United States Department of Agriculture

Final Report

Title:	Behavioral and Demographic Response of Wildlife to Human Land-Use in Natural Ecosystems

Sponsoring Agency	NIFA	**Project Status**	COMPLETE
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Accession No.	208198	**Project No.**	IND011532MS
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Reporting Period Start Date	10/01/2011	**Reporting Period End Date**	09/30/2016
Submitted By	Julie Estrada	**Date Submitted to NIFA**	02/20/2017

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Performing Department

Forestry & Natural Resources

Non-Technical Summary

Forest management in the eastern United States is faced with many modern challenges. Professional foresters have an innovative set of management options for the maintenance of healthy forest ecosystems; however, some options raise public objections when applied to public lands (e.g., types of timber harvest). The effects of some management options on forests and their native inhabitants are poorly understood. The forest lands in the eastern and Midwestern United States primarily are in private ownership as small parcels. Such lands often do not have any active management plans and haphazard land-use often degrades the forest habitats over time. As populations of forest organisms decline, restrictions on landowners may increase as species are classified as endangered or threatened. These problems are compounded by the lack of scientifically rigorous research on the impact of forest management options on the affected ecosystems and their components. To address this set of issues, we initiated a collaborative study of the long-term, large-scale impacts of forest management on a variety of selected species. Our research includes experimental field studies on wild bird species in the state forests of southern Indiana and computer simulation modeling of the behavior of birds and mammals in the Midwestern United States. The combination of field study and computer modeling holds great promise for improving our understanding of how an animal's behavioral rules interact with human activities to determine the nature and magnitude of those human activities upon wildlife species of concern.

Accomplishments

Major goals of the project

1) understand the responses (occurrence, abundance, productivity, behavioral responses) of targeted native bird and mammals species to human land-use such as forest management (e.g., silvicultural treatment of forest stands) and outdoor recreation in order to identify the positive effects and mitigate the potential negative effects on species of conservation concern, and 2) develop information that can be communicated to private landowners and public land managers on practices that help sustain desired natural communities, such as those dominated by oak species, and associated native plant and animal populations, and 3) implement recently developed modeling tools to provide predictive insights into the potential implications of human activities upon wildlife species of concern.

What was accomplished under these goals?

We conducted field research at two study sites located in the temperate deciduous forests of southern Indiana. At one site, we participated in the Hardwood Ecosystem Experiment, monitoring the responses of small mammals, birds, insects and plants (both canopy trees and understory species) to active timber management. At the second site we were part of an interdisciplinary group studying the ecological nd economic impacts of harvesting downed woody debris for bioenergy. The second project has concluded while the HEE project is continuing. We produced 20 peer-reviewed research and extension publications from these two projects. We also finished 2 Master's students (one non-thesis) and created an online biomass calculator for private landowners to assess the effect of biomass harvest on their properties. Presentations have been made at 3-4 conferences and workshops annually.

We also conducted research on how to improve our ability to assess the status of mammalian species of conservation concern relative to habiat changes caused by forest management or human disturbance. The paper in press in The Journal

of Mammalogy documented how the use of an acoustis lure significantly increased the probability of capturing threatened and endangered species of bats. This improved probabiltyof capture will be critial in assessing the status of bat populations that are in jeporody due to the emergence of white nose syndrom and expanding wind energy development. The paper in press The African Journal of Ecology demonstrates how nocturnal surveys will provide much more precise estimates of duuiker denstities than tradiational diurnal surveys. This inference will be invalualbe in understanding how expanding bush meat harvest is impacting duikers.

What opportunities for training and professional development has the project provided?

To date the Hardwood Ecosystem Experiment has supported 27 graduate students of which 25 have graduated. The HEE project has also employed over 100 undergraduates as field technicians, giving them experience in land management practices and techinques in monitoring and handling vertebrate subjects. Across our entire project, the results of our work demonstrate improved methods for conducting analyses of population data and document the results of amphibians, birds, mammals and understory plants to changes in land management. Work on portions of our project outside of HEE strongly emphasize research by undergraduate students resulting in two first-authored publications by undergraduate students and 11 undergraduates mentored in independent research projects. Our work has also strengthened collaborations among ecologists at regional universities such as Indiana University and Drake University (Iowa). During the overall project period we developed and presented a day long workshop at The University of Missouri to 20 interested academics about Individual based modeling.

How have the results been disseminated to communities of interest?

Results of field projects were presented at professional society meetings and to the general public and land managers at extension events and field days. One Ph.D. student working on our project was an invited speaker to a regional birding festival in Indiana and was the keynote speaker at the annual meeting of a regional ornithological conference. We continue to contribute to the regular quarterly issues of the HEE newsletter and have finished two extenstion publications, including an executive summary of the HEE project to date. These extension publications inform private landowners and public land managers how forest ecological systems and their components respond t otimber harvest and other forms of active land management. During the overall project period we organized a special session on Individual Based Modeling at the midwest fish and wildlife meetings that was very well attended and helped explain to many managers how these modeling tools can be used to address challanges they face.

What do you plan to do during the next reporting period to accomplish the goals?

{Nothing to report}

Participants

Actual FTE's for this Reporting Period

Role	Non-Students or faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	1.8	0	0	0	1.8
Professional	1.8	0.4	3	1	6.2
Technical	0	0	0	0	0
Administrative	0	0	0	0	0
Other	0.9	0	0	0	0.9
Computed Total	4.5	0.4	3	1	8.9

Student Count by Classification of Instructional Programs (CIP) Code

Undergraduate	Graduate	Post-Doctorate	CIP Code
2	6	1	03.06 Wildlife and Wildlands Science and Management.

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Target Audience

Private and public landowners, forest managers, forest products industry representatives, ecologists, wildlife biologists and tribal biologists.

Products

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2015	YES

Citation

Ruhl, P. J., J. K. Riegel, and J. B. Dunning. 2015. Confirmation of successful chestnut-sided warbler breeding in south-central Indiana. Proceedings of the Indiana Academy of Science 124:38-42.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2015	YES

Citation

Ruhl, P. J., and J. B. Dunning. 2015. Morphometrics of Worm-eating Warblers in south-central Indiana: hatching year and after hatching year comparison. North American Bird Bander 43:81-84.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2015	YES

Citation

Ruhl, P.J., R.N. Chapman, and J.B. Dunning. 2016. Field-testing a standard metabolic rate estimation technique for eastern red-backed salamanders. Journal of Herpetology 50:138-144.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2016	YES

Citation

Doughty, C.E., J. Roman, S. Faurby, A. Wolf, A. Haque, L. Bakker, Y. Malhi, J.B. Dunning, J.-C. Svenning. 2016. Global nutrient transport in a world of giants. Proceedings of the National Academy of Sciences 113:868-873

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2016	YES

Citation

Kellner, K.F., P.J. Ruhl, J.B. Dunning, J.K. Riegel, and R.K. Swihart. 2016. Multi-scale responses of breeding birds to experimental forest management in Indiana, USA. Forest Ecology and Management 382:64-75.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Awaiting Publication	2016	YES

Citation

Gasc, A., B. Pijanoski, J. B. Dunning. 2016. Future directions for soundscape ecology and the importance of ornithological contributions. Auk, in press

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Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Awaiting Publication	2016	YES

Citation

Murray, B.D., J.D. Holland, K.S. Summerville, J.B. Dunning, M.R. Saunders, and M.A. Jenkins. 2016. The functional diversity of multiple taxa after timber harvesting generates trade-offs among hardwood silvicultural systems. Ecological Applications, in press.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Accepted	2017	YES

Citation

Ruhl, P.J., J.M. Pierce, and J.B. Dunning. An efficient and inexpensive apparatus for collecting fecal samples during banding studies: an underutilized technique. North American Bird Bander, accepted.

Type	Status	Year Published	NIFA Support Acknowledged
Theses/Dissertations	Published	2014	YES

Citation

Ruhl, P.J. 2014. Effects of biomass harvest on eastern red-backed salamander (Plethodon cinereus). M.S. thesis, Purdue University, West Lafayette IN

Type	Status	Year Published	NIFA Support Acknowledged
Theses/Dissertations	Published	2012	YES

Citation

Malloy, M.C. 2012. Effects of forest management on breeding bird populations of mixed deciduous forests of southern Indiana. M.S. thesis, Purdue University, West Lafayette IN.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Submitted	2017	YES

Citation

Homoya, W., J.W. Moore, P.J. Ruhl, and J.B. Dunning. American Golden-Plover use of agricultural fields occupied by wind-energy turbines. Wilson Journal of Ornithology.

Type	Status	Year Published	NIFA Support Acknowledged
Books	Awaiting Publication	2017	YES

Citation

Dunning, J.B. Body masses of North American birds. International Wildlife Rehabilitation Council, Eugene OR.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2015	YES

Citation

Meier, A. R., A. Pizzo, M. Malloy, J. K. Riegel, and J. B. Dunning. 2015. Breeding birds and forest management in the Hardwood Ecosystem Experiment and the Central Hardwoods Region. Purdue University Cooperative Extension Publication FNR-500-W.

Accession No. 208198 **Project No. IND011532MS**

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2016	NO

Citation

Urban, M.C., G. Bocedi, A.P. Hendry, J.-B. Mihoub, G. Pe'er, A. Singer, J.R. Bridle, L.G. Crozier, L. De Meester, W. Godsoe, A. Gonzalez, J.J. Hellmann, R. D. Holt, A. Huth, K. Johst, C.B. Krug, P.W. Leadley, S.C.F. Palmer, J.H. Pantel, A. Schmitz, P.A. Zollner, and J. M. J. Travis. 2016. Improving the forecast for biodiversity under climate change. Science 353:(6304). [doi: 10.1126/science.aad8466]

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Awaiting Publication	2016	NO

Citation

Jost Robinson, C.A., Zollner, P.A., and Kpanou J.B. (In Press) Night and day: the use of nocturnal and diurnal transects to monitor ungulates (genus Cephalophus) in the Dzanga-Sangha Protected Areas, Central African Republic. African Journal of Ecology June 2016.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Awaiting Publication	2016	NO

Citation

Quackenbush, H.L., D'Acunto, L.E., Flaherty, E. and P.A. Zollner (In Press) Testing the efficacy of an acoustic lure on bat mist-netting success in North American central hardwood forests. Accepted to The Journal of Mammalogy July 2016.

Other Products

Product Type

Software or NetWare

Description

Online biomass calculator for private landowners in the Central Hardwoods Region. The calculator allows landowners to assess the economic impact of harvesting woody material from their property for bioenergy.

Changes/Problems

{Nothing to report}