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Research Laboratory



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of Engineers®  
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## Red-cockaded Woodpecker Research at ERDC/CERL

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## Foreword

The research described in the references included here was supported overwhelmingly by either the Strategic Environmental Research and Development Program (SERDP), a Department of Defense activity, or by the Army Environmental Quality Research Program, a part of Program Element P62720. The specific studies involved many different titles, principal investigators, and sponsors between 1994 and 2001. Many other, smaller studies were performed for individual installation sponsors, and the reports to these sponsors were not published at the time. In some cases, however, information contained in these reimbursable projects was later incorporated into the more formal studies whose reports were published.

We wish to acknowledge each of the authors whose materials are included in this summary. In almost every case, they responded readily to our request for copies of their publications, and, in many cases, prepared new summaries suitable for this publication. Without their support even this brief summary would not have been possible.

The technical editor was Gloria J. Wienke, Information Technology Laboratory. Stephen E. Hodapp is Chief, Ecological Processes Branch (CEERD-CN-N), and Dr. John T. Bandy is Chief, Installations Division (CEERD-CN). The associated Technical Director was Dr. William D. Severinghaus, CEERD-CN-N. The Acting Director of CERL is William D. Goran.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Director of ERDC is Dr. James R. Houston and the Commander is COL James S. Weller.

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# 1 Introduction

This brief overview of reports prepared by many researchers at the Engineer Research and Development Center/Construction Engineering Research Laboratory (ERDC/CERL) has been prepared to illustrate the intensive focus that the Army Threatened and Endangered Species (TES) research program placed on the Red-cockaded Woodpecker (RCW) (*Picoides borealis*) in the period from 1994 through 2000. As has been recounted many times, the RCW, found on almost every military installation in North and South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana, was declared to be endangered in 1970. With almost a quarter of the remaining populations located on military installations, the potential for conflict was very high. Military planners and training directorates feared that a majority of the training capability of these installations might be lost if more was not learned rapidly about the potential for interaction between the needs of the woodpecker and the demands of the mission.

Early in this process, certain military-unique activities were proposed as the most likely to result in adverse effects on RCW population viability. They were: military noise, especially heavy weapons noise, tracked vehicle maneuvers, and use of fog oil smoke obscurant during training exercises. Many other potential effects, including that of forest management practices, were determined to be sufficiently similar to non-military activities that no Army-sponsored studies were required.

The studies included here thus fall into these three categories: noise, maneuver, and fog oil effects, with some other examinations of general factors. Within the limitations of any *in-situ* investigation, the results are intended to help to develop management guidance for all installations that must accommodate the RCW. They also serve as an example of the “species specific” type of investigation, i.e., one that examines a single species at a time. Of necessity, this type of study is costly and time-consuming. The Army cannot afford many studies of this type, and likely prioritized the RCW as the highest priority because of the potential effect on the Army mission should research not reveal any mitigating factors.

The result of these years of research has generally been satisfying to the Army and to Department of Defense (DoD). The RCW appears not to be extremely sensitive to any of the putative stressors originally identified, i.e., noise, maneu-

ver, or fog oil smoke. That is not to say they are totally immune to all potential effects from them, just that none of these appears, at present, to be a critical factor in population management. Other factors, including availability of suitable trees, empty nest cavities, and a suitably open understory, appear to be much more important to the species' potential success. This significant investment in research into RCW sensitivities has paid off for the Army and DoD. Management funds can now go into habitat improvement practices since the consequences of mission activities are known and understood, and should no longer be the focus of great speculation as to their effects.

There are several ways to find out more about these publications and reports. The reports listed as specific ERDC or CERL Technical Reports or Special Reports are available for DoD customers through your installation library or information management office. Many of these reports are also posted on the ERDC/CERL website, where they are listed by report number or author. The address for access to this site is [www.cecer.army.mil](http://www.cecer.army.mil). For non-DoD customers, contact the National Technical Information Service at [www.ntis.org](http://www.ntis.org).

It is also possible to request more information by e-mail. For convenience, the best method is to make the initial request through me, in my role as the Project Leader for Threatened and Endangered Species (TES) research at ERDC/CERL. My full e-mail address is: [hal.e.balbach@erdc.usace.army.mil](mailto:hal.e.balbach@erdc.usace.army.mil).

## 2 Publications

### Mitigation and Management

*Biological Assessment of Army-Wide Management Guidelines for the Red-cockaded Woodpecker*, Carter, J.H., and T.J. Hayden, CERL Report Number EN-94/03 (1994).

This document was prepared to meet the requirements of the Endangered Species Act. It examines briefly the effects that the implementation of the proposed management guidelines for the Red-cockaded Woodpecker (RCW) would be expected to have on the RCW and other associated threatened and endangered species at each Army installation where the RCW is (or was) found. The conclusion is that use of the guidelines would stabilize existing populations in most cases. Some exceptions were noted where preexisting non-military Army land management issues and constraints affected populations.

*Biological Assessment of the Effects of the Proposed Revision of the 1994 "Management Guidelines for the Red-cockaded Woodpecker on Army Installations,"* Hayden, T.J., CERL Special Report Number 97/48, ADA322086 (1997).

This biological assessment evaluates the effects on threatened or endangered species of implementing the proposed revision to the 1994 "Management Guidelines for the Red-cockaded Woodpecker on Army Installations" in compliance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended. These Department of the Army guidelines provide programmatic guidance for managing RCW populations and habitats on Army installations. This assessment determined that, based on available knowledge, implementing the proposed revision may affect the endangered RCW. Although some individual RCWs and habitat may be subject to greater training activity and resulting disturbance under the proposed revision, this programmatic guidance, when implemented, is expected to stabilize and expand RCW populations on Army installations where this guidance is implemented. This assessment determines that implementation of the proposed revision will have no adverse effect on other listed species considered in this assessment. Fully implemented, it is anticipated the proposed

revision will meet conservation objectives for the RCW, assist species recovery, fulfill regulatory requirements of the ESA, and alleviate current restrictions on Army training.

*Environmental Assessment of Army-Wide Management Guidelines for the Red-cockaded Woodpecker*, Hayden, T.J., CERL Report Number EN-94/04 (1994).

This programmatic assessment was prepared to meet requirements of the National Environmental Policy Act. It examines, in a programmatic and non site-specific manner, the environmental and socioeconomic consequences of the proposed implementation of Army-wide management guidelines for the Red-cockaded Woodpecker. It proposes that each affected installation prepare a site-specific management plan, using the principles contained in this environmental assessment as guidance.

*Environmental Assessment of the Effects of the Proposed Revision of the 1994 "Management Guidelines for the Red-cockaded Woodpecker on Army Installations,"* Hayden, T.J., CERL Special Report Number 97/49/ADA321919 (1997).

This environmental assessment provides an analysis of the environmental and socioeconomic effects of implementing a proposed revision of the 1994 "Management Guidelines for the Red-cockaded Woodpecker on Army Installations." This assessment is completed in compliance with requirements of the National Environmental Policy Act (NEPA) of 1973, as amended. Two alternatives were considered in detail: (1) continue implementing the 1994 Army RCW guidelines, and (2) implement the proposed revision to the 1994 guidelines. Implementing the proposed revision is the preferred alternative. This assessment determines that implementing the proposed revision would have no significant cumulative adverse effects on biological, physical, social, or economic resources on Army installations where these guidelines would be implemented.

*Integrated Endangered Species Management Recommendations for Army Installations in the Southeastern United States, Assessment of the Potential Effects of the 1994 Army-wide Management Guidelines for the Red-cockaded Woodpecker on Associated Endangered, Threatened, and Candidate Species*, Jordan, R.A., K.S. Wheaton, W.M. Weiher, and T.J. Hayden, CERL Special Report Number 97/94/ADA286931 (1997).

In 1994, the Army established Army-wide management guidelines for the red-cockaded woodpecker (*Picoides borealis*) (RCW), a Federally endangered species protected under the Endangered Species Act. The 1994 RCW Management Guidelines outlined population goals, inventory requirements, and land management practices directed toward the protection and stewardship of RCW populations on Army lands. This report assesses the potential effects of implementation of the Guidelines on other endangered, threatened, and candidate species associated with RCWs on Army installations subject to the Guidelines. The report provides recommendations to reduce the potential for adverse effects on non-target species and communities and to move RCW management toward multi-species management of the landscape. Guidance for the integration of ecosystem-based approaches into endangered species management is also included. Appendix B of the report (furnished on diskette) provides land managers with in-depth management-related information on those endangered, threatened, or candidate species that may co-occur with the red-cockaded woodpecker or that are associated with particular habitat types that occur within the longleaf pine landscape. The 16 animal species and 31 plant species discussed are either known to occur or may potentially occur on at least one of the U.S. Army installations subject to the Guidelines.

*Management of Longleaf Pine Woodlands for Threatened and Endangered Species*, Harper, M., A. Trame, R.A. Fischer, and C.O. Martin, CERL Report Number 98/21/ADA339343,paa (1997).

Longleaf pine woodlands on military installations support multiple uses, including the Department of Defense (DOD) training and testing mission; threatened, endangered, and sensitive species (TES) conservation; and forest commodities (e.g., timber, pine straw) production. This report documents strategies to manage TES and their habitats on a plant community basis, using methods that apply to multiple species, and using methods that apply across the southeastern region of the United States. This report combines the pine flatwoods and sandhills communities because they have several features that link them. Ecological descriptions are provided for each community, along with available information about community occurrences on DOD installations throughout the southeast

region. Known occurrences of plant and animal TES associated with longleaf pine woodlands on DOD lands are also reported. Known and potential impacts to the integrity of longleaf pine woodlands as TES habitat, and to associated species are reported. Impacts may be related to habitat fragmentation, or changes in community composition, structure and function due to altered fire regime, hydrologic patterns, soil stability and structure, groundcover integrity, or the invasion of exotic or pest species. Management recommendations are made within an ecosystem-based, adaptive management context.

## Maneuver Training

*Assessment of Effects of Maneuver Training Activities on Red-cockaded Woodpecker Populations on Fort Stewart, Georgia.* Hayden, T.J. (In preparation).

This report presents the results of a multi-year research activity that was a part of the Army TES research program. In this study, data were analyzed from a minimum of 20 10-minute observations of from 24 RCW clusters (1997) to 60 clusters (1999). The preliminary conclusions, which are not necessarily directly capable of being extrapolated to other installations, indicate minimal effect of human activity on the clusters studied. Training restrictions in place during this period restricted mechanized maneuver within 200 feet of cavity trees except on maintained roads, and success of RCW reproduction appears to have been related largely to factors other than field training.

*Research Plan to Evaluate the Relationship Between Maneuver Training Activities and Red-cockaded Woodpecker Populations and Habitats on Fort Stewart, GA,* Hayden, T.J., CERL Report Number 99/106/ADA374084,paa (1999).

The U.S. Army must maintain an adequate land base to meet current and future requirements for realistic training and operations in support of its mission. To fulfill long-term mission requirements, the military must achieve environmental objectives of sustainability of training lands and fill compliance with conservation requirements under law. The Army is committed to maintaining its role as a national leader in the conservation of threatened and endangered species on Army lands. The purpose of this research plan is to develop and implement protocols to evaluate the relationship between maneuver training activities and Red-cockaded Woodpecker (RCW) populations and habitats on Fort Stewart, GA. This research plan meets requirements of the 1996 "Management Guidelines for the Red-cockaded Woodpecker on Army Installations" and the U.S. Fish and

Wildlife Service (USFWS) October 1996 biological opinion to develop and implement a peer-reviewed monitoring program to evaluate potential training effects on RCWs. It is anticipated that the 1996 Army guidelines will be implemented on Fort Stewart prior to the 2000 RCW breeding season pending completion and approval of the installation's Endangered Species Management Plan.

*Training Effects Assessment and Reporting for Installations Implementing the 1996 Management Guidelines for the Red-cockaded Woodpecker (RCW) on Army Installations*, Hayden, T.J., CERL Report Number 99/107/ADA 374116,paa (1999).

The "1996 Management Guidelines for the Red-cockaded Woodpecker (RCW) on Army Installations" requires installations to summarize and report monitoring annually to the U.S. Fish and Wildlife Service (USFWS). This document provides guidance for data summary and reporting of training effects and RCW population monitoring in compliance with this requirement. This guidance has been approved by the USFWS for incorporation into installation endangered species management plans (ESMPs) by reference or addendum. A primary objective of installation data summaries and reporting is to identify changes in RCW populations as a result of training activities under the 1996 management guidelines or other management activities. This guidance outlines data sources and parameters necessary to evaluate population trends in response to these activities.

## Noise

*Assessment of Training Noise Impacts on the Red-cockaded Woodpecker: Preliminary Results*, Pater, L.L., D.K. Delaney, T.J. Hayden, B. Lohr, and R. Dooling, CERL Report Number 99/51/ADA367234,paa (1999).

Because military noise management has traditionally focused on minimizing human annoyance, loud training activities have often been relocated to sparsely populated areas where wildlife resides. This has led to increased conflicts between training activity and conservation of threatened and endangered species. Increasing importance has been placed on determining how noise affects these species. This report presents preliminary results of a multiyear study to determine the effects of certain kinds of training noise on the endangered Red-cockaded Woodpecker (RCW). This research shows that the basic technical approach to data gathering and analysis is appropriate and effective. Preliminary data suggest that measured levels of military training noise did not affect RCW

nesting success and productivity. The RCW flushed infrequently and returned to their nests quickly.

*Assessment of Training Noise Impacts on the Red-cockaded Woodpecker: 1999 Results*, Delaney, D.K., L.L. Pater, T.J. Hayden, L. Swindell, T. Beaty, L. Carlile, and E. Spadgenske, ERDC/CERL Technical Report Number 00-13/ADA379281,paa (2000).

It is estimated that nearly a quarter of the remaining Red-cockaded Woodpecker (RCW) population resides on military installations in the southeastern United States. Such a close association has raised questions about the interaction between training and the conservation of RCW on military land. Increased importance has been placed on determining how noise affects these species. This report presents second year results of a multiyear study to determine the effects of certain kinds of training noise on the endangered RCW. Preliminary data suggest that: measured levels of experimental noise from .50-caliber blank fire and artillery simulators did not affect RCW nesting success or productivity; RCW flush frequency increased as stimulus distance decreased, regardless of stimulus type; woodpeckers returned to their nests relatively quickly after being flushed; and noise levels in RCW nest cavities were substantially louder than levels recorded at the base of the nest tree.

*Assessment of Training Noise Impacts on the Red-cockaded Woodpecker: 2000 Results*. Delaney, D.K., L.L. Pater, L. Swindell, T. Beaty, L. Carlile, and E. Spadgenske. SERDP 2000 Annual Report and ERDC/CERL Technical Report (In preparation).

This report summarizes the third year of a 3-year study of the effects of military weapons noise on the reproductive success of Red-cockaded Woodpecker clusters on Fort Stewart, GA. Behavioral responses were recorded at 50 sites in response to two standardized stimuli: artillery simulators and .50-caliber blank machine gun fire. During this series of tests, birds were not noticeably disturbed by any level of noise used. Previous years' studies have shown that the birds are not generally disturbed by heavy weapons firing when the source was greater than 1,000 m from the nest. The preliminary conclusion of this series of studies is that military weapons noise appears not to be a significant limitation to RCW reproductive success at Ft. Stewart.

## Smokes and Obscurants

*Ecological Risk Assessment of Military Fog Oil Obscurant on the Red-cockaded Woodpecker*, Reinbold, K.A., W. Grethen, M. Hohmann, and B. Stenson. (In preparation).

In an application of the EPA Ecological Risk Assessment procedures to the use of fog oil smoke during military training activities, this project focused on body weight surrogates for the endangered Red-cockaded Woodpecker. Several species of birds were exposed as nestlings, fledglings, or adults to concentrations of fog oil smoke equivalent to the highest normally encountered in the field. There were no significant effects, from any exposure within these environmental limits, on any surrogate bird species. Fog oil aerosol concentrations and exposure durations shown to cause acute effects in other animals are higher and longer than expected exposures of RCW adults, nestlings and eggs. No significant effects are expected on the Red-cockaded Woodpecker under field training conditions.

“Methodology for measurement of fog oil smoke penetration into a red-cockaded woodpecker nest cavity,” Guelta, M.A., and Checkai, R.T. *Proceedings of the Smoke/Obscurants Symposium XIX* vol. 1 (4/97).

As a part of the SERDP studies focused on the Red-cockaded Woodpecker, a study was developed to determine whether, and to what degree, fog oil smoke penetrated into the nesting cavity of the birds. An apparatus was constructed with a small generator and sensors that could be deployed in a breeze tunnel as well as within the nest cavity. At an air flow rate through the tunnel corresponding to a range of 3 to 4 mi/hr, concentrations in the cavity ranged from 64% to 93% of the ambient concentration, partly depending on the orientation of the cavity to the air flow direction. The conclusion is that the in-cavity concentration should be considered virtually equal to the ambient levels, and no significant protective value should be assumed.

## Modeling

*Hurricanes and the Population Viability of Red-cockaded Woodpeckers on Fort Stewart, Georgia*, Melton, R.H. L.A. Jetté, T.J. Hayden, and T.A. Beaty (In preparation).

This assessment of the viability status of the Red-cockaded Woodpecker (RCW) population on Fort Stewart, Georgia, USA, considers the presence vs. absence of hurricane catastrophes, using the population viability program PVAves 1.0.

Scenarios with and without the effects of hurricanes were run over a wide range of potential RCW carrying capacities. For realistic starting density and carrying capacity, the risk of RCW extinction on Fort Stewart was substantially underestimated over the long term (100 years), but not the short term (10-20 years), when hurricane effects were not included in the analyses. Similarly, the probability of achieving a population greater than or equal to a target value of 250 breeding females was substantially underestimated, at the end of 100 years, in the absence of hurricanes. The threshold carrying capacity below which extinction risk dramatically increased, with hurricanes present (200-250 breeding females), was underestimated (50-100 breeding females) when hurricanes were not included in the analysis. Increasing carrying capacity above its present estimated value (506 breeding females) did not further reduce the probability of extinction under either hurricane scenario. The results were robust to assumptions about habitat regeneration time.

*Population Viability of Avian Endangered Species: the PVAves Program*, Melton, R.H., L.A. Jetté, T.J. Hayden, and T.A. Beaty, ERDC/CERL Technical Report Number 01-7 (2001).

This report presents version 1.0 of the Population Viability for Avian Endangered Species (PVAves) computer model. The program is designed to assess the viability of endangered bird species populations on U.S. Army lands. It also facilitates the comparison of alternative ecological scenarios based on different assumptions about the effects of natural or human (military) activities. The primary algorithms used in PVAves are described. The model is used to assess the viability of the Red-cockaded Woodpecker (RCW) *Picoides borealis*, population at Fort Stewart, GA. The results showed that extinction risks were significantly underestimated, and prospects for achievement of long-term population goals were significantly overestimated, if hurricane catastrophes were not included in the population viability model. This suggests that the effects of hurricanes should not be ignored in future population viability analysis of coastal RCW populations. Some potential uses of PVAves include estimating population viability effects of: (1) ecological catastrophes, (2) long-term (chronic) ecological disturbance of survival and/or reproduction rates, (3) changes in population carrying capacity regenerates after disturbance, (4) population supplementation through translocation, or (5) population losses due to "take." Some limitations of the model are discussed.

## 3 Presentations

### Modeling

*An Object-oriented, Individual-based, Spatially explicit Environmental Model: A Discussion of the Approach to Implementing the System*, Rewerts, C.C., P.J. Sydelko, J.E. Dolph, A.M. Shapiro, and T.N. Taxon, Jr., Conference Presentation at the 4th International Conference on Integrating GIS and Environmental Modeling, Banff, Canada (Sept 2-8, 2000).

This presentation examines some of the computational issues related to the development of a spatially explicit simulation of habitat requirements of the Red-cockaded Woodpecker (*Picooides borealis*) (RCW). Elements such as the development of reusable tools for modeling and the design of the model are examined. The model was designed so that it would be modular, expandable, and re-use code describing the objects manipulated. In addition to the discussion of the design issues, the references cited provide a background into the many attempts to model various aspects of RCW needs and behavior.

### Environmental Education and Awareness

*Your Responsibilities to the Red-Cockaded Woodpecker*, Denight, M.L., Interactive Computer Program presented at the Federal Construction Council Symposium on Continuing Education for Construction Professionals, National Academy of Sciences, Washington, DC (03 March 1993).

The presentation discussed the importance of motivators built into the Integrated Training Area Management (ITAM) program's Environmental Awareness component. Success of the environmental awareness education is improved when the motivation for compliance is enhanced. Motivators that were used included command support, appropriate language, video presentations, professionalism and interactive computer programs. The materials that were produced may have included guidelines to protect Red-cockaded woodpecker populations during training activities.

## 4 Products

### Noise

*Woodpecker Audiogram.* Pater, L.L. (1999).

An audiogram was obtained for a closely-related species. This audiogram is representative of RCW hearing range and sensitivity, and thus is useful for guiding interpretation of RCW response to noise.

*RCW Noise Effects Model and Population Effects Analysis.* Pater, L.L. (2001).

The Military Noise Effects on RCW research will result in statistical dose-response models for proximate response of the RCW to various types of military noise events. These models, along with population viability analysis and population monitoring and reproductive success data, will be used to assess impacts of military training noise on the RCW at the population level.

### Modeling

*Population Viability of Avian Endangered Species (PVAvES) Computer Model.* Melton, R.H. (2001).

This computer model is designed to assess the viability of endangered bird species populations on U.S. Army lands. It also facilitates the comparison of alternative ecological scenarios based on different assumptions about the effects of natural or human (military) activities.

*PRISM - Planning and Resource Integration Stewardship Modules; Module on Endangered Species (red-cockaded woodpecker).* Land Management Decision Support System. Majerus, K. (1994).

PRISM was developed with several modules allowing different stewardship activities to be supported utilizing a geographic information system based on the GRASS system developed by USACERL in the 1980s. One of these modules spe-

cifically addressed the needs of the Red-cockaded Woodpecker, using it as an example of an endangered species with known habitat requirements. The concept adapts conventional GIS system interfaces, database management system interfaces, and other information sources for use with a graphical interface using simple menus.

*RCW Behavior Model - An Object-oriented, Individual-based, Spatially Explicit Environmental Model.* Rewerts, C.C. (2001).

This computer model is an object-oriented, individual-based, spatially explicit model of the population dynamics of the Red-cockaded Woodpecker. There are a number of natural, military, and natural resources management processes that affect the spatial distribution of RCW nesting habitat. This model allows RCW biologists to experiment with how these changes may affect the overall dynamics of the population.

## **Environmental Education and Awareness**

*Environmental Education and Awareness Products (Handbooks, Field Cards, Posters, and Videotapes for Installations with Red-cockaded Woodpeckers).* Denight, M.L. (1992-1994).

As a part of a decade-long development program in Army installation Environmental Awareness, a wide variety of leaders' guides, field cards, posters, and other materials were prepared for many installations. These materials focused on local problems and local approaches to their mitigation. In materials prepared for Forts Benning, Polk, Stewart, and Jackson, and Camps Blanding and Shelby, among others, restrictions on training near RCW clusters were emphasized, as well as general information on the need to preserve these species. All these installations, and others, now produce their own variety of awareness materials covering these and other environmental issues.

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