Adapted by:

Sarah Ashton, Project Coordinator
Lauren McDonell, Assistant Project Coordinator
Kiley Barnes, Program Assistant

This project was made possible by the National Association of Conservation Districts through funding from a joint cooperative agreement with the U.S. Department of Interior and the USDA Forest Service.

NACD services and programs are provided without regard to race, color, national origin, sex, age, handicap, or religious affiliation.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>vii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>ix</td>
</tr>
<tr>
<td>Purpose of the Desk Guide and Toolkit</td>
<td>xi</td>
</tr>
<tr>
<td><strong>Chapter 1 – Setting the Stage</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Global Climate Change</td>
<td>2</td>
</tr>
<tr>
<td>Loss of Forests</td>
<td>3</td>
</tr>
<tr>
<td>Growing Energy Demands and Security</td>
<td>4</td>
</tr>
<tr>
<td>Wildfire and Forest Health</td>
<td>5</td>
</tr>
<tr>
<td>Changing Forest Economy</td>
<td>6</td>
</tr>
<tr>
<td>Summary and Conclusion</td>
<td>7</td>
</tr>
<tr>
<td><strong>Handout 1–Electricity Production: Comparing Wood And Fossil Fuel Feedstocks</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 2 – What is Woody Biomass?</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>9</td>
</tr>
<tr>
<td>Biomass</td>
<td>9</td>
</tr>
<tr>
<td>Woody Biomass</td>
<td>9</td>
</tr>
<tr>
<td>Harvesting and Other Residues</td>
<td>10</td>
</tr>
<tr>
<td><em>Unconsolidated</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Comminuted</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Bundled</em></td>
<td>11</td>
</tr>
<tr>
<td><em>In-woods Conversion</em></td>
<td>11</td>
</tr>
<tr>
<td>Forest Health Improvement</td>
<td>11</td>
</tr>
<tr>
<td><em>Fire</em></td>
<td>11</td>
</tr>
<tr>
<td><em>Insects</em></td>
<td>12</td>
</tr>
<tr>
<td><em>Ecological Restoration</em></td>
<td>12</td>
</tr>
<tr>
<td>Municipal and Construction Wastes</td>
<td>12</td>
</tr>
<tr>
<td><em>Municipal Solid Waste</em></td>
<td>13</td>
</tr>
<tr>
<td><em>Landfill Gas</em></td>
<td>13</td>
</tr>
<tr>
<td><em>Construction and Demolition</em></td>
<td>13</td>
</tr>
<tr>
<td><em>Natural Disasters</em></td>
<td>14</td>
</tr>
<tr>
<td>Processing Residues</td>
<td>14</td>
</tr>
<tr>
<td><em>Sawdust</em></td>
<td>14</td>
</tr>
<tr>
<td><em>Bark</em></td>
<td>14</td>
</tr>
<tr>
<td><em>Black Liquor</em></td>
<td>15</td>
</tr>
<tr>
<td>Short Rotation Woody Crops</td>
<td>15</td>
</tr>
<tr>
<td>Fuelwood</td>
<td>15</td>
</tr>
<tr>
<td>Agricultural Biomass</td>
<td>16</td>
</tr>
<tr>
<td>Food-based Portion of Crops</td>
<td>16</td>
</tr>
<tr>
<td>Nonfood-based Portion of Crops</td>
<td>16</td>
</tr>
<tr>
<td>Perennial Grasses</td>
<td>16</td>
</tr>
</tbody>
</table>
### Handout 2 – Woody Biomass Basics

### Handout 3 – Agricultural Biomass

### Chapter 3 – Products and Possibilities

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>19</td>
</tr>
<tr>
<td>Conversion Processes</td>
<td>19</td>
</tr>
<tr>
<td>Bio-chemical Conversion</td>
<td>19</td>
</tr>
<tr>
<td>Chemical Conversion</td>
<td>19</td>
</tr>
<tr>
<td>Thermochemical Conversion</td>
<td>20</td>
</tr>
<tr>
<td>Electricity and Heat</td>
<td>20</td>
</tr>
<tr>
<td>Electricity</td>
<td>20</td>
</tr>
<tr>
<td>Small Heating Systems</td>
<td>20</td>
</tr>
<tr>
<td>Process Heat</td>
<td>21</td>
</tr>
<tr>
<td>Transportation Fuels</td>
<td>22</td>
</tr>
<tr>
<td>Ethanol</td>
<td>22</td>
</tr>
<tr>
<td>Methanol</td>
<td>23</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>23</td>
</tr>
<tr>
<td>Bioproducts</td>
<td>23</td>
</tr>
<tr>
<td>Char</td>
<td>23</td>
</tr>
<tr>
<td>Glass Aggregates</td>
<td>24</td>
</tr>
<tr>
<td>Anaerobic Digestion Effluent</td>
<td>24</td>
</tr>
<tr>
<td>Bedding-Wood Shavings and Pellets</td>
<td>24</td>
</tr>
<tr>
<td>BioPlastics</td>
<td>24</td>
</tr>
<tr>
<td>Ash</td>
<td>24</td>
</tr>
<tr>
<td>Biochemicals</td>
<td>25</td>
</tr>
<tr>
<td>Acids</td>
<td>25</td>
</tr>
<tr>
<td>Specialty Chemicals</td>
<td>25</td>
</tr>
<tr>
<td>Oils</td>
<td>25</td>
</tr>
<tr>
<td>Carbon</td>
<td>26</td>
</tr>
<tr>
<td>Summary and Conclusion</td>
<td>27</td>
</tr>
</tbody>
</table>

### Chapter 4 – Implications of Producing and Using Woody Biomass

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>31</td>
</tr>
<tr>
<td>Environmental Implications</td>
<td>31</td>
</tr>
<tr>
<td>Maintaining Forests</td>
<td>31</td>
</tr>
<tr>
<td>Air Quality</td>
<td>32</td>
</tr>
<tr>
<td>Greenhouse Gases</td>
<td>32</td>
</tr>
<tr>
<td>Water Quality and Quantity</td>
<td>33</td>
</tr>
<tr>
<td>Soil</td>
<td>34</td>
</tr>
<tr>
<td>Exotic Invasives</td>
<td>35</td>
</tr>
<tr>
<td>Economic Implications</td>
<td>35</td>
</tr>
<tr>
<td>Implications for Landowners</td>
<td>35</td>
</tr>
<tr>
<td>Revenue for Biomass Sales</td>
<td>35</td>
</tr>
</tbody>
</table>
Savings on Site Preparation Costs 35
Revenue from the Sale of Carbon Credits 36
Low to No-cost Timber Stand Improvement 36
Implications for Consumers 36
Bioenergy 36
Biofuels 37
Implications for Communities 37
Social Implications 38
Competition for the Resource 38
Potential for Community Engagement 38
National Security 39
Aesthetic and Health Issues 39
Summary and Conclusions 39

Handout 4 – Implications of Using Woody Biomass for Energy and Other Products

Chapter 5 – Incentives to Produce and Use Woody Biomass

Introduction 43
Federal Policies and Incentives 43
Federal Incentives 45
Federal Renewable Energy Production Tax Credit 45
Grants for Forest Biomass Utilization 45
Research and Development 46
Grants for Small Enterprises, Training, and Outreach 46
Incentives for Biomass Producers 46
State and Local Policies and Incentives 46
State and Local Policies 46
Generation Disclosure Rules 47
Renewable Portfolio Standards/Set Aside 47
Interconnection or Line Extension Analysis 47
Construction and Design Standards 48
Green Power Purchasing/Aggregation Policies 48
Green Pricing Programs 48
State and Local Incentives 49
Net Metering 49
Public Benefit Funds 49
Financing Options for Bioenergy Projects 50
U.S. Department of Agriculture 50
The Food, Conservation, and Energy Act of 2008 50
Business and Industry (B&I) Guarantee Loan Program 50
Rural Utilities Service 50
Renewable Energy Grant and Loan Program 50
Value-Added Agricultural Product Market Development Grants 50
Biomass Research and Development Initiative 51
Cooperative Services 51
Economic Action Program 51
Additional Financing Resources 51
U.S. DOE Tribal Energy Program Grant 51
Revenue Ruling 63-20 Bonds 51
Tax Increment Financing 52
General Obligation and Revenue Bonds 52
Summary and Conclusion 52

Handout 5 – State and Local Policies and Incentives to Produce and Use Woody Biomass

Chapter 6 – Do-It-Yourself Supply Curve: Tools to Help You Get Involved in an Entrepreneurial Woody Biomass Project

Introduction 55
Tool 1: Using Google Earth to Identify a Potential Biomass Utilization Facility Location 56
Tool 2: Surveying Quantities of Locally Available Biomass 57
Quantifying urban waste wood using U.S. Census data 57
Quantify logging residues from FIA data 59
Tool 3: Estimate Costs of Locally Available Biomass Resources 64
Rank resources from cheapest to most expensive 67
Tool 4: Create the Supply Curve 68
Summary and Conclusion 76

Handout 6 – Financing A Bioenergy Project

Chapter 7 – Outreach and Education

Introduction 77
Principles of Effective Outreach 77
Understanding Your Audience 78
Responding to Your Audience 78
Attracting an Audience 78
Public Perceptions 79
Defining Your Goals and Objectives 80
Selecting a Medium and a Message 81
Outreach Tools 81
Dear neighbor letter 81
Media opportunities 82
Newletters 82
Posters and signs 82
Brochures and handouts 82
Field trip 82
Conference/Symposium presentation 82
Presentations at city or county commission meetings 83
How to Organize a Community Forum or Meeting 84
Bringing in Experts 84
Evaluation 86
Summary and Conclusion 87

Handout 7– Common Concerns
Chapter 8 – Case Studies

Fuels for Schools Warms and Cools a Community 91
BioOil Hits the Midwest 95
Biomass Powers Texas 97
Woody Biomass to Pellets 103
Community Involvement in Developing a Wood-powered Utility 105
Powering the Grid with Waste 109
Wood and Paper Trim the Energy Bill 111
Wood Power Heats a Public School 113
Co-firing with Wood and Sugarcane Waste 115
Co-firing with Wood and Switchgrass 117

Appendices

Appendix A–Frequently Asked Questions 119
Appendix B–Glossary 131
Appendix C–Resources 143
Appendix D–Biomass Supply and Cost Profile: Matanuska-Susitna Borough-owned Lands, Alaska 157
Appendix E–Biomass Supply and Cost Profile: Five North Florida Counties 161
Appendix F–Biomass Supply and Cost Profile: Worcester, Massachusetts 171
Appendix G–Outreach Planning Worksheet 183
Appendix H–Sample Dear Neighbor Letter 185
Appendix I–Sample News Release for Publicity 187
FOREWORD

Since 2002, the National Association of Conservation Districts (NACD) has been working in partnership with the Department of the Interior and the U.S. Forest Service in helping to implement the National Fire Plan and related efforts to help reduce hazardous fuels through increased utilization of woody biomass.

Over the years we have published several booklets regarding the role of conservation districts in implementing the National Fire Plan. Since the publication of these documents many conservation districts have become more actively involved in fire prevention and rehabilitation activities in their communities.

NACD, at the encouragement of our Department of the Interior and U.S. Forest Service partners, has embarked in an effort to develop a set of three new desk guides and “toolkits” for use by the nation’s conservation districts in assisting their communities with increasing concerns over forest health, energy, and local economies. In short, the topics for these three new desk guides involve woody biomass utilization; community wildfire mitigation; and handing woody debris after major disasters.

This “Woody Biomass Desk Guide and Toolkit” is the first in the series and is designed to serve as an easy to use “how-to” handbook for conservation district leaders in working with their communities. It is also readily applicable for use by county extension agents and leaders of Rural Conservation and Development Districts as well as other community-based organizations. The primary focus of this Desk Guide and Toolkit is the utilization of woody biomass as an energy feedstock. However, other potential uses and opportunities can be found in the ensuing pages.

Please use this Desk Guide to motivate and educate your community on the many opportunities associated with utilizing woody biomass to enhance the environment while, at the same time, developing creative solutions to address energy needs and stimulating local economies.

Charles Holmes, Chair
NACD Forestry Resources Planning Group
ACKNOWLEDGEMENTS

The need for educating landowners, local leaders, and the public about woody biomass production and utilization for renewable energy and other biobased products is becoming increasingly important. The various advantages, disadvantages, challenges, and opportunities of woody biomass must be considered when evaluating its potential as a resource. We hope that this Woody Biomass Desk Guide and Toolkit will help assist agencies and individuals who work to increase awareness about biomass utilization and empower landowner, community, and industry decision making. We are grateful to the team of talented and dedicated people who helped write, review, edit, and design the content for this guide. Their contributions are greatly appreciated. We specifically would like to thank the following individuals:

Development Team:
Sarah Ashton, Program Coordinator, Southern Regional Extension Forestry, University of Georgia
Lauren McDonell, Wood to Energy Project Coordinator, School of Forest Resources and Conservation, University of Florida
Kiley Barnes, Biomass Program Assistant, Southern Regional Extension Forestry, University of Georgia
Matthew Langholtz, Project Director, BioResource Management

Supervisory Team:
William Hubbard, Southern Regional Extension Forester, University of Georgia
Martha C. Monroe, Professor, School of Forest Resources and Conservation, University of Florida

Advisory Team:
Fred Deneke, Forestry Programs Coordinator, National Association of Conservation Districts
Ron Bell, President, Arkansas Association of Resource Conservation and Development Councils
Debbie Moreland, Program Administrator, Arkansas Association of Conservation Districts
Doug Williams, Managing Editor, National Association of Conservation Districts Forestry Notes
Phillip Edwards, Extension Agent, University of Georgia
Tucker Price, Extension Agent, University of Georgia
Editor:
Eleanor K. Sommer

Graphic Designer:
Camilla Geniatulina, Southern Regional Extension Forestry, University of Georgia

Funding Agency:
This project was funded by the National Association of Conservation Districts through funding from a joint agreement with the U.S. Department of Interior and the USDA Forest Service

Contributing Authors and Editors:
Work from the following authors was adapted for this program from the Sustainable Forestry for Biomass and Bio-based Products and Wood to Energy Outreach programs:

Sarah Ashton, Phil Badger, Larry Biles, Rob Brinkman, Doug Carter, Daniel Cassidy, Bruce Crain, Jian Gan, Darwin Foster, Alan W. Hodges, Bill Hubbard, Ben Jackson, Chyrel Mayfield, Lindsey McConnell, Lauren McDonell, Martha C. Monroe, Sam Negaran, Jennifer O’Leary, Annie Oxrart, Richard Plate, Pratap Pullammanuppallil, Mohammad Rahmani, Richard Schroder, Sara Sillars, and Tat Smith.
Purpose Of The Desk Guide And Toolkit

Communities today are challenged to develop effective strategies that support forest ecosystem health, mitigate the effects of climate change, satisfy growing energy needs, and provide local economic opportunities. For some communities, woody biomass may be a viable option for meeting these needs and deserves serious consideration. Forests in the United States represent an important potential energy and biobased product resource. The National Association of Conservation Districts (NACD), in collaboration with federal, state, and local partners is working to raise awareness about the potential for woody biomass as a primary feedstock for such products.

This Woody Biomass Desk Guide and Toolkit provides an overview of woody biomass production and utilization in the U.S., tips of how to provide effective outreach for your clientele, and educational handouts to share with your audiences. The purpose of this guide is to equip natural resource professionals and outreach specialists with the information and tools needed to increase awareness of the use of woody biomass for energy in the U.S. All of the materials in the guide are available at:

http://nacdnet.org/resources-guides/biomass/

Who Should Use the Woody Biomass Desk Guide and Toolkit?

This Guide is designed for use by conservation district, Resource Conservation & Development and Extension professionals throughout the U.S. It also contains handouts and other resources to assist in educating respective audience.

Using the Desk Guide and Toolkit

The Woody Biomass Desk Guide and Toolkit is a comprehensive guide comprised of reference sections, handouts, case studies, an introductory PowerPoint presentation, Frequently Asked Questions, a glossary, and additional resources. Here, each of these sections is explained in greater detail.

Reference Sections

The Woody Biomass Desk Guide and Toolkit consists of eight chapters. Each of the first seven chapters, contains a reference section, which provides background and overview information for natural resource professionals and outreach specialists. In textbook format, the reference sections are designed to increase understanding of the basic concepts for producing and using woody biomass.
woody biomass for energy, transportation fuels, and other bioproducts. Additionally, the reference sections serve as a quick reference guides to answer questions from clients or the public about the production and utilization of woody biomass.

**Handouts**

In addition to the reference sections, most of the chapters also contain handouts. These outline important points, strategies, and information that may be useful for landowners, the public, local leaders, or other audiences.

**Case Studies**

Chapter 8 of the Guide is a compilation of case studies. Sometimes new concepts are easier to explain with examples. As such, these case studies provide examples of both the challenges and successes of existing or planned woody biomass production and utilization projects throughout the U.S. Case studies highlight relevant points found throughout the Guide and Toolkit and may be used as background reading or outreach handouts.

**PowerPoint Presentation**

The Microsoft PowerPoint® presentation included with this Guide provides a detailed introduction designed for an audience interested in learning more about woody biomass production and utilization. You can simplify this presentation or modify it to address the particular topic area you need to cover or for the particular audience or geographic location you are addressing.

**Frequently Asked Questions**

Towards the end of this guide is a set of frequently asked questions with answers (appendix A). These questions were collected during a series of community forums conducted by the University of Florida, and the answers were provided by experts in the wood-to-energy field. The FAQs provide insight into the concerns and misconceptions that the public has about using wood for energy. This resource may help you prepare to answer similar questions from your audiences. Additional questions from the U.S. Department of Energy, Biomass Programs website are also included in the list.

**Glossary**

A glossary of terms related to woody biomass production and utilization (appendix B) labeled is provided at the end of this guide to familiarize you with relevant terms.

**Resources**

A bibliography of books, articles, Web sites, programs, and other tools pertaining to woody biomass production and utilization is included in appendix C. These resources can help you expand your library and knowledge.
about woody biomass and may also be used to supplement the handouts for outreach activities.

**Desk Guide and Toolkit Chapter Topics**

**Chapter 1 – Setting the Stage**
This chapter introduces the environmental, energy, economic, and social issues that are shaping the potential for woody biomass as an alternative to fossil fuels.

**Chapter 2 – What is Biomass?**
Chapter 2 provides a general overview of biomass types and sources and more comprehensive information on woody biomass, specifically.

**Chapter 3 – Products and Possibilities**
Electricity and ethanol are just two possible products that can be produced from woody biomass. This chapter introduces the major processes—thermochemical, biochemical, and chemical—used to convert woody biomass into products such as heat, biodiesel, char, specialty chemicals, and more.

**Chapter 4 – Implications of Producing and Using Woody Biomass**
This chapter explores, in detail, the environmental, economic, and social implications (costs and benefits) of producing and using woody biomass for bioenergy and other biobased products.

**Chapter 5 – Incentives to Produce and Use Woody Biomass**
Chapter 5 outlines many of the policies and incentives that exist nationally and at the state and local levels which influence woody biomass production and utilization. Becoming familiar with these policies and incentives can help you better assist and advise your clients or audience.

**Chapter 6 – Do-It-Yourself Supply Curve: Tools to Help You Get Involved in an Entrepreneurial Biomass Project**
The feasibility of woody biomass utilization projects depends, to a significant extent, on the cost and availability of wood resources. One way to illustrate the economic availability of the biomass resources is with supply curves. This chapter introduces several tools that you can use to construct supply curves for woody biomass resources in a particular area. These tools may be useful to potential suppliers and users of biomass or to communities considering using biomass.

**Chapter 7 – Outreach and Education**
Chapter 7 provides tips and tools for engaging in effective woody biomass outreach activities. Whether you are designing a community-wide outreach program or giving a brief slide presentation on woody biomass, this chapter may be helpful.
Chapter 8 – Case Studies

As previously mentioned, case studies can be an excellent resource to increase understanding, provide insight, and make concepts like woody biomass more conceivable. There are many woody biomass production and utilization projects underway throughout the U.S. This chapter provides several examples of woody biomass use for a variety of locations, scales, and applications that can be used for background reading or handouts for your audiences.

Strategies for Using the Resources

You can pick and choose from the materials in this Guide and Toolkit to create the outreach strategy or program that best meets your objectives. Whether you need to give a thirty-minute presentation to your local county commission or conduct a week-long professional development training for consulting foresters, the resources in this program can help. See chapter 7 for specific ideas on how you can use the resources in this program to provide effective outreach to your target audience.

A Special Note

This Woody Biomass Desk Guide and Toolkit was adapted from two programs: The Sustainable Forest Management for Bioenergy and Biobased Products Trainer’s Curriculum Notebook (http://www.forestbioenergy.net) and the Wood to Energy Biomass Ambassador Guide (http://www.interfacesouth.org/woodybiomass). Both of these programs contain a variety of information for those working with the public, landowners, community leaders, and other audiences about woody biomass. Both programs are focused on the southern U.S. and include varying degrees of technical information.