planning to use one.

Additional Comments:

Wildlife/Habitat Relationships

☐ Yes, we have computerized wildlife/habitat association information that relates to our selected habitat classification system (please indicate in Comments)

☐ No, we do not have computerized wildlife/habitat association information, or it does not relate to our selected habitat classification system (please indicate in Comments)

Additional Comments:

6. Help us build a list of existing plans/planning efforts useful towards the development of the list of species of greatest conservation need. Information for each source should include title, author, complete citation, sponsoring organization, format (book, report, web site), length, short description, why important, specific information about where to obtain reference. For example:

> Taylor, C.A., M.L. Warren, Jr., J.F. Fitzpatrick, Jr., H.H. Hobbs, III, R.F. Jezerinac, W.L. Pflieger, and H.W. Robison. 1996. Conservation status of crayfishes of the United States and Canada. Fisheries 21 (4): 25-38.

Comments: Publication of the American Fisheries Society (www.fisheries.org). Uses several sources of information, including state and federal listings, agency reports, research documents, and books. Species or subspecies assigned: Endangered (E), Threatened (T), Special Concern (SC), or Currently Stable (CS).

7. Help us build a list of references related to wildlife information management and mapping/use of GIS in conservation planning. Information for each source should include title, author, complete citation, sponsoring organization, format (book, report, web site), length, short description, why important, specific information about where to obtain reference. For example:

> **Conservation GIS, The Conservation Fund. URL: http://www.conservationgis.com/** . The Web site provides an introduction to conservation GIS and examples of how GIS is used for strategic conservation planning and related purposes.

8. Information about the person completing the questionnaire:

Name:	E-mail Address:
Title:	Telephone Number:
Affiliation:	Fax Number:
Address:	
City, State Zip, Country:	

Appendix C – List of OFWIM 2003 Annual Meeting Attendees

Name	Affiliation	CWCS? *
Olin Allen	Delaware Division of Fish and Wildlife	yes
Stan Allen	Pacific States Marine Fisheries Commission	no
Michael S Barbour	Alabama Natural Heritage Program	yes
Doug Beard	U.S. Geological Survey	no
Sally Benjamin	International Assn of Fish and Wildlife Agencies	yes
Steven P Benson	Minnesota Department of Natural Resources	no
Stacey L Bork	South Dakota Game, Fish, and Parks	no
Cara A Campbell	U.S. Geological Survey/BRD/NARL	no
Sandra D Canning	Nevada Division of Wildlife	yes
Steve S Carson	Montana Fish Wildlife and Parks	yes
Mary E Clawson	South Dakota Game, Fish and Parks	no
Glenn Clemmer	Nevada Natural Heritage Program	yes
Shelaine Curd-Hetrick	Information International Associates, Inc.	no
David D Diamond	Missouri Resource Assessment Partnership (MORAP)	yes
Aliya Y Ercelawn	The Nature Conservancy	no
Jack W Erickson	South Dakota Game, Fish, and Parks	no
Jacob G Faibisch	International Assn of Fish and Wildlife Agencies	yes
Shannon M Flynn	Minnesota Department of Natural Resources	yes
Walter E Foster	U.S. Environmental Protection Agency	no
Jay Francis	Nebraska Game and Parks Commission	yes
Andy E Gabbert	South Dakota Game, Fish, and Parks	no
Kathleen Graham	Virginia Department of Game and Inland Fisheries	yes
Sandra K Hagen	North Dakota Game and Fish Department	yes
Jon Haufler	Ecosystem Management Research Institute	yes
Janet Hess-Herbert	Montana Fish, Wildlife, and Parks	yes
Kevin A Hoffman	South Dakota Game, Fish, and Parks	no
Nan Hong	North Carolina State University	no
Falk Huettmann	Institute of Arctic Biology	no
Vivian B Hutchison	U.S. Geological Survey/NBII Program	yes
Corey M Huxoll	South Dakota Game, Fish, and Parks	no
Andrew F Jakes	Montana Fish, Wildlife, and Parks	yes
J. Johnson	Alaska Department of Fish and Game	yes
Jeff M Johnston	Arkansas Game and Fish Commission	yes
Kevin J Kading	North Dakota Game and Fish Department	yes
Scott Klopfer	Conservation Management Institute	no
Walter S Kordek	West Virginia Depatant of Natural Resources	yes
Greg Krakow	Georgia Natural Heritage Program	yes
Kurt Kulinski	Oklahoma Department of Wildlife Conservation	yes
Jeff Lerner	Defenders of Wildlife	yes
Michael J Link	Belize Audubon Society	no
Dennie Mann	South Dakota Game, Fish and Parks	no
Amy E Martin	Virginia Department of Game and Inland Fisheries	no
Vincent J McClain	U.S. Fish and Wildlife Service	no
Randy Meissner	North Dakota Game and Fish Department	yes

Name	Affiliation	CWCS? *
M A Messer	Montana Fish, Wildlife, and Parks	yes
Julie A Michaelson	University of Alaska	no
Shelly A Miller	Virginia Department of Game and Inland Fisheries	yes
David D Morton	Virginia Department of Game and Inland Fisheries	yes
Tracy J Moy	Arkansas Game and Fish Commission	yes
Aimee Nickolas	South Dakota Department of Game, Fish and Parks	no
Viivian P Nolan	U.S. Geological Survey/BRD/NBII Program	no
Charlie Olson	South Dakota Department of Game, Fish and Parks	no
Sudhir Ponnappan	Nebraska Game and Parks Commission	yes
Julie S Prior-Magee	U.S. Geological Survey/BRD/NBII Program	no
Karen K Reay	Virginia Department of Game & Inland Fisheries	yes
Andy Rosenberger	Conservation Management Institute	no
Joel F Sartwell	Missouri Department of Conservation	yes
Angie Schmidt	Idaho Fish and Game	yes
Bruce R Schmidt	Pacific States Marine Fisheries Commission	no
Donald L Schrupp	Colorado Division of Wildlife	yes
Sabra S Schwartz	Arizona Game and Fish Department	yes
Lori Scott	NatureServe	yes
Chad Sebade	South Dakota Department of Game, Fish and Parks	no
Greg Simpson	South Dakota Department of Game, Fish and Parks	no
Arthur E Smith	South Dakota Department of Game, Fish and Parks	yes
Michelle Snyder	Washington Department of Fish and Wildlife	yes
Tiffany Stram	North County Trail Association	no
Beth D Stys	Florida Game and Freshwater Fish Commission	yes
Michael J Sweet	U.S. Fish and Wildlife Service (Fed Assistance)	yes
C. Diane True	Missouri Resource Assessment Partnership (MORAP)	yes
Randy L Tucker	West Virginia Department of Natural Resources	yes
Robert P.D Vanderkam	Canadian Wildlife Service	no
Daniel Vichitbandha	Kentucky Department of Fish and Wildlife Resources	yes
Rebecca K Wajda	Virginia Department of Game and Inland Fisheries	yes
Jeff Waldon	Conservation Management Institute	yes
Whitney L Weber	Montana Natural Heritage Program	yes
M. Keith Wethington	Kentucky Department of Fish and Wildlife Resources	yes
Barbara M White	U.S. Fish and Wildlife Service/Division of ITM	no
Chris M Wieberg	Missouri Department of Conservation	yes
Lila B Wills	Conservation Management Institute	yes
Lisa S Zolly	U.S. Geological Survey/BRD/NBII Program	no

* NOTE: At the time of the OFWIM annual meeting, some attendees were not involved in their states' CWCS. As a result of the information provided at the meeting, some individuals and organizations (e.g., Pacific States Marine Fisheries Commission) recognized the need for coordination with the state fish and wildlife agency and planned for follow-up contacts. A number of states initiated their CWCS processes after the OFWIM meeting; some agency attendees may now be directly involved in these initiatives.

Appendix D – Wildlife Information/GIS in Conservation Planning References

WEB SITES

Web Site Theme: Conservation GIS
Sponsor: The Conservation Fund
Content: The Web site provides an introduction to conservation GIS and examples of how GIS is used for strategic conservation planning and related purposes. Links to data sets are also offered.
URL: http://www.conservationgis.com

Web Site Theme: Natural Diversity Information Source (NDIS)
Sponsor: Colorado Division of Wildlife
Content: NDIS provides browser-based access to online wildlife habitat and distribution information for Colorado vertebrate wildlife species. Maps are delivery through a Java-client to user's browser.
URL: http://ndis1.nrel.colostate.edu

Web Site Theme: Maximizing Mapping Resources (Wildlife Management)
Sponsor: GeoWorld Magazine
Content: An article on how the Colorado Division of Wildlife captures institutional knowledge using stand-up, real-time digitizing.
URL: http://www.geoplace.com/gw/2003/0303/0303nrs.asp

Web Site Theme: The Nature Conservancy's GIS Web Site
Sponsor: The Nature Conservancy
Content: Provides Conservancy and partners with information and links to GIS knowledge, systems, data, maps, and community resources. The "Knowledge" section includes a resource library.
URL: http://gis.tnc.org
URL: http://gis.tnc.org/gisattnc.php

Web Site Theme: Virginia Fish and Wildlife Information Service (VAFWIS)
Sponsor: Virginia Department of Game and Inland Fisheries
Content: VAFWIS provides online access to the most current and comprehensive information about Virginia's wildlife and wildlife resources. Geo-referenced data are delivered to the user via Server-Side scripting and Image manipulation software.
URL: http://vafwis.org/WIS/ASP/default.asp

Web Site Theme: Interactive Biodiversity Information System (IBIS)
Sponsor: Northwest Habitat Institute
Content: IBIS contains information about Pacific Northwest fish, wildlife, and their habitats, and attempts to reveal and analyze species-habitat relationships. IBIS includes on-screen query functions to allow users to work interactively without requirements of other software.
URL: http://www.nwhi.org/ibis/home/ibis.asp

Web Site Theme: GIS Resources
Sponsor: Society for Conservation GIS
Content: Provides direct links to a suite of GIS data, information, and resources available to the GIS specialist or conservation planner.
URL: http://www.scgis.org/resource.html

Web Site Theme: GIS in Conservation Planning
Sponsor: American Planning Association
Content: Online outline of a presentation about GIS in conservation planning delivered at the 1999 American Planning Association's National Planning Conference. The outline includes an summary of key GIS design questions.
URL: http://ww.asu.edu/caed/proceedings99/ALLEN/ALLEN.HTM

Web Site Theme: Status and Location of Species and Ecosystems
Sponsor: NatureServe
Content: Online suite of data and technical references applicable to biodiversity planning. Information resources include links to state data available online, NatureServe Explorer, InfoNatura, and downloadable ecological and zoological data sets. NatureServe Explorer is a source for authoritative conservation information on more than 50,000 plants, animals, and ecological communities of the United States and Canada. NatureServe Explorer provides detailed information on rare and endangered species, but includes more general information for common plants and animals too. The Explorer site provides distribution maps, life history information, and more.
URL: http://www.natureserve.org/getData/index.jsp

Web Site Theme: NPS Planning
Sponsor: National Park Service
Content: Online tools for park planning, including GIS data and other information.
URL: http://planning.nps.gov/tools.cfm

Web Site Theme: Protocol for Monitoring Vertebrate Populations and Their Habitats
Sponsor: U.S. Forest Service
Content: Online summary of research underway by the U.S. Forest Service on the development and evaluation of a national protocol for monitoring vertebrate populations and their habitats at an ecoregional scale. Featured abstracts focus on the integration of Forest Inventory and Analysis reports into the development of models, monitoring protocols and related topics.
URL: http://www.fs.fed.us/research/monitoring_vertebrate.html

Web Site Theme: Forest Inventory Analysis
Sponsor: U.S. Forest Service
Content: Forest Inventory and Analysis 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. Links are available to online databases and spatial data services and tools.
URL: http://www.fia.fs.fed.us

Web Site Theme: U.S. Fish and Wildlife Service Refuge Conservation Planning
Sponsor: U.S. Fish and Wildlife Service
Content: Includes Refuge comprehensive conservation plans, GIS and spatial data, and other information about refuge lands.
URL: http://refuges.fws.gov/habitats/index.html

Web Site Theme: Natural Resources Inventory (NRI)
Sponsor: Natural Resources Conservation Service
Content: The Natural Resources Inventory (NRI) is a statistical survey of land use and natural resource conditions and trends on U.S. non-Federal lands. Site includes maps, imagery and data resources, as well as technical analysis tools. The site also includes a link to the "State of the Land" section of this site, which provides data and analyses on land use, soil erosion, water quality, wetlands and other issues regarding the conservation and use of natural resources.
URL: http://www.nrcs.usda.gov/technical/NRI/

Web Site Theme: Habitat Restoration Initiatives
Sponsor: Ducks Unlimited
Content: Ducks Unlimited is restoring habitat on private lands in all fifty states across America. Information about specific projects identifies data and GIS applications in these initiatives.
URL: http://www.ducks.org/Regions/index.asp

Web Site Theme: Wildlife and Habitat Conservation
Sponsor: Trout Unlimited
Content: Includes information about the organization's conservation agenda, and identifies specific threats to coldwater fisheries (including habitats).
URL: http://www.tu.org/conservation/

Web Site Theme: GeoPlan (Geo-Facilities Planning and Information Research Center)
Sponsor: University of Florida
Content: Online information and examples related to the use of GIS tools for conservation planning in Florida and the southeastern United States.
URL: http://www.geoplan.ufl.edu

Web Site Theme: Conservation Planning and GIS Mapping by the Southern Appalachian Forest Coalition
Sponsor: Southern Appalachian Forest Coalition
Content: Article documenting use of GIS in conservation planning in western North Carolina (use the Table of Contents link to see the full list of topics).
URL: http://www.main.nc.us/GIS/wnc_gis/safc/safc.htm

Web Site Theme: Science Support for Regional and Refuge Bird Conservation Planning
Sponsor: U.S. Geological Survey – Upper Midwest Environmental Sciences Center
Content: Information about statistically sound, science-based models (using information management and GIS tools) to support public land management for high priority bird species within a regional context.
URL: http://www.umesc.usgs.gov/terrestrial/migratory_birds/5004911_bird_conservation.html

Web Site Theme: Conservation Planning and Monitoring Avian Habitat
Sponsor: Partners In Flight
Content: Article identifying the use of GIS for habitat planning and monitoring for migratory bird conservation plans. The article also includes information about monitoring progress towards accomplishment of conservation objectives.
URL: http://birds.cornell.edu/pifcapemay/twedtloesch.htm

Web Site Theme: Global Conservation Planning
Sponsor: Center for Applied Biodiversity Science: Research at Conservation International
Content: Information about processes and information management/GIS tools used in global conservation planning.
URL: http://www.biodiversityscience.org/xp/CABS/research/global_planning/globalplan.xml

Web Site Theme: The Biodiversity Partnership – Information Management
Sponsor: Defenders of Wildlife
Content: Access to programs that attempt to gather and organize information about biodiversity and that have established protocols to ensure consistency at the regional or national level.
URL: http://www.biodiversitypartners.org/infomanage/index.shtml

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