

Action Plan for Damaged Timber and Woody Debris Management

Prepared by the Disaster Debris Team
Federal Woody Biomass Users Group

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EXECUTIVE SUMMARY

In the event of a natural disaster, damaged timber and woody debris pose many challenges for their communities and regions. Residential debris management and disposition generally constitute the largest single public cost after a disaster, often in the billions of dollars. The rapidity (and hence the effectiveness) of emergency response to a disaster usually depends on how quickly debris (initially, mainly woody debris – downed trees, shrubs, and other vegetation) can be removed from roads and highways. Woody debris is a major – and sometimes the dominant – component of the debris generated by a disaster in residential areas, taxing the capacities of local disposal facilities. The rapidity (and hence the effectiveness) of forest restoration (reforestation, watershed improvement, insect/disease suppression) and forest industry economic recovery from a disaster also usually depends on how quickly woody debris and damaged timber can be removed.

However, these challenges can be met if the forest enterprise – forest owners; the forest products industries; state, local and federal government – prepares for the next disaster by learning from the failures and successes of previous disasters. The federal interagency Woody Biomass Utilization Group initiated an effort to identify methods to better meet these challenges by holding a workshop in April, 2008. This Action Plan is the result of that effort. It is intended to help each of the stakeholders in the disaster response community and the forest enterprise better meet the challenges of damaged timber and woody debris by incorporating the lessons from the past into their preparations for future disasters.

Specific recommendations (by stakeholder), listed below, are discussed in detail in the text. The Action Plan also identifies information and research needs that, if filled, would enhance the resilience of the forest enterprise.

Department of Homeland Security / Federal Emergency Management Agency

Develop a plan to implement Emergency Support Function (ESF) 14, Long-Term Recovery, that focuses on the special problems associated with damaged timber and woody debris (both forest and residential).

Aggressively incentivize communities to segregate woody residential debris after a natural disaster so that woody residential debris can be beneficially used.

Department of Agriculture (Forest Service, Farm Service Agency, Natural Resources Conservation Service)

All USDA

Streamline procedures for applying for grants to manage damaged timber and forest debris, and to restore watersheds and wildlife habitats after a disaster.

Forest Service

Provide technical assistance in woody biomass utilization to facilitate implementation of the USDA FS woody biomass utilization strategic plan.

Farm Service Agency

Provide financial and technical assistance through the Emergency Conservation Program to farmers and ranchers to rehabilitate farmland damaged by natural disasters.

Provide financial assistance through the Emergency Forest Restoration Program to owners of non-industrial private forest land to carry out emergency measures to restore their land that was damaged by a natural disaster.

Natural Resources Conservation Service

Provide financial assistance through the Emergency Watershed Protection Program to private and public landowners (all projects must be sponsored by a political subdivision of the State, such as a city, county, general improvement district, or conservation district) to relieve imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences.

Department of Energy

Continue the development and deployment of new technologies for the economic conversion of wood waste to biofuels, biopower, and bioproducts.

Provide technical assistance and financing mechanisms to assist federal agencies in deploying heating, cooling and biopower systems using woody biomass debris.

Environmental Protection Agency

Provide technical assistance to delegated states as they develop draft general permits for wet deck storage facilities (and/or draft model permits for individual sites), and through existing MOAs/MOUs, be prepared to expeditiously review and concur with such permits post-incident.

State forestry agencies

Serve as the lead agency for assessing damaged timber and wood debris management on state and private lands and take the lead to coordinate applications for financial and technical assistance from federal agencies.

Develop and maintain a list of viable facilities for wet storage of damaged timber.

Develop and maintain a list of qualified in-state damaged timber and forest debris

loggers, haulers, and biomass contractors.

Develop and maintain Emergency Management Assistance Compacts (EMACs) with neighboring states for assistance in dealing with damaged timber and forest debris issues.

Provide the forest community with a database that will provide state-specific guidance and information for preparation for, response to, and recovery from a natural disaster.

State departments of transportation

Prior to a natural disaster, determine permissible routes and allowable load limits for damaged timber and forest debris removal and storage including alternative routes in the event of bridge or road closures.

State environmental agencies/forestry agencies/agriculture agencies

Prior to a natural disaster, develop draft general permits for wet deck storage sites (and/or draft model permits for individual sites) and provide to EPA for review and concurrence. Work with industry and local governments to review and/or pre-approve their anticipated proposed sites to be used for emergency storage of damaged timber and other woody biomass.

Universities

Develop and maintain a library of documentation on disaster preparedness, timber recovery and forest restoration.

After a storm, conduct workshops on timber recovery and forest restoration.

Provide technical expertise on damage assessment and inventory.

Conduct research to improve future hurricane preparedness, timber recovery, and forest restoration.

State law enforcement agencies/forestry agencies/emergency management agencies

Prior to a natural disaster, develop and maintain a credentialing system for loggers and haulers.

Communities / local governments

Develop and implement a debris management plan that includes damaged timber and woody debris.

Require that methods for determining the amount of debris collected and the collection location specified by the Corps of Engineers in its debris collection and hauling contracts be used by locally-contracted debris haulers.

Forest owners

Develop and implement a continuity of operations plan that includes debris management, storage and resale of damaged timber, and forest restoration.

Forest products industry

Develop and implement a business continuity plan that considers the impacts of potentially high volumes of a wide-range of raw materials over a short period, recovering and using damaged trees, providing storage, and working with other organizations.

Loggers and contractors

State and regional logging, arboriculture and municipal/utility forester associations should develop a plan to train and prepare loggers to respond to both timber recovery from forestlands and woody biomass debris from roads and streets, residential areas, and utility right-of-ways.

INTRODUCTION

In the event of a natural disaster, damaged timber and woody debris pose many challenges for their communities and regions.¹ Residential debris management and disposition generally constitute the largest single public cost after a disaster. The rapidity (and hence the effectiveness) of emergency response to a disaster usually depends on how quickly debris (initially, mainly woody debris) can be removed from roads and highways. Woody biomass is a major – and sometimes the dominant – component of the debris generated by a disaster from residential areas, taxing the capacities of local disposal facilities.

In the aftermath of a natural disaster, damaged timber and forest debris pose special challenges – institutional, economic, logistical, and environmental. Historically, emergency management planning for natural disasters has ignored damaged timber and forest debris. Unfortunately, this means that much of the damaged timber and forest debris is not dispositioned rapidly. As a result, the risk of wildfires increases greatly, forcing costly reactions to dangerous conditions.²

Slow or poor response also means rapid loss of timber economic value due to deterioration – a crucial long-term economic factor in timber-dependent communities. In general, damaged timber and forest debris are seen as a “local problem,” and left to local jurisdictions to handle. However, virtually all forest land is in unincorporated areas or public lands – there really is no “local jurisdiction” that can deal with a problem of this magnitude.^{3,4}

Most of the forest land in the Atlantic and Gulf Coast regions is owned by small landowners, who have limited resources to fund recovery efforts. A large number of the businesses making up the forest products industries are small concerns whose economic viability relies on a ready supply of wood. Depending on post-disaster weather conditions and the severity of the disaster, damaged timber may no longer be usable for lumber in as little as three weeks. However, if kept in wet storage areas, damaged timber will maintain its commercial viability for a year or more, depending on the intended product. Road access and load limits affect the ability of the landowner to remove (or even reach) damaged timber and take it for subsequent processing. If not removed, damaged timber poses very real dangers: wild fires due to drought, or as a host for pests.

¹ Throughout this document the term “damaged timber” will be used to refer to dead, damaged, standing damaged (trees with minimal crown or significant bole damage, for example) or root sprung/leaning trees which must be removed for safety, silvicultural or economic purposes. The term “forest debris” will be used to denote downed woody material in forests that is not usable as a conventional forest product (e.g., timber, furniture). The term “woody residential debris” will be used to denote woody debris in residential areas.

² After Hurricane Katrina, the federal government provided the state of Mississippi with helicopters to rapidly locate and extinguish incipient wildfires. Otherwise, it is likely that tens of thousands of acres would have been consumed by fire.

³ Independent estimates of the damage indicate that Hurricane Katrina knocked down 320 million trees in Mississippi and Louisiana.

⁴ It should be noted that public lands are almost never included in early response efforts. They have also required separate funding authority to initiate recovery actions.

Damaged timber can also have significant indirect impacts, especially on waterways. Damaged timber that enters a stream can become a hazard to navigation if it catches on culverts, for example, and forms a blockage. If a blockage forms, it can lead to damage to roads and bridges. It also can lead to erosion of the banks of the stream.

A lengthy recovery of the forests in an affected area puts additional stresses on the natural environment - reducing wildlife habitat and connectivity, water quality, and recreational opportunities - perhaps for decades. Most importantly, the forests and forest industries are large components of the economy of several states, especially in the southern United States. An ineffective recovery after a natural disaster could affect the economies of these states for decades.

Careful planning can circumvent many of these challenges. There are several documents that can help with this planning. FEMA developed its **Public Assistance: Debris Management Guide** to help communities plan for debris removal and develop a debris management plan (located at <http://www.fema.gov/pdf/government/grant/pa/demagde.pdf>). EPA published its **Planning for Natural Disaster Debris** (PNDD) to provide communities further information on developing a disaster debris management plan (located at <http://www.epa.gov/epawaste/consERVE/rrr/imr/cdm/pubs/pnDD.pdf>). These documents can help stakeholders plan for rapid and effective woody debris management in the aftermath of a disaster. For example, the PNDD recommends that the disaster debris management plan include an estimate on the amounts of woody debris expected for both forest and residential areas, a list of the locations of all types of facilities that can handle woody debris (including reuse and recycling opportunities) and their respective capacities, a list of pre-selected debris management sites, an evaluation of equipment and administrative needs, and a communication plan.

Several other groups have also developed handbooks to provide disaster response and recovery guidance to various groups of stakeholders such as **Disaster Response; Handbook for State Forestry Agencies**, developed by the Southern Group of State Foresters (located at <http://www.southernforests.org/documents/SGSF%20Disaster%20Response%20Handbook.pdf>). The federal Woody Biomass Utilization Working Group (Woody BUG) composed of members from several federal entities, including the USDA, the Corps of Engineers, and the Departments of Energy and Interior, intends to post several of these guides on their website.

These two sets of challenges –the impacts of a natural disaster on the forest community, and woody residential debris – essentially pose the same question: what should be done with the woody debris arising from a natural disaster.

- While there are guidance documents for damaged timber and forest debris, our nation's response to Hurricane Katrina makes it clear that we have not yet implemented a consistent approach to allow the forest community (i.e., the forest owners; their customers, the forest industries; local, state and federal governments; and regulatory bodies) to quickly respond to and return to normalcy from a natural disaster. In this document – the **Action Plan for Damaged Timber and Woody Debris Management** –

actions are proposed that will better integrate the actions of the stakeholders in the forest community, and allow the community to return to normal as rapidly as possible.

- Emergency response plans for urban/residential areas do not offer materially different disposition paths for woody vs non-woody disaster debris. In this document, actions are also proposed that would lead to beneficial use of woody debris, reducing both the burden on landfills and potentially the cost of recovery.

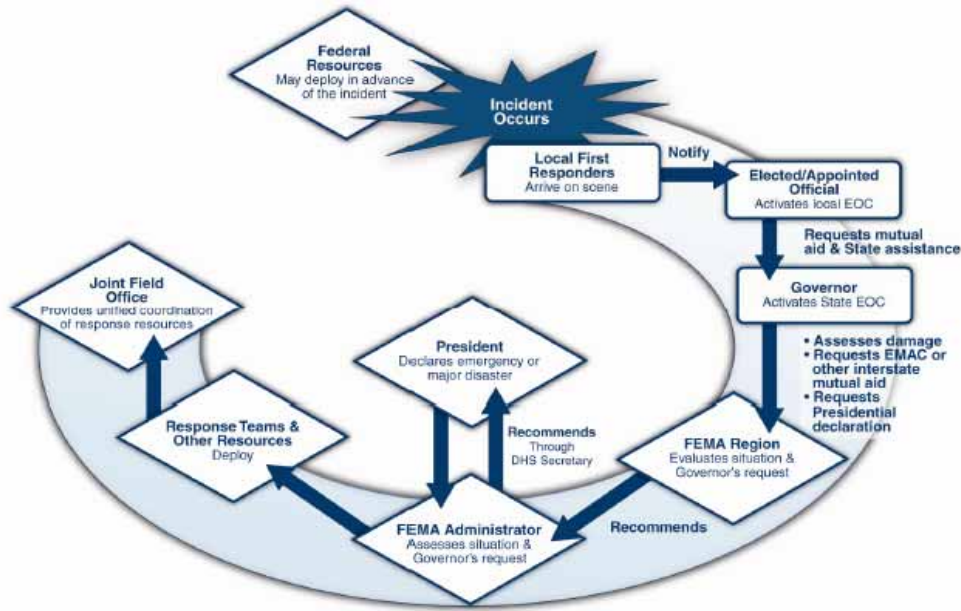
This document – the **Action Plan for Damaged Timber and Woody Debris Management** – describes actions that each of the stakeholders can and should take now to minimize the impact of woody debris, and to speed the recovery of forests and the forest industries after a natural disaster. It is the result of a workshop held in April, 2008, (sponsored by the Woody BUG and the Community and Regional Resilience Institute^{5, 6}) that focused on these challenges.

FEDERAL EMERGENCY RESPONSE FRAMEWORK

This Action Plan must work within the broader emergency response and recovery context. The *National Response Framework* presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies. The *Framework* establishes a comprehensive, national, all-hazards approach to domestic incident response and recovery. The Federal Emergency Management Agency assists state governments in coordinating the national and regional response to disasters. Other federal agencies provide specific assistance under the Emergency Support Functions annexes. The following graphics help to explain these roles of emergency responders:

⁵ The Community and Regional Resilience Institute is funded by the Department of Homeland Security, and led by Oak Ridge National Laboratory. As its name implies, it is focused on helping communities to rapidly recover from natural and manmade disasters.

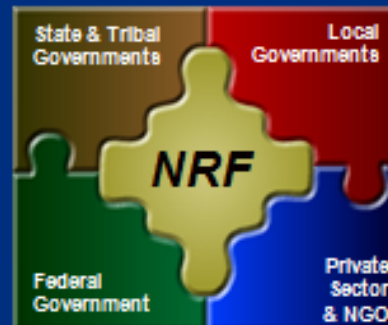
⁶ The presentations made at the workshop can be found at http://www.forestsandrangelands.gov/Woody_Biomass/news_events/recovery_utilization_workshop_031908.shtml.



State & Local Leadership and the Framework

Effective, unified national response requires layered, mutually supporting capabilities

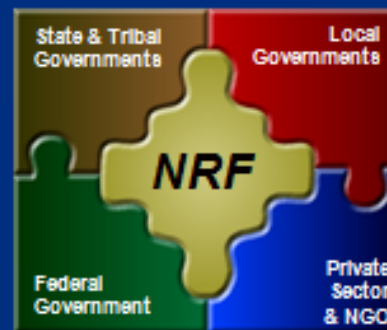
- **States** are sovereign entities, and the Governor has responsibility for public safety and welfare; States are the main players in coordinating resources and capabilities and obtaining support from other States and the Federal government
 - Governor
 - Homeland Security Advisor
 - Director State Emergency Management Agency
 - State Coordinating Officer
- **Local officials** have primary responsibility for community preparedness and response
 - Elected/Appointed Officials (Mayor)
 - Emergency Manager
 - Public Safety Officials
- **Individuals and Households** are key starting points for emergency preparedness and support community efforts



Private Sector & NGOs and the Framework

Effective, unified national response requires layered, mutually supporting capabilities

- **The Private Sector** supports community response, organizes business to ensure resiliency, and protects and restores critical infrastructure and commercial activity
- **NGOs** perform vital service missions
 - Assist individuals who have special needs
 - Coordinate volunteers
 - Interface with government response officials at all levels



Emergency Support Functions / Annexes

- ESF #1 - Transportation
- ESF #2 - Communications
- ESF #3 - Public Works and Engineering
- ESF #4 - Firefighting
- ESF #5 - Emergency Management
- ESF #6 - Mass Care, Emergency Assistance, Housing and Human Services
- ESF #7 - Logistics Management and Resource Support
- ESF #8 - Public Health and Medical Services
- ESF #9 - Search and Rescue
- ESF #10 - Oil and Hazardous Materials Response
- ESF #11 - Agriculture and Natural Resources
- ESF #12 - Energy
- ESF #13 - Public Safety and Security
- ESF #14 - Long-Term Community Recovery
- ESF #15 - External Affairs

Emergency Support Function 3, Public Works and Engineering, is responsible for emergency debris clean up, primarily within public right-of-ways. Emergency watershed improvement and hazard reduction outside of public rights-of-ways falls under ESF# 11 Agriculture and Natural Resources. Longer term debris removal, such as reforestation and timber stand improvement on forested landscapes, falls under ESF# 14 Long Term Recovery.

STAKEHOLDERS AND ROLES

Damaged Timber and Forest Debris

The variety of the stakeholders who must answer the challenges posed by the large amounts of damaged timber and forest debris caused by natural disasters is shown in Figure 1. Most central is the owner of forest land that is directly impacted by a natural disaster. In general, the owner is a small businessman, with limited resources. If affected by a natural disaster, the owner must rely on emergency grants or loans. While insurance is available to protect against damage from storms, few landowners purchase such insurance because of its cost. The owner's interests are best served by removing debris and damaged timber quickly to recover as much value as possible and so that forest restoration can begin. Ideally, removal of damaged timber would be done slowly enough to avoid depressed prices because of a glut of wood, but rapidly enough so that the forest owner has an adequate revenue stream for survival. An alternative is to develop local wet storage yards to prevent deterioration of the large volume of material.

Non-governmental organizations (NGOs), such as state or county forest associations, provide support to the forest owner by helping the owner to anticipate disasters, plan for their effects, and then obtain the resources needed to remove debris and damaged timber and restore operations. Thus, their interests lie in a robust forest owner community.

The loggers and haulers who must remove debris and damaged timber from the forest owner's property have similar interests to the forest owner – remove the damaged timber and forest debris as rapidly as possible. After a natural disaster, there may not be enough of timber operators in the affected area. Thus, the forest owner often must rely on ready availability of loggers and haulers from outside of the affected area. However, loggers and haulers (e.g., from Alabama) were turned away in parts of Mississippi by law enforcement personnel who were limiting road access to emergency responders only immediately after Hurricane Katrina.⁷ It must be noted, however, that out-of-state contractors are often unfamiliar with local harvesting practices and conditions which can pose safety and productivity challenges.

Local governments/communities near forests are likely to have conflicting needs after a disaster. On the one hand, rural communities are often economically dependent on the forest enterprise (forests + forest products industry), so the community wants and needs the forest owner back in business as soon as possible. However, the community is likely to have other needs after a

⁷ It should be noted that local logging and hauling firms may face competition for their labor supply from other disaster recovery activities that pay higher wages. In the past, this has meant that many private forest owners were unable to hire a logger to salvage their timber, and as a result suffered significant losses.

natural disaster as well (e.g., delivery of emergency supplies) that may be of more immediacy. The local government may also control many of the roads and bridges that are crucial for both debris and timber removal and for bringing in relief supplies. This forces the community into an uncomfortable tug-of-war between actions needed for short-term emergency response (e.g., limiting what was viewed as non-essential traffic) and those needed for long-term recovery (getting qualified loggers and haulers in to affected areas as rapidly as possible).

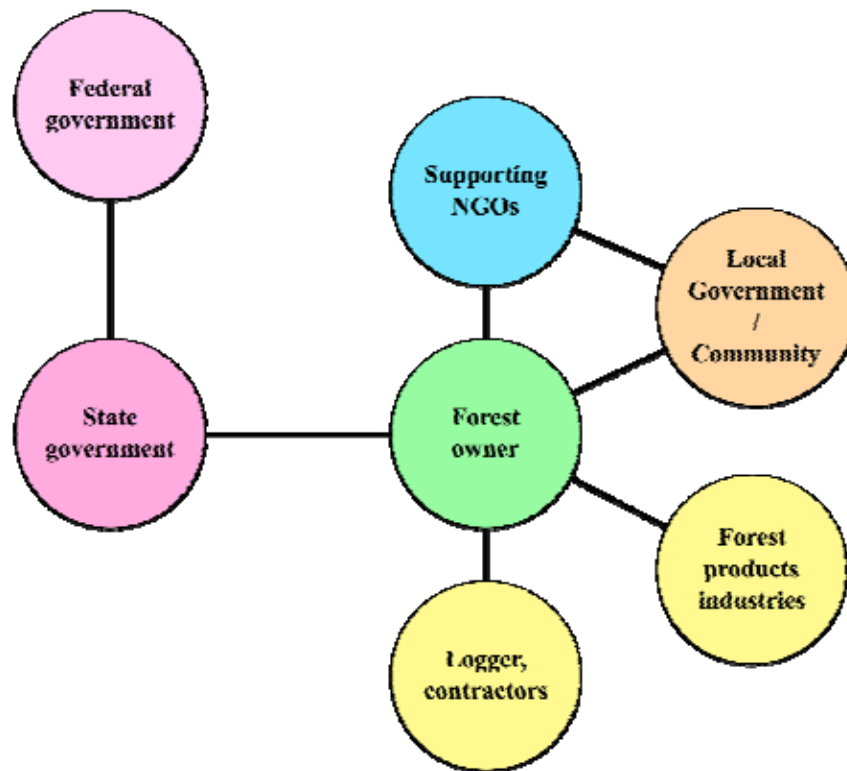


Figure 1. Damaged timber and forest debris stakeholders.

The forest owner’s customers – the forest product industries – also have conflicting needs. They need usable timber to maintain their own viability. A glut of timber on the market is a one-time boost to their bottom lines because of the reduced price of the raw material (although damaged material often results in reduced final product quality and value). However, this sort of glut is usually followed by a longer period (up to five years) of reduced availability of quality timber, leading to higher prices. Thus, the forest products industries also have value for wet interim storage as a means to ensure wood availability and price stability.

State government is perhaps in the most difficult position of any of the stakeholders because of the breadth of its responsibilities. The governor of the state is responsible for asking the federal government to declare a disaster and to provide disaster relief assistance. By law (the Stafford Act), the federal government cannot provide assistance until the governor’s request is received and accepted. The state forestry agency must act as an advocate for the forest owner and his/her recovery. Often, this agency will act as a primary source of information for the forest owner and

may act as the conduit for funds from the USDA's Emergency Management Program or the Emergency Watershed Protection Program. The state's economic development agency has a vested interest in ensuring that the important sector of the economy that depends on the forests remains viable – that in-state customers for wood have adequate supplies, and that their suppliers, the forest owners, manage their forests in a sustainable manner. The state office of transportation must balance the need to remove timber quickly against factors such as road weight limits.⁸ The state law enforcement agency must balance the need for access to forests by loggers and haulers against the need to limit access to public roads during the response to a natural disaster. The state emergency management agency coordinates state responses to a natural disaster, but also acts as the conduit for federal emergency support to communities. The state's agency for environmental quality regulates wet deck storage facilities for timber, vegetative and structural debris land disposal facilities, staging sites, chip sites, and the burning of woody debris, while the state's agency responsible for its natural resources may be more concerned with the sustainability of the forest rather than with response to the disaster. While all of these disparate functions can be and usually are harmonized, generally it is only after some initial dissonance after a disaster occurs.

The federal government also plays many roles. Emergency response actions applicable to damaged timber and forest debris are carried out under Emergency Support Function (ESF) #14 (Long-Term Community Recovery). Under ESF #14, the Federal Emergency Management Agency coordinates the response of many agencies – most notably the USDA's Forest Service, Farm Service Agency and Natural Resources Conservation Service, and the Small Business Administration. The Forest Service manages forests within the National Forest System, and thus is a "forest owner." The Forest Service also carries out research intended to improve the economic, recreational, and environmental sustainability of the forests and thus acts as an information resource to forest owners. Other federal land management agencies (Department of Interior's Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service and National Park Service) manage public and tribal forest lands with similar forest ownership issues. The Small Business Administration is authorized to provide loan assistance to address the adverse economic impacts of the natural disaster. Its ability to carry this out is limited by the availability of funds.

The USDA is responsible for providing emergency loans and grants to the forest owner depending upon the availability of funds. After Hurricane Katrina, \$504 M was made available in grants to the forest communities in Mississippi through USDA's Emergency Conservation Program. These grants were on a 75% cost share basis, not to exceed \$150 per acre. By the end of 2007, only \$70 M had actually been spent. This is primarily because

- The grant program's eligibility requirements are onerous. All of the following conditions must be met.
 - If untreated, the land will be impaired or endangered.
 - The land's productivity must be materially affected.
 - The damage is unusual, and not likely to recur frequently in the same area.

⁸ A temporary increase in weight limits to facilitate recovery of valuable timber must be balanced against the potential for increased wear of roads and bridges.

- The damage is so costly to repair that federal assistance is required to return the land to productive use.
- The entire forest must have sustained damage to at least 35% of the forest.
- Eligibility decisions are subjective. Eligibility is determined by the county committees of the USDA's Farm Service Agency.
- Eligibility decisions require on-site inspections. This puts the applicant in a "Catch-22" position – part of the emergency grant is to be used to clear debris and damaged timber to provide access, but access is also needed for on-site inspection of damage in order to get a grant. The lack of easy access and, in some cases, a limited number of inspectors, means that determination of eligibility is almost certain to take a long time.

Woody residential debris

As can be seen in Figure 2, the set of stakeholders for residential debris is similar to those for damaged timber and forest debris. The relationships among these stakeholders are decidedly different, primarily because of the Stafford Act, that controls residential debris management. The Stafford Act authorizes the Federal Emergency Management Agency (FEMA) to provide funds to local jurisdictions (counties and municipalities) on a cost-shared basis, with FEMA providing from 75 to 100% of the cost of debris management (100% for Hurricane Katrina). In general, the debris must be on either public land or thoroughfares, or pose a danger to transportation. Local jurisdictions have the option of using the Corps of Engineers for debris collection and hauling, or subcontracting the work themselves (It is important to note that the Corps of Engineers has imposed additional requirements on its contractors to improve the accuracy of estimates of the amount of debris, and of pickup location.). The debris haulers are not authorized to remove debris from private land, i.e., the homeowner is responsible for moving debris from the homeowner's property to a public thoroughfare. Unlike the forest owner, the homeowner is not eligible for direct federal assistance for debris management.

There is one other important difference between residential debris and damaged timber and forest debris – forest debris and damaged timber is entirely woody biomass while residential debris is a mixture of woody biomass, construction materials, foodstuffs, and personal possessions.⁹ The makeup of this mixture changes over time. Immediately after wind-related disasters, the residential debris will be predominantly composed of "green waste" – damaged trees and vegetation. Once homeowners return to their homes, the other materials become a much greater proportion of the waste stream.

⁹ EPA's PNDD, referred to previously, is a helpful source of information on collection and segregation of residential debris.

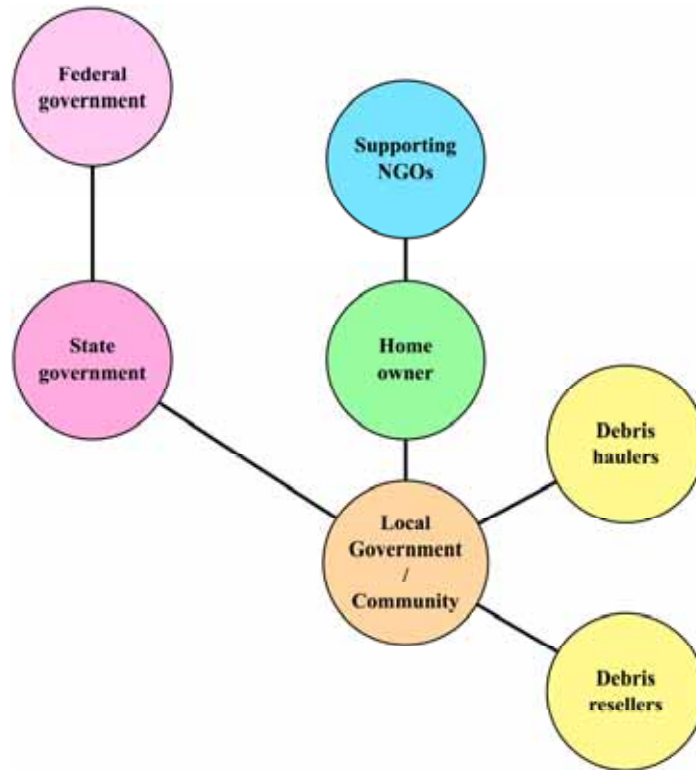


Figure 2. Residential debris stakeholders.

However, because of the Stafford Act, homeowners do not have a customer for their debris, i.e., there is no incentive for the homeowner to separate and segregate debris.¹⁰ Any profits from reuse or resale of debris go to the local jurisdiction. This acts as a significant deterrent to reuse of debris and utilization of the woody biomass in residential debris, particularly in communities that do not have active recycling programs. The space required to store reusable debris, and the uncertainty of demand, are also significant impediments to debris reuse.

RECOMMENDED ACTIONS

Each of the stakeholders can take action(s) that can significantly improve wood debris management (downed timber, forest debris and residential woody debris. Most of the recommended actions should be taken prior to the disaster to reduce its overall impact. They are predicated on the experience the forest community has gained since over the last two decades (esp. Hurricanes Hugo and Katrina). They reflect practices that have proven successful either in the forest enterprise, or for other enterprises in similar situations.

The recommended actions also reflect that the perspective of the stakeholders vary with their distance from the problem (as indicated in Figures 1 and 2). The forest owner or homeowner, the local community, and debris management personnel (loggers, haulers) have the primary

¹⁰ As discussed in the PNDD, Palm Beach County, FL, developed a public information campaign that was successful in increasing segregation of residential woody debris and mixed debris into different piles for collection to assist in recovery efforts.

responsibility for debris management. Ideally, prior to the disaster each of these stakeholders will develop debris management plans detailing how each will respond. The federal and state governments are responsible for helping these stakeholders to pre-plan, for helping them to integrate their responses, for providing assistance when the scale of the response exceeds local capabilities, and for assisting in recovery. The actions recommended for each reflect these different perspectives.

It should be noted that state government plays the keystone role as both planner and regulator. The state's planning functions are primarily driven by economics and environmental quality; its regulatory functions are primarily statutory, but are vested in a large number of entities within state government. Thus, plans at the state level also need to address how state government will ensure that these functions do not conflict.

In this section, information needed to guide future actions is also highlighted. In general, research programs will be needed to provide the necessary information.

Department of Homeland Security / Federal Emergency Management Agency (FEMA)

Develop a plan to implement Emergency Support Function (ESF) 14, Long-Term Recovery, that focuses on the special problems associated with damaged timber and woody debris (both forest and residential).

Under the National Response Framework, the Department of Homeland Security is responsible for fostering long-term recovery under ESF #14. Little has been done in terms of implementation beyond identifying the roles and responsibilities of various agencies. As noted earlier, if forest debris and damaged timber is not managed properly, the potential consequences, from wildfires to environmental and ecological degradation, are significant. The resources necessary to respond to such a situation exceed those of most owners – and even individual federal agencies - of forest land. Thus, federal assistance is justified.

The implementation plan should identify the following:

- the mechanism(s) to be used to provide assistance to the forest owner;
- the funding agent;
- the criteria for funding;
- allowable uses of the funding (at a minimum, these should include logging and hauling);
- communication of the program to the forest community.

Consideration should also be given to including a representative of the Woody BUG as part of ESF# 3, Public Works and Engineering, implementation.

Aggressively incentivize communities to segregate woody residential debris after a natural disaster so that woody residential debris can be beneficially used.

The Stafford Act, as amended, is the primary funding vehicle that assists communities in debris disposal. Currently, there is no incentive for communities to segregate woody biomass from solid wastes. Up until the end of 2008, the Act had a little-known provision that increased the

proportion of debris management costs paid by the federal government based on an existing (pre-disaster) waste segregation / recycling program. Its reinstatement could encourage communities to find beneficial uses of woody residential debris from a natural disaster, and greatly reduce the solid waste impacts. However, reinstatement of the provision would do little good without a campaign to communicate the benefits of the program to potentially affected communities. Thus, action is needed to reinstate this provision and to publicize it to communities.

Department of Agriculture (USDA) (Forest Service, Farm Service Agency, Natural Resources Conservation Service)

All USDA

Streamline procedures for applying for grants to manage damaged timber and forest debris after a disaster.

Forest Service (FS)

Provide technical assistance in woody biomass utilization to facilitate implementation of the USDA FS woody biomass utilization strategic plan.

Farm Service Agency (FSA)

Provide financial and technical assistance through the Emergency Conservation Program (ECP) to farmers and ranchers to rehabilitate farmland damaged by natural disasters. Funding availability for ECP is subject to appropriations. See also:

<http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=ecp>

Provide financial assistance through the Emergency Forest Restoration Program (EFRP) to owners of non-industrial private forest land to carry out emergency measures to restore their land that was damaged by a natural disaster. EFRP is a new program authorized by the Food, Conservation and Energy Act of 2008, which amended the existing ECP. Funding availability for EFRP is subject to appropriations. See also:

http://www.fsa.usda.gov/Internet/FSA_File/2008fbemergencyforestsummary.pdf

Natural Resources Conservation Service (NRCS)

Provide financial assistance through the Emergency Watershed Protection Program (EWP) to private and public landowners (all projects must be sponsored by a political subdivision of the State, such as a city, county, general improvement district, or conservation district) to relieve imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. EWP work may include removing debris from stream channels, road culverts, and bridges. A case by case investigation of the needed work is made by NRCS. See also: <http://www.nrcs.usda.gov/programs/ewp/>

As noted above, two years after Katrina, less than 20% of the funds available for management of damaged timber and forest debris through USDA's Emergency Conservation Program had

actually been granted. Although no published figures are available, past experience suggests that this delay resulted in a loss of commercial value for the damaged timber, and significantly increased the danger of wildfires. The application process needs to be streamlined so that application preparation, submittal, and evaluation can be accomplished more rapidly. Since rural areas are usually among the last to have electricity restored, consideration must be given to developing an alternative application process, for example a very efficient paper system. Further, assessments of damage must be accomplished more quickly. As discussed in the section on research and development needs, research is needed to develop methods to make the damage assessment process more automatic.

The USDA Forest Service has developed a national woody biomass utilization strategic plan. Woody biomass utilization options range from small-scale enterprises to larger, commercial-scale operations such as electric power plants, and cellulosic ethanol production facilities. The Forest Service is working with federal state and local agencies; tribes; and private organizations and can provide technical assistance in the sustainable use of woody biomass through the assurance of supply, fostering partnerships, developing science and delivering technology, and expanding markets. It can assist to accomplish this by the following tasks:

Implement the incident command system along with USDA Forest Service, Region 8 (Southern).

Provide support and technical assistance from the woody biomass utilization strategic plan.

The Forest Service will use all authorities to facilitate planning treatment, and implementation to provide a supply of woody biomass from public and private lands.

Reduce contracting barriers, revise merchantability policies, and improve contracting practices and templates within existing authorities.

Assist partners in analyzing their opportunities for sustainable woody biomass utilization for energy or wood products and include these opportunities in an analysis of the local wood supply stream.

Identifying preferences for woody biomass products in Federal procurement guideline.s

Providing technology transfer information regarding woody biomass utilization.

Providing technical assistance to entrepreneurs and businesses looking to develop new and expand use of woody biomass products.

Explore the concept of local cooperatives to facilitate a supply and forest owner investment in infrastructure and facilities.

Department of Energy

Continue the development and deployment of new technologies for the economic conversion of wood waste to biofuels, biopower, and bioproducts.

The Office of the Biomass Program (OBP) has ongoing research and development and deployment of new technologies and processes that can reduce the cost and increase the efficiency of producing biofuels, products, and power from wood waste such as those that result from wind events. Efforts are also underway to commercialize integrated biorefineries that employ conversion technologies to produce a variety of products, with the main focus on producing biofuels. Such new technologies can make it more cost effective to utilize wood wastes from natural disasters as well as other feedstocks in order to have a viable, established market in areas of high risks.

Provide technical assistance and financing mechanisms to assist federal agencies in deploying heating, cooling and biopower systems using woody biomass debris

Disaster debris can provide feedstock for wood-fired systems in federal facilities. The Federal Energy Management Program (FEMP) assists federal agencies in facility and feedstock assessments and in the financing mechanisms for deployment; while not of immediate assistance during the initial stages of the disaster clean-up, this can be beneficial in pre-disaster planning or in long-term recovery. The FEMP team can also play an important role in pre-disaster planning by providing advice on feedstock centers for temporary storage of the large quantities of uncontaminated woody debris.

Environmental Protection Agency (EPA)

Provide technical assistance to delegated states as they develop draft general permits for wet deck storage facilities (and/or draft model permits for individual sites), and through existing MOAs/MOUs, be prepared to expeditiously review and concur with such permits post-incident.

Wet storage of damaged timber is of crucial importance to the forest owner, the forest owner's customers, and their communities. If proposed locations for wet deck facilities can be identified by industry or local governments prior to a natural disaster, then EPA-delegated state authorities can review, assess and perhaps even pre-approve such sites. EPA can play an important role in this pre-disaster planning and preparedness by providing input, as requested by the states, and by assisting delegated states with a preliminary review of state-drafted general permits and/or draft model permits that may be used for individual wet deck sites. Post-incident, EPA would then be familiar with the draft state permits and be able to quickly review and concur with those permits.¹¹

State forestry agencies

¹¹ After Hurricane Katrina, the Mississippi Department of Environmental Quality offered an expedited permitting process for wet storage sites within three weeks after the storm. Sites that had previously been permitted but had been closed were permitted within 48 hours.

Serve as the lead agency for assessing damaged timber and wood debris management on state and private lands and take the lead to coordinate applications for financial and technical assistance from federal agencies.

Develop and maintain a list of viable facilities for wet storage of damaged timber.

In the event of a natural disaster, wet storage of damaged timber is of crucial importance to both the forest owner and his customers. It allows the forest owner to be able to recover at least some of the value of his timber asset, while providing his customers with a more stable supply. State forestry agencies should develop a list of viable wet storage sites and provide it to all stakeholders. This list will also provide the basis for state transportation authorities to identify hauling routes and load limits, and for state environmental authorities to develop emergency use permits for these sites.

Develop and maintain a list of qualified in-state damaged timber and forest debris handlers (e.g., loggers, haulers).

In the event of a disaster, loggers and haulers will be needed across the affected areas. Unfortunately, if not bonded or otherwise qualified, they may do more harm than good. If a disaster directly impacts the state, then this list will be a useful resource for forest owners in the state. If the disaster occurs elsewhere, then other states can use the list to identify needed resources, and to avoid flim-flam artists.

Develop and maintain Emergency Management Assistance Compacts (EMACs) with neighboring states for assistance in dealing with damaged timber and forest debris issues.

EMACs have proven to be invaluable tools to take action when the federal government cannot take action (e.g., because of legal constraints) or when federal assistance cannot begin quickly enough. Their nature will vary depending on the states involved (regional EMACs are also possible). Providing access to lists of qualified debris handlers could be one aspect covered in an EMAC. Other examples could include use of wet deck storage facilities in a neighboring state, or use of trained personnel from one state to assess timber damage in another.

Provide the forest community with a database that will provide state-specific guidance and information for preparation for, response to, and recovery from a natural disaster.

In general, such a database will also reflect lessons learned from previous disasters. The Woody BUG is developing a model database that is expected to initially be applicable to Mississippi and North Carolina. Its content will eventually expand to include

- Independent wet log storage operators in state;
- Emergency wet log storage sites in state;
- Loggers, haulers, and the appropriate associations, in state;
- Wood buyers and dealers, in state;

- Foresters to contact for assistance during an emergency, in state;
- Equipment suppliers, in state;
- Forest owners, in state;
- Silvicultural services, in state;
- Debris removal services, in state;
- Salvage Coordination Center, in state (if applicable);
- Other state and local emergency contacts;
- State-specific models or templates for pre-disaster planning (e.g., cutting permits, temporary authorizations);
- Lessons learned;
- Information on planning and preparing for disaster debris management (e.g., FEMA's **Public Assistance: Debris Management Guide**, EPA's **Planning for Natural Disaster Debris**, and EPA's Region 4 **Disaster Debris Resource Guide**);

State departments of transportation

Prior to a natural disaster, determine permissible routes and allowable load limits for damaged timber and forest debris removal and storage.

State departments of transportation have established load limits for state roads that apply to normal traffic flows. However, under emergency conditions, these limits may be increased on at least some roads in order to speed the removal of debris and the inflow of emergency supplies. Both Mississippi and Louisiana increased load limits after Katrina for this reason. By identifying which routes will be permissible for travel, and identifying emergency load limits for these routes, the state department of transportation can have a major impact on pre-positioning of assets for both emergency response and debris removal.

State environmental agencies/forestry agencies

Prior to a natural disaster, develop draft general permits for wet deck storage sites (and/or draft model permits for individual sites) and provide to EPA for review and concurrence. Work with industry and local governments to review and/or pre-approve their anticipated proposed sites to be used for emergency storage of damaged timber and other woody biomass.

As noted, transportation is one of the limiting factors in the successful utilization of damaged timber and woody biomass. By siting staging areas and storage sites prior to a natural disaster at locations that are likely to have minimal impact on emergency responders, the logging and hauling of this material will be able to proceed more rapidly.

Proposed locations for staging areas and wet deck facilities need to be identified by industry or local governments prior to a natural disaster. States delegated by EPA to implement permitting programs can review, assess and perhaps even pre-approve such sites. These state programs can also prepare draft general permits for wet deck facilities, draft language for model site-specific permits and request EPA's input while developing them. Then, when the need arises post-disaster, the states can request and expect EPA's expedited review and concurrence on the

general permit to be used or on any site-specific permit that follows the previously-reviewed model. Other states can review the Mississippi Department of Environmental Quality (MDEQ) model developed after Hurricane Katrina when a regulation providing expedited permitting of previously permitted but closed wet storage sites was put in place. MDEQ's draft general permit for new wet deck facilities is also another available resource. Because there will be knotty problems to address (such as capacity, ownership and operation), it is important that the permitting process be as far along as possible prior to the actual need for such facilities.

Universities

Develop and maintain a library of documentation on disaster preparedness, timber recovery, and forest restoration.

In general, forest owners are unlikely to have all of the information they need to both prepare for and recover from disasters. Thus, they need a repository of information about topics such as hurricane preparation, the salvage of damaged timber, forest restoration, chain saw safety, casualty loss reporting, timber marketing, and management of damaged stands. The university systems – especially the extension offices – are well-suited to collect and codify this information and to provide it to those who need it.

After a storm, conduct workshops on timber recovery and forest restoration.

After a disaster, many forest owners may not have access to the latest and best information on timber recovery and forest restoration and certainly not to the internet. After Katrina, workshops proved to be a very effective means of reaching the affected owners and providing them with information about the salvage of damaged timber, forest restoration, chain saw safety, casualty loss reporting, timber marketing, and management of damaged stands.

Provide technical expertise on damage assessment and inventory.

As noted earlier, assessment of timber damage after a disaster is a slow and somewhat subjective process, carried out at the local level. Universities can play a valuable role in improving both the speed and accuracy of the damage assessment by acting as consultants to those carrying out local assessments and by disseminating “best practices” to them.

Conduct research to improve future disaster preparedness, timber recovery, and forest restoration.

In many ways, the development of a systematic body of knowledge around disasters, their impacts on the forests, and recovery is still in its infancy. Much of the information available is anecdotal, with little care being given to whether local conditions actually match the anecdote. Universities can perform a crucial service for the forest enterprise if they will systematize existing knowledge and extend it to improve response and speed recovery. Improving the approach used for damage assessment is an area where enhancements could have a major impact on the forests and their owners.

State law enforcement agencies/forestry agencies/emergency management agencies

Prior to a natural disaster, develop and maintain a credentialing system for loggers and haulers.

As noted earlier, there is a natural tension between the need to bring in loggers and haulers to deal with damaged timber and bringing in emergency supplies. Several municipal and county governments have resolved similar situations by establishing credentialing programs. Ideally, the state law enforcement agency will set up a system that operates as follows:

- Prior to a natural disaster, the state forestry agency issues a call to each of the loggers and haulers on its list, and to those in neighboring states, inviting them to request credentials.
- The loggers and haulers respond with information identifying individual(s) and vehicle(s) that request authorization to enter disaster-affected areas.
- The state forestry agency supplies this information to the state law enforcement agency which then issues credentials that will allow access to disaster-affected areas. The state law enforcement agency may choose to limit the number of credentials granted to a single company, or may place restrictions on the routes that can be used.
- The credentials would have a finite lifetime (1-3 years). The state forest agency would send out reminders to apply for new credentials prior to termination.

Communities / local governments

Develop and implement a debris management plan that includes woody debris and damaged timber.

Managing the debris after a natural disaster is a major drain on a communities resources. Woody debris often constitutes the largest individual component of the debris a community must manage, especially immediately after a disaster. Some communities – particularly those in rural areas – may also have to deal with large amounts of forest debris. Without careful pre-planning, the volume of debris generated from a disaster can overwhelm the capacity of a community’s solid waste facilities.¹² Thus, communities need to develop and implement debris management plans so that alternative methods of debris management can be ready when disaster strikes.

Since woody debris makes up so much of the debris generated by a natural disaster, community planners, in consultation with urban foresters and municipal arborists, should consider means to reduce the amount that must be sent to disposal facilities. Most alternatives require segregation of woody biomass from other debris for potential beneficial reuse. Currently, the Corps of Engineers requires its contracted debris haulers to have the capability to keep any segregated materials separate. However, unless the infrastructure necessary to support disposition (including reuse) of woody debris is developed by local communities, beneficial use of woody residential debris will not be possible – the time and cost to separate woody debris from other residential debris would be prohibitive unless there was a large enough return to justify

¹² As an example, the volume of debris generated in the Charlotte, NC, area by Hurricane Hugo was equivalent to the solid waste generated in Charlotte in the previous 15 years.

investment.¹³ Thus, implementation of a debris management plan that reduces debris volume by using woody biomass (rather than simply sending it to a landfill) requires putting in place the infrastructure needed to segregate and process the woody debris. The ability to keep segregated materials separate from others is also important for contaminated materials. If, for example, woody biomass is not kept separate from hazardous materials, then the presumption is that the entire load of material is contaminated, placing an undue and unnecessary burden on the limited space in hazardous waste landfills.

When a local government develops the physical infrastructure for segregation of woody debris, it should also develop a “social” infrastructure, including the public and potential customers for woody debris. The most important parts of the necessary “infrastructure” are the members of the community. As noted above, they have little direct stake in segregating debris. They will not do it unless community leaders communicate both the importance of doing so and how it should be done. The Corps suggests an information campaign centered around “CHEAT” – as in “Don’t CHEAT the environment!” and segregation of debris into piles of:

Construction and demolition debris;
Hazardous household waste;
Electronic waste;
Appliances;
Trees and woody debris.

The local government should also develop plans for reuse, which should identify potential uses and customers.

Require that the methods for determining the amount of debris collected and the collection location specified by the Corps of Engineers in its debris collection and hauling contracts be used by locally-contracted debris haulers.

The amount of debris collected at a given location is an important component in calculating how much Stafford Act funding a community will receive after a disaster.¹⁴ The manual data recording methods used to document the disposition of debris from Hurricane Katrina frequently resulted in inaccurate amounts and locations. The Corps of Engineers has developed a system of more accurate documentation (GPS for locations, photographs of loads) that has been incorporated into their contracts with debris haulers. This new system, the Automated Debris Management System (ADMS), was successfully used during Hurricane Ike in Louisiana and greatly improved the accuracy of records.

The Stafford Act allows local governments (counties, municipalities) to hire debris haulers on their own, but does not require that the contracts for these locally-contracted debris haulers

¹³ One example of this is a construction and demolition landfill in Franklin County, GA, operated by Earth Resources, Inc. The facility is permitted to separate, segregate, and recycle most of the debris received. Woody biomass is being converted to a fuel material that will ultimately be used in a power generation facility operated on an adjacent plot of land.

¹⁴ The Forest Service disseminates an excellent software tool – i-Tree STORM – for estimation of the quantity of urban woody debris after a storm.

contain Corps of Engineers' requirements. However, it is in the best long-term interests of these local governments to impose these requirements: after Hurricane Katrina, FEMA auditors often could not verify either the amount of debris removed or the location from which it was removed. This resulted in legal disputes over reimbursement of the federal government for Stafford Act expenses that could not be verified. The scope of work for local governments to include ADMS in their debris contracts is located at www.englishlink.usace.army.mil under debris management.

Forest owners

Develop and implement a continuity of operations plan that includes debris management, storage and resale of damaged timber, and forest restoration.

The rule of thumb from both Hurricanes Andrew and Katrina is that without a continuity of operations plan, about one-third of affected small businesses fail after natural disasters. This mirrors the experience of forest owners in south Mississippi after Katrina: one third were unable to salvage more than 10% of their downed or damaged timber. Beyond the business viability concerns, failure of the forest owner's business entails a significant risk for the entire region from forest fires, pest contagions, and environmental degradation. Thus, prior to a natural disaster, the forest owner (whether public or private) should develop a plan that identifies how the forest owner will respond to the disaster, how the debris and damaged timber will be extracted from the property, who will carry out important activities (e.g., logging, hauling), where damaged timber will be stored, who will be the customer(s) for the material, and how the forest will be restored (The *Forest Landowner Natural Disaster Desk Guide and Tool Kit* is an excellent place for forest owners to start. This concise guide – developed by the Mississippi Coastal Plains RC&D Council – provides clear assistance to the forest owner on how to adapt his property and operations to facilitate access, assessment, and salvage after a disaster.).

Clearly, implementation of such a plan will involve resources well beyond those of the owner. Implementation of the plan requires that the owner ensure that all of the resources outside the owner's control will be available to carry out the planned activities. This can be done by the owner alone (pre-contracting for loggers and haulers), or in conjunction with other owners (e.g., an arrangement with out-of-state loggers to come in after a hurricane can be made through a state or district forest association). The forest owner should ensure that he is familiar with the external resources available, and has carried out all preparation necessary to claim those resources as soon as possible after the disaster.

As a result of developing the plan, the owner will identify issues that might provide major stumbling blocks when encountered after a disaster occurs, e.g.,

- how to get out-of-state loggers or haulers into an affected region;
- how much damaged timber will require storage;
- how long damaged timber will have to be stored;
- how to access financial resources needed to manage debris;
- how to restore the forest to sustainable production.

Forest products industries

Develop and implement a business continuity plan that considers the impacts of potentially high volumes of a wide-range of raw materials over a short period, recovering and using damaged trees, providing storage, and working with other organizations.

Forest products industries range from small businesses to global operations. The wood processor must be in a position to convert it into products and/or to provide long-term storage. Depending on the timing of the disturbance event, there may be a short window of recovery which causes large volumes of timber in a short period of time. This will have many ramifications from straining timber purchasing/contracting ability, having to access additional logging capacity, lines at the scales and unloading, to payment procedures. There may be a need to expand storage, or at least manage storage issues.

The industries will have to manage the damaged timber to maximize recovery and ensuring that specifications are met. The timber will have high incidences of splits, shatter, and other damages that can degrade and reduce value. If the wood processor does not ensure that the processing infrastructure can tolerate the variability of damaged timber, then the wood processor may not have sufficient timber to remain viable (in a business sense).

The industry needs to have a plan in place as to how to internally prepare and respond to such events as well as to coordinate with forest owners, contractors and other organizations.

Loggers and contractors

State and regional logging, arboriculture and municipal/utility forester associations should develop a plan to train and prepare loggers to respond to both timber recovery from forestlands and woody biomass debris from roads and streets, residential areas, and utility right-of-ways.

Some loggers have already had experience in dealing with damaged timber. Many loggers also have experience harvesting/handling biomass. Successful timber recovery and woody biomass utilization is dependent on having properly prepared and trained loggers, arboriculture and municipal/utility foresters to recover damaged timber and woody biomass on forestlands. These same loggers, arboriculture and municipal/utility foresters can, if contracted to do so, provide assistance in clearing downed trees from highways, roads, and streets and other critical infrastructure, including utility right-of-ways. Through coordination with FEMA and the Corps of Engineers, they can also help recover and better utilize such material instead of placing in landfills. The key to recovering woody biomass from wind events is having loggers, arboriculture and municipal/utility foresters trained and prepared and then able to execute a response plan successfully at various scales. Existing state and regional logger training and education programs can provide the education and training necessary to those loggers and contractors who wish to be involved in debris removal activities.

There are many legal and logistics concerns as loggers provide disaster response, especially if engaged in the removal woody biomass from highways, roads, and residential areas. The best way to ensure that loggers, arboriculture and municipal/utility foresters can properly respond is

through preplanning and by coordinating with other entities in advance. Preplanning should include the following:

- Training in managing and conducting safe recovery operations with specific handling of damaged timber and woody biomass in residential areas and roadways
- Having operations and trucking inventories and contacts for potential contractors at local and regional levels
- Develop a process for coordination and procedure for activation
- Understanding legal, contractual, and regulatory issues at various government levels
- Organizing access to fuel, lodging, meals, parts, repair, etc.

Each state already has in place a professional requirement for loggers to attend training and continue updating their training status. Each state maintains a trained logger's data base specific to training and meeting SFI requirements. New training programs are needed for contracting and conducting operations in storm-damaged areas and can become a part of loggers, arboriculture and municipal/utility foresters education programs.

Some guidelines on storing storm debris for extended use may also have some potential. Training is an opportunity to fine tune debris recovery before events. Loggers that need to keep up with certification requirements are looking for opportunities to meet their training requirements. Some training could be done through State forestry, Extension, Logging Associations, Forestry Associations or County EMAs. Loggers can also keep current through web-based education.

Contractors will need to work very closely with the forest owners, local governments, and the forest industry to ensure all concerns are addressed and the debris removal operations are performed in as expeditious and efficient manner as possible to recover the maximum amount of woody debris in order to capture as much value and benefit as possible from the operations. There are several avenues for coordination. For example, the Forest Resource Association has a safety standards and education foundation. Almost all states have a logger training program through universities and other entities where disaster response planning and safety could be added. There are also State and regional logging associations that could help develop plans, conduct safety courses, and coordinate responses. Loggers can also work with County EMA directors.

INFORMATION AND RESEARCH NEEDS

The answers to many of the challenges in managing damaged timber and forest and residential woody debris have already been discovered. Improvement in these activities requires better dissemination of what is known, not the development of new knowledge (As noted above, the Woody BUG is working with Mississippi State University and others to implement a website to further information transfer.). However, research is needed so that the forest community can better recover from disasters. Some of the more important areas are listed below.

Develop a more automated method of providing Stafford Act funds to communities to collect and dispose of residential debris that minimizes auditing and improves accountability.

As seen in the aftermath of Katrina, FEMA can rather quickly get Stafford Act funds to communities for debris management. However, several counties and other jurisdictions in the affected areas now may have to pay back some of that funding due to audit findings. Almost all of these findings were due to faulty records – for example, incomplete or incorrect addresses, inability of the auditor to verify the amount of debris removed, or illegible load tickets.

Modern remote sensing has the potential to provide quantitative assessments of the amount of debris needing disposal. It is recommended that the use of this and other applicable technologies be explored that can provide an improved method of disbursing Stafford Act funds. The ultimate goal is to provide funds to local communities almost immediately after a disaster, with limited need for after-the-fact auditing, in a fair and equitable manner for both local communities and the federal government.

Develop a more automated method of assessing the damage to forests so that emergency funds can flow more rapidly to the forest owner for cleanup.

The damage assessment process is a significant impediment to the release of emergency funds from USDA to the forest owner after a disaster. Damage is generally assessed by local experts who determine whether the land meets the program's requirements, and the amount, quality and usability of damaged timber. This is a time-consuming process, often made more difficult by the limited access to affected areas. Excellent work has been done in recent years toward making remote sensing (LIDAR, visual imagery) into a usable tool to assess overall damage to a forest, and to determine the amount of timber damaged.

Recently, Cooke and others at Mississippi State University have shown that it is possible to develop accurate quantitative estimates of forest damage based on forest conditions and storm data (manuscript in preparation). They compared Mississippi Forestry Association assessments of forest damage made by experienced foresters against a model based on remote sensing data, forest data such as tree and soil type, and information about storm winds and surges, and found that the model's predictions compared well to the human assessments. This kind of approach could be expanded to include usability determinations, but needs to take into consideration the types of soils and trees in other parts of the country.

Develop alternative uses for woody biomass, and move to support market development.

Unfortunately, there are not enough markets nor satisfactory infrastructure in place to recover large volumes of biomass from wind disturbances. Immediate actions include the clearing and removal of materials in roads/right-of-ways, certain urban wastes and the saving of the most valuable and accessible timber resources. Investments in the harvest and long-term storage of wood have been economically limited to valuable saw logs. In large events where the National Response Framework is triggered, FEMA's disaster response assistance is based on clearing, removal and disposition of debris, and not necessarily upon increasing utilization of potentially recoverable materials. The necessity for immediate response usually dictates expedited removal rather than increased recovery. Historically, federal assistance for more progressive and

sustainable methods of disaster debris management in short-term post-incident circumstances has been limited. In the long-term, federal assistance is even more limited and the utilization of recoverable materials is difficult because of costs and limited markets.

Economic recovery and the restoration of landscape functions are huge challenges following disasters. Improved utilization of the woody debris and damaged biomass can help address these two issues. Successful increased diversion and utilization of woody biomass is dependent upon pre-planning. These plans must include actions to be taken both in the early stages after an incident occurs and as well as during the recovery phase. A more coordinated and informed approach will help guide decision makers to shift toward practices that promote environmental sustainability or environmental stewardship outcomes. In addition to conventional forest product uses, such as sawtimber and pulp and paper, woody biomass is an energy source for alternative fuel and energy uses. One key challenge associated with utilization of biomass as an energy source is solving the economics of transport in order to effectively move these materials outside of the “saturated zone”. Commercialization and efficient cost-recovery for a wide variety of forest products will provide sustainable, economic solutions to waste disposal and environmental clean up and restoration.

Woody biomass also has the potential to replenish carbon in soils and has exceptional cross-media applications. Processed end-use products derived from woody biomass and directly applied can aid in the remediation of contaminated media and disturbed soils, improve the physical, chemical and biological properties of soils, reduce erosion and control sedimentation resulting from wind and water forces and reduce nutrient runoff. Processed organic materials can be used to manufacture erosion control products and air and water filtration products. Soils amended with compost can provide many important stormwater management functions by providing functional landscapes that allow for infiltration, absorb and adsorb contaminants, filter, store, evaporate, and slow the velocity of stormwater runoff, thereby reducing both peak flows and volumes. In summary, returning organic resources to the soil is a method of decreasing the dependence on non-renewable resources, conserving water, improving air quality, reducing stream pollution and providing a more aesthetically pleasing and sustainable environment.

It is strongly recommended that research be focused on the development of non-traditional uses for woody debris, that consider the special problems of availability and collecting and hauling, as well as market size and return on investment. Woody debris can be converted into non-traditional products with a higher return on investment for the forest owner, or for urban communities.¹⁵ Examples include

- Emergency energy. Small portable boilers exist that could convert residential debris into electricity for small neighborhoods to assist in food preservation or preparation, or provision of clean water supplies.
- Baseload energy. Most coal-fired plants can substitute wood for a small (up to 5%) proportion of their coal without loss of reliability.
- Chemical products. In the 1970's, the Department of Energy demonstrated several technologies that could be used to convert wood debris into fuels and other chemical

¹⁵ For some excellent concepts particularly applicable to urban woody biomass, see <http://www.treelink.org/linx/?navSubCatRef=45>.

products. One in particular would be worth pursuing – a two-step process that starts with extrusion of woody biomass (removes 90% of the water, and reduces both weight and volume) followed by conversion into products. An attractive feature of this process is that the extrusion could be done in the forest, reducing the volume of material requiring removal and transport. Subsequent studies have shown that the extruded intermediate can be used for a variety of products (e.g., composite “lumber” for decking).