

Assessing Storm Damage in Urbanized Landscapes: Preparation, Response & Recovery



David Bloniarz, USDA Forest Service





www.unri.org/research-documents



Why Prepare?

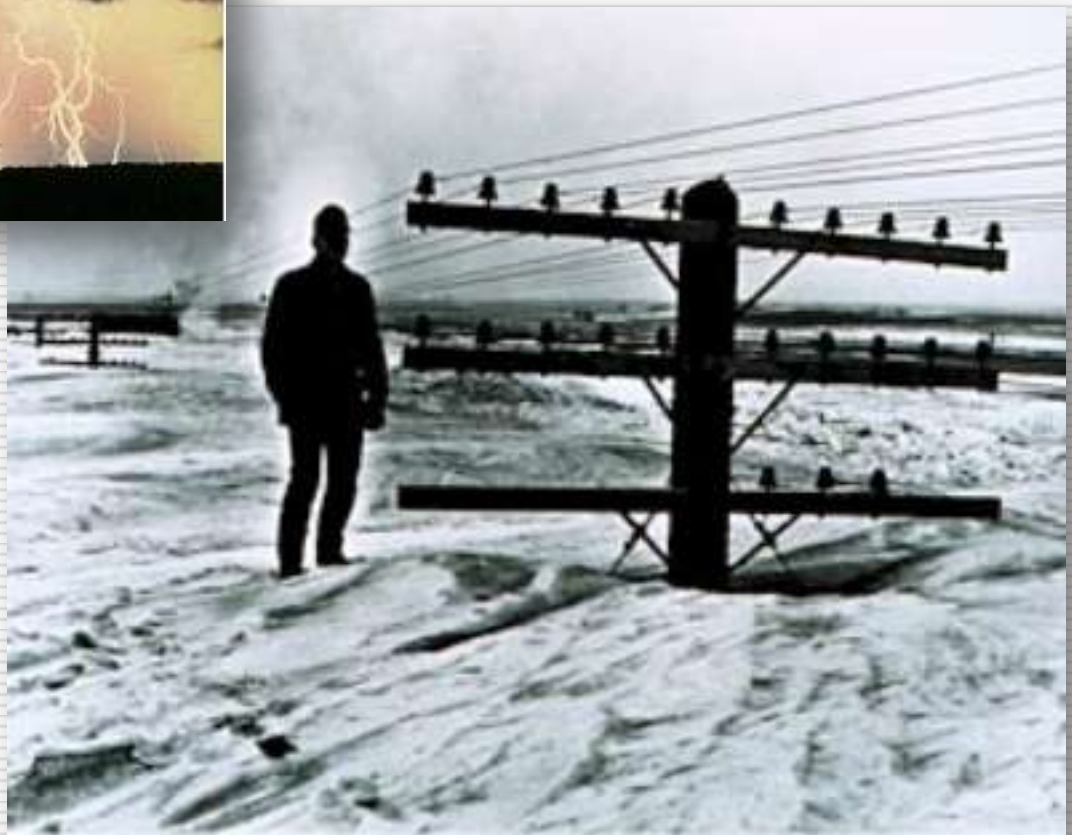
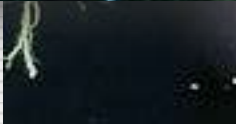




Tornados




Thunderstorms & Wind




Snow

Any Time, Any Place....




My Location
Springfield, MA


Tornado Watch


Expires: 06/02/2011 12:00 AM
Ma . Massachusetts
Counties Included Are


Essex
Hampden
Middlesex
Suffolk


Franklin
Hampshire
Norfolk
Worcester

86°F 

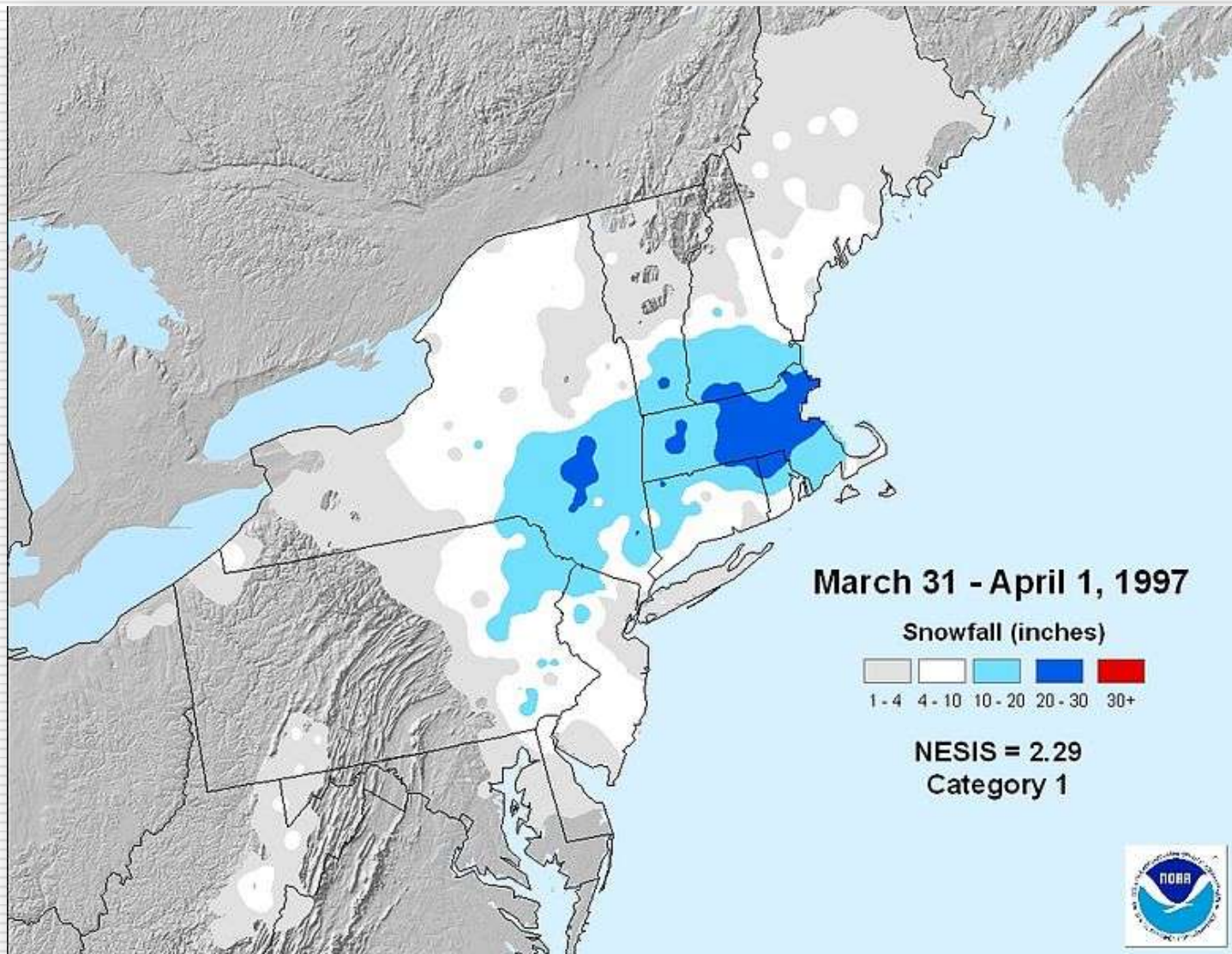








1997 April Fool's Day Blizzard

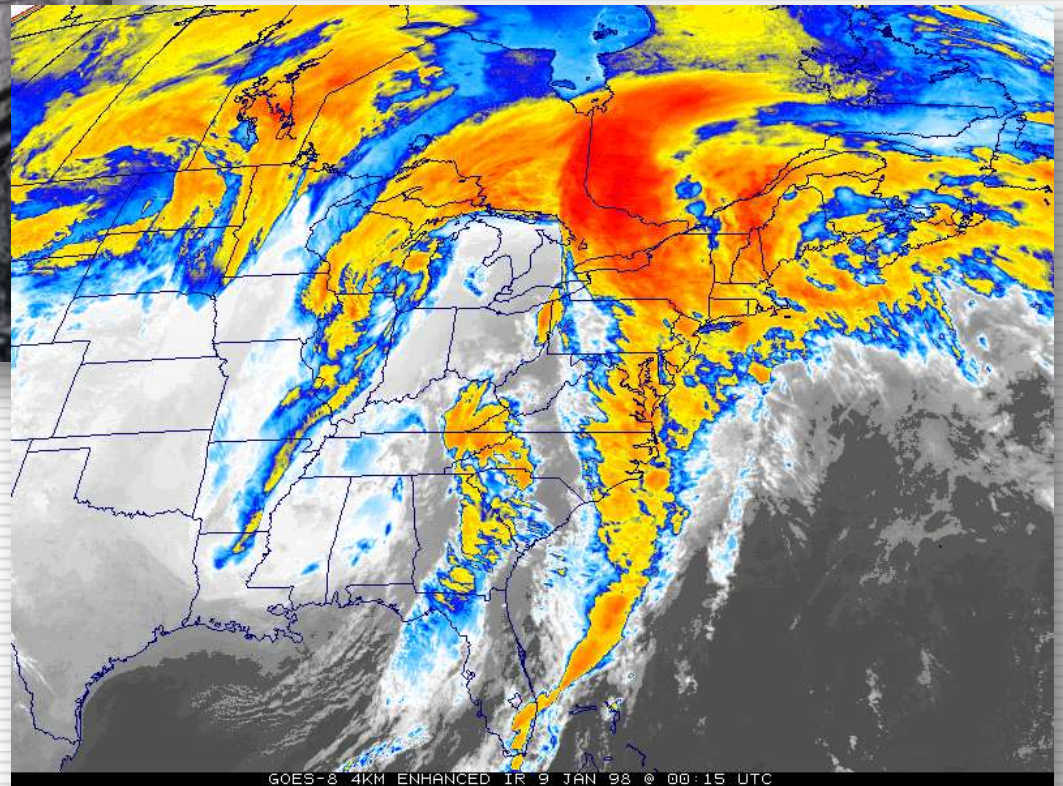


1997 April Fool's Day Blizzard



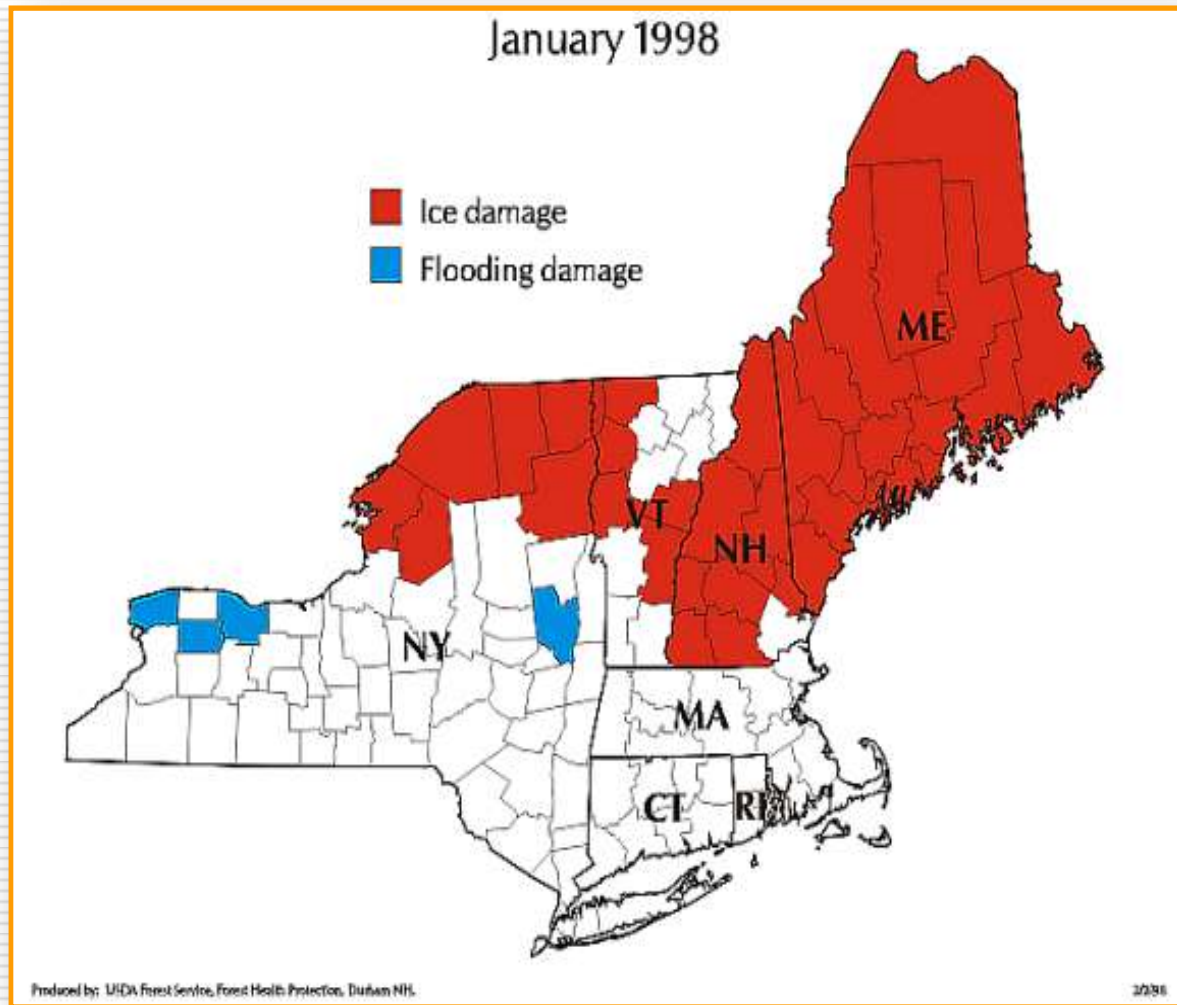
- 700,000 customers Lost Electricity
- Nearly 13% of New England lost power
- Boston's greatest April 24-hr snowfall





1998 Northeast Ice Storm Storm

FEMA Disaster Aid





Tree Damage



Transmission tower outside Montreal

Urban Core Impacts



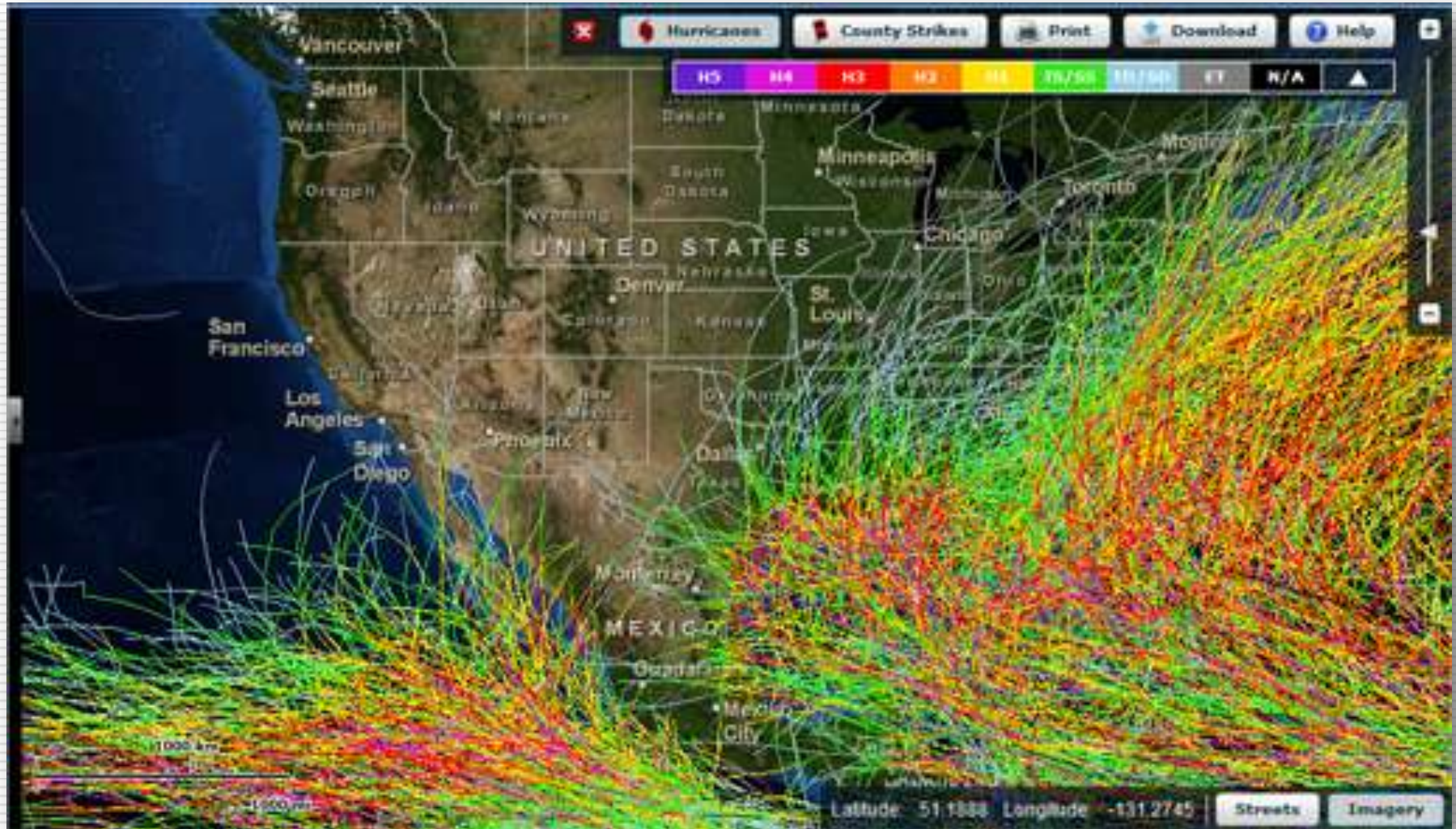
Downtown
Montréal

Landscape Scale Damage



Central Vermont - January 1998

Historical Tracks of US Hurricanes



Isabel 2003: "A Storm of Trees"



COPING WITH ISABEL: WHAT YOU NEED TO KNOW

13 PAGES OF SPECIAL COVERAGE INSIDE ■ TIPS, CLOSINGS AND INFORMATION ON HOW AND WHERE TO GET HELP/PAGES A20-A21

SATURDAY
September 20, 2003
\$4 cover
1304 VIA Rte. 384

The Virginian-Pilot

Woods Landing Road and Northcreek Road, Norfolk, VA
Phone: 757/622-6000
Fax: 757/622-6001
Web: www.vp.com

- 1.8 million Dominion customers lost power
- Northern end of Hatteras Village decimated
- At least 17 in four states reported dead



Robert Brown, 40, of Hatteras Village, looks on as the sea stacks around his home. Brown's home was destroyed by the storm.

SWEPT AWAY



A 50-foot brick chimney is all that remains of the Sea Ball Motel in Hatteras Village in the Outer Banks, which were hit by high winds and high waves as the storm made landfall nearby.

THE OUTAGES

"Catastrophic" damage done to power grid, officials say

By David Hume
Hurricane Isabel hit the Eastern Shore of Virginia on Saturday, Sept. 19, and the power grid was left in a state of "catastrophic" damage, officials say. The storm's winds and waves caused widespread damage to the power lines and substations, leaving millions of people without power. Dominion Energy, which serves the area, reported that the damage was "catastrophic" and that it would take weeks to restore power. The storm also caused significant damage to the infrastructure of the area, including roads and bridges.



A damaged power line tower is seen in the Outer Banks, where the storm caused significant damage to the power grid.

AFTERMATH Q&A

From downed lines to water, problems Isabel left behind

Q. How will the power come back on?
A. Dominion Energy has sent out crews to repair the damage. The company expects that power will be restored within a few days, but it may take longer in some areas. The company is working to prioritize the most critical areas for restoration.

Q. Are there any safety concerns?
A. Yes, there are. The storm caused significant damage to the infrastructure, including roads and bridges. There are also concerns about the safety of the power lines and substations. The company is working to ensure that the infrastructure is safe and secure.

Q. Are there any other problems?
A. Yes, there are. The storm caused significant damage to the infrastructure, including roads and bridges. There are also concerns about the safety of the power lines and substations. The company is working to ensure that the infrastructure is safe and secure.

THE OUTER BANKS

Hatteras Village isolated after hurricane cuts island in half

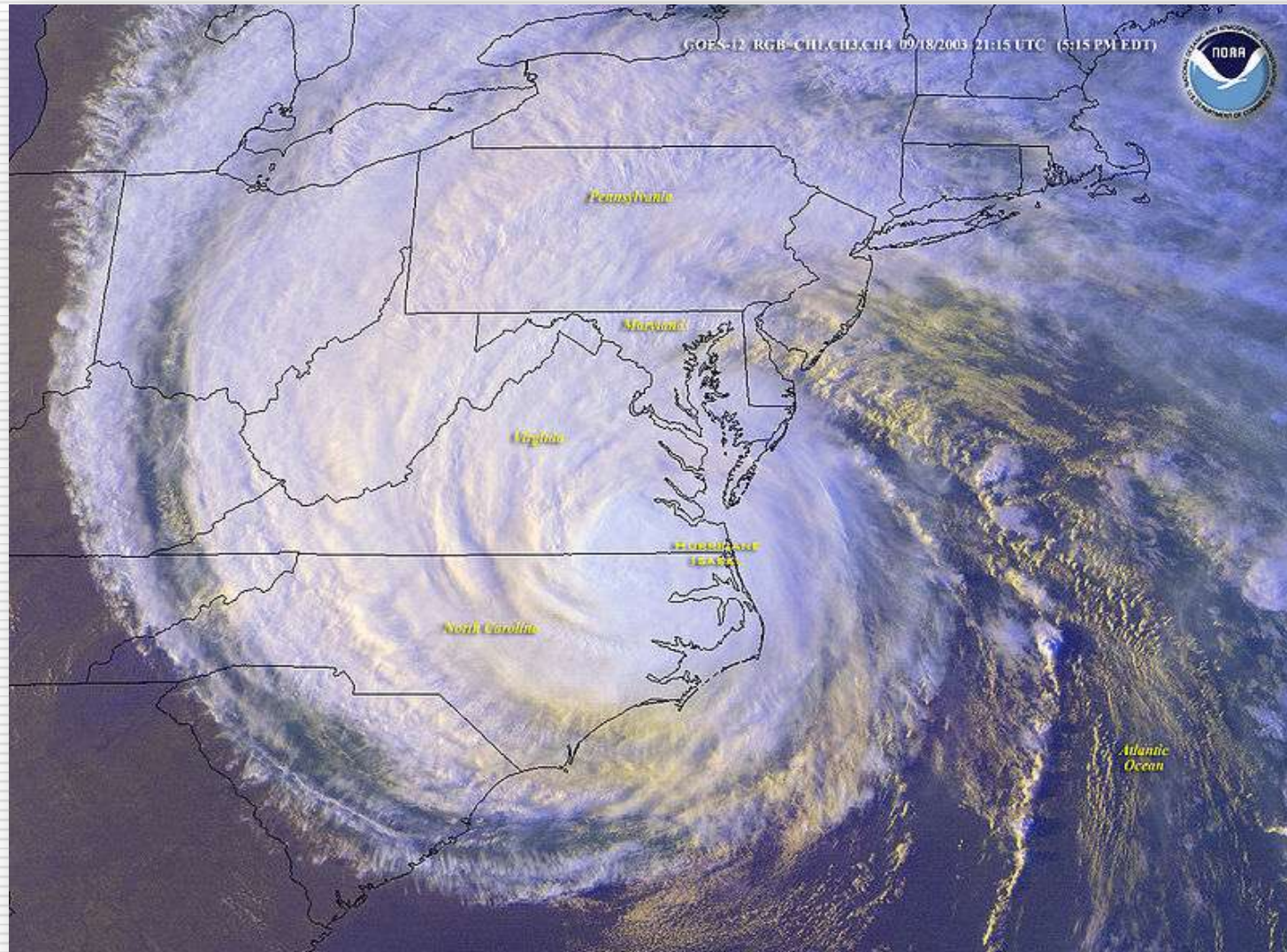
By David Hume
Hatteras Village, N.C., is a small, isolated community on the Outer Banks. The village was hit hard by Hurricane Isabel, which cut the island in half. The storm caused significant damage to the infrastructure, including roads and bridges. The village is now isolated, and it is difficult to get supplies and services. The community is working to recover from the damage and rebuild the infrastructure.



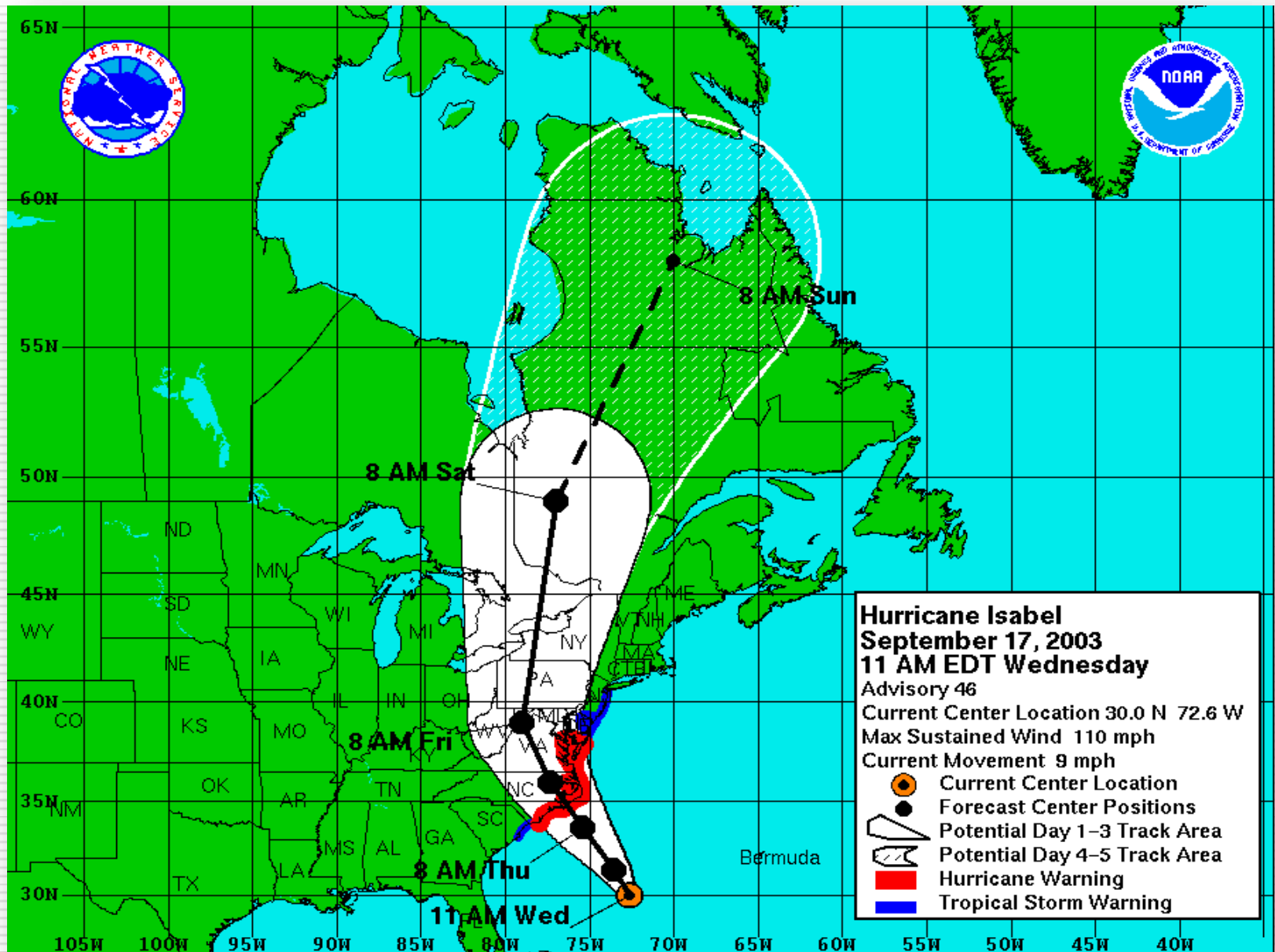
A map showing the location of Hatteras Village and the damage caused by Hurricane Isabel. The map highlights the area around Hatteras Village and shows the extent of the damage to the infrastructure.

■ CITY OF CLEVELAND REPORT: HATTERAS VILLAGE IS ISOLATED BECAUSE OF DAMAGE TO THE BRIDGE. THE BRIDGE WAS HIT BY HIGH WINDS AND WAVES, AND IT IS NOW IN A STATE OF DISREPAIR. THE CITY IS WORKING TO REPAIR THE BRIDGE AND RESTORE ACCESS TO THE VILLAGE.

Isabel 2003: “A Storm of Trees”



Isabel 2003: "A Storm of Trees"



Isabel 2003: “A Storm of Trees”



- Affected Maryland and Washington, DC
- \$945 million (2003 USD, (\$1.13 billion 2011 USD))
- Highest Sustained Winds 60 MpH
- Over 2 million households/businesses lost power

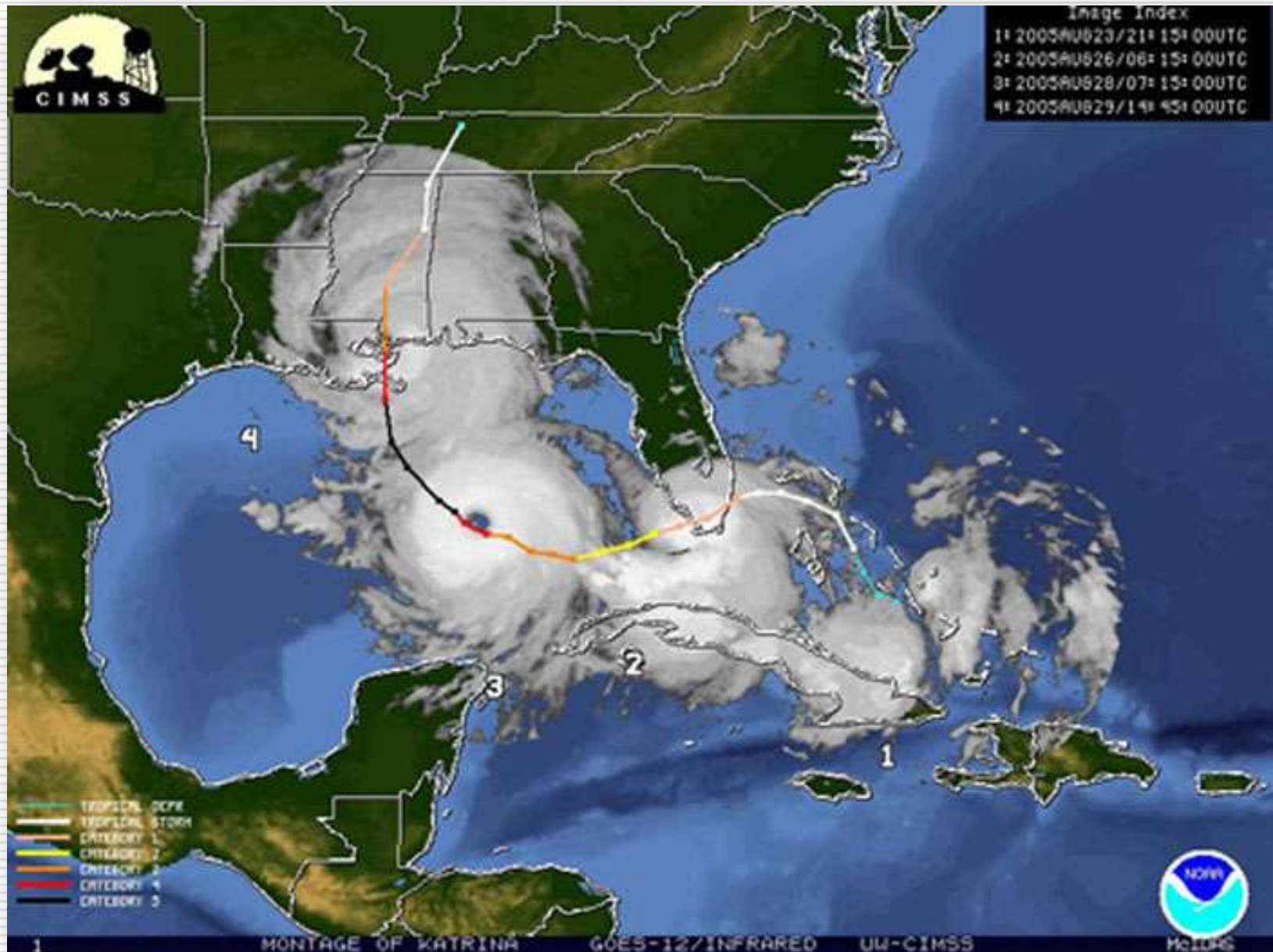
Isabel 2003: “A Storm of Trees”



Isabel “wreaked havoc on the forest of urban and suburban trees... Many of them are so big that, when blown over by tropical storm-force winds, they’re likely to find a power line that was once thought safely distant.”

- Pat Michaels
Virginia State
Climatologist

Katrina: Beyond the Trees



Katrina: Beyond the Trees

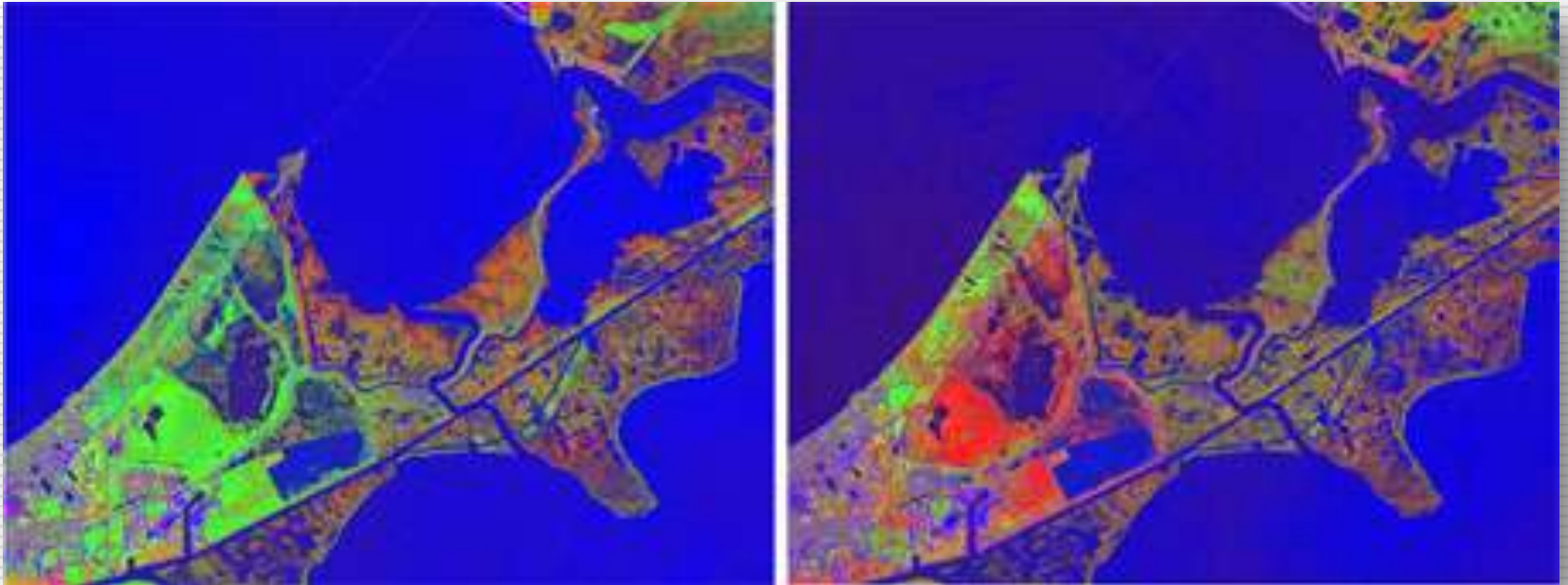


- \$81 Billion in damage
- 1,836 fatalities
- 80% New Orleans submerged
- 3 million without electricity
- 90,000 sq miles declared disaster

Katrina: Beyond the Trees



Katrina: Tree Loss




http://www.nasa.gov/mission_pages/hurricanes/archives/2007/katrina_carbon.html


- 5 million acres affected
- 320 million trees lost

Western/Central Massachusetts

June 1, 2011 Tornado




 My Location
Springfield, MA


 Tornado Watch


Expires: 06/02/2011 12:00 AM
Ma . Massachusetts
Counties Included Are


Essex
Hampden
Middlesex
Suffolk


Franklin
Hampshire
Norfolk
Worcester

86°F 









Western/Central Massachusetts June 1, 2011 Tornado



4:30 p.m.

Possible tornado touchdown in Shaker Road area.

6:07 p.m.

Electric company reported to police a tornado on the ground in southwest portion of Westfield.

4:32 p.m.

Amateur radio operator reported tornado on the ground one-half mile from Main Street. Widespread damage.

6:20 p.m.

State Police report tornado in north Springfield area.

5:22 p.m.

State Police report tornado on the ground in Sturbridge on Interstate 84 exit. Cars overturned.

7:25 p.m.

Amateur radio report of a tornado touchdown in Sturbridge at Route 49A.

NOTE: Preliminary information from NOAA as of 10:30 p.m. yesterday.

SOURCES: National Oceanic and Atmospheric Administration ; ESRI; TeleAtlas

PATRICK GARVIN/GLOBE STAFF

Western/Central Massachusetts June 1, 2011 Tornado



Western/Central Massachusetts June 1, 2011 Tornado



Western/Central Massachusetts June 1, 2011 Tornado



Tornado
June 1, 2011
Springfield MA.

'Snowtober Surprise – October 2011



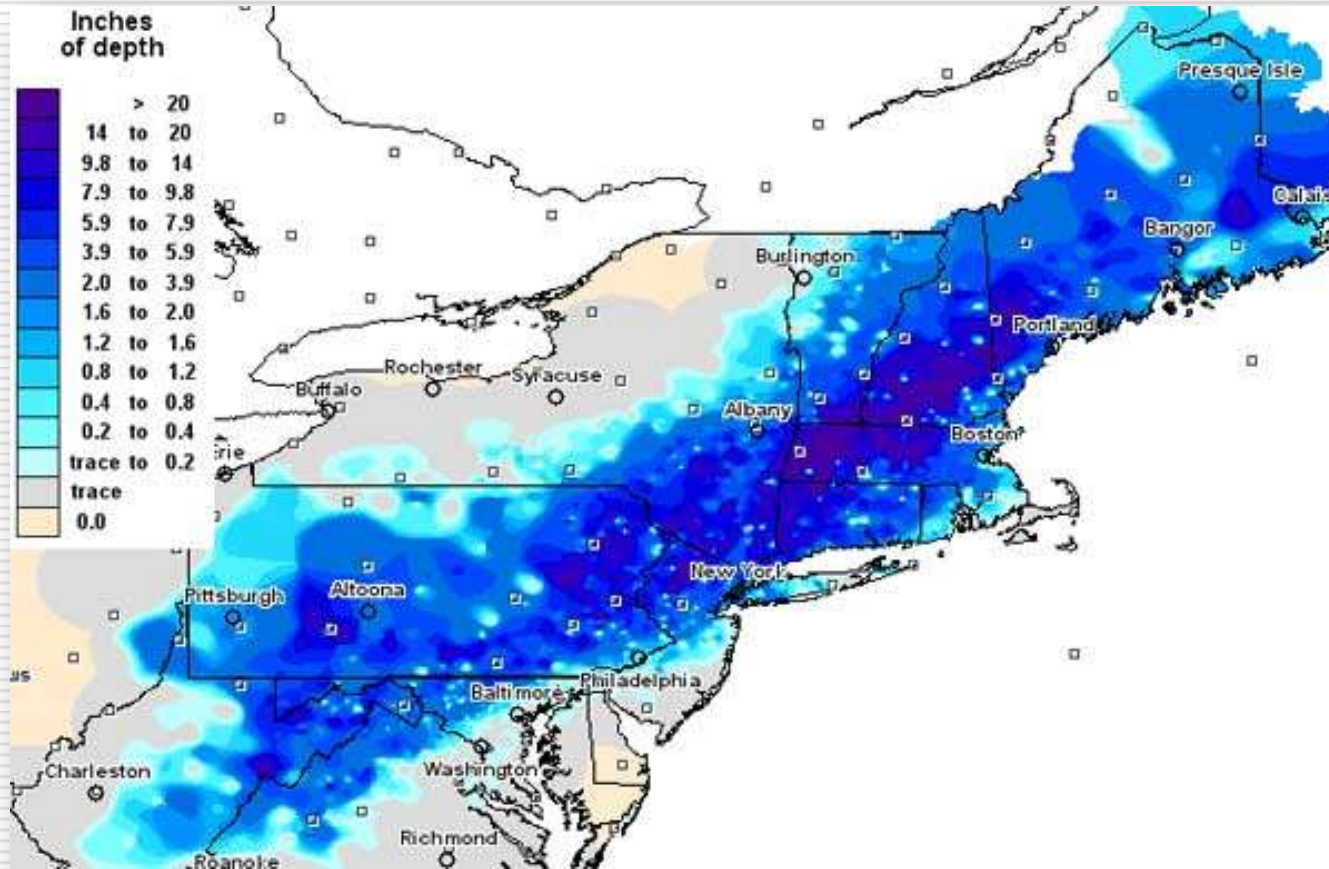
'Snowtober Surprise' – October 2011



'Snowtober Surprise' – October 2011



'Snowtober Surprise – October 2011



'Snowtober Surprise – October 2011

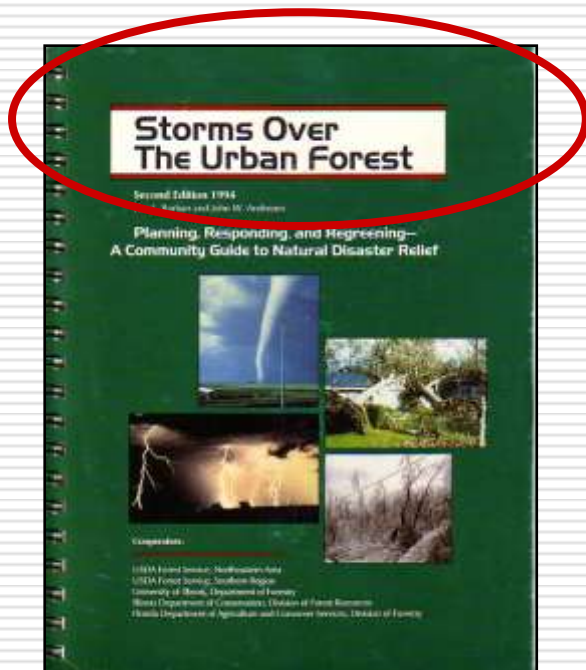


On the ground response and action



On the ground response and action





Tree Emergency Plan Worksheet

For Urban and Community Foresters, Community Leaders, Public Works and Parks Departments, Planners, Councils, and other Public Officials

1. Early Warning System/Weather Forecasting Service — Use an early warning procedure to enhance residents' consciousness with the National Weather Service, a consulting meteorologist firm, a volunteer television weather channel, or the local police department. Write a procedure to place, you should have at least three points of contact before major tree-damaging weather strikes.

Staff List: _____

Contact Name: _____
 Address: _____
 Phone: _____
 Mobile: _____
 FAX: _____
 Email: _____ Job: _____

Description of services provided: _____

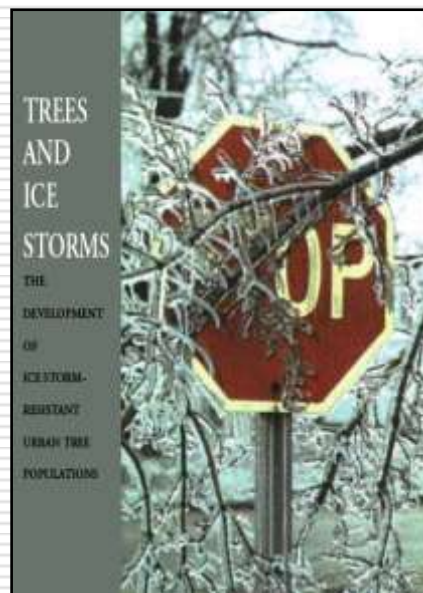
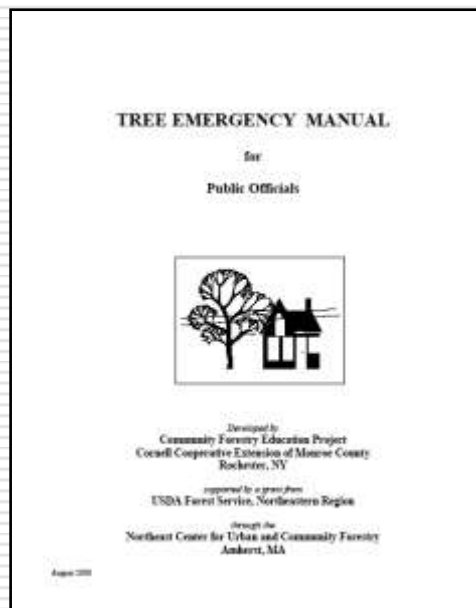
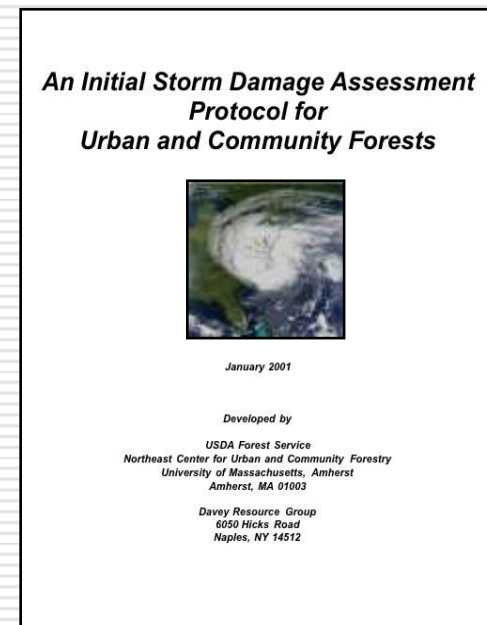
2. Local Emergency Manager — Lead contact for a community and responsible for emergency planning and response activities.

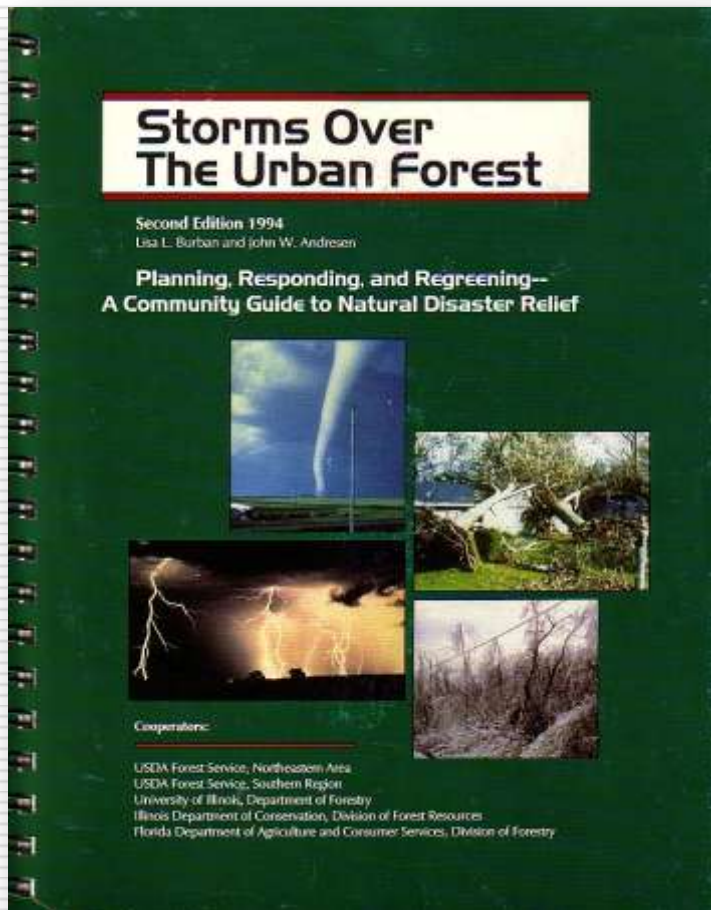
Name: _____ Phone: _____
 District: _____ Mobile: _____

3. Public Relations Coordinator — This is the individual responsible for primary public relations, media contacts, clear information and communications about the natural disaster (must have no knowledge of damage, community issues and capabilities, and be able to make decisions).

Name: _____ Phone: _____
 Mobile: _____

Alternate(s):
 Name: _____ Phone: _____
 Mobile: _____
 Name: _____ Phone: _____
 Mobile: _____





Chapter 1 Introduction

Chapter 2 Coping with Natural Disasters

Chapter 3 Preparing for Natural Disasters

Chapter 4 Natural Disaster Alert, Response and Recovery

Chapter 5 Regreening the Community

Chapter 6 Approaches to Working With Disaster Relief Organizations

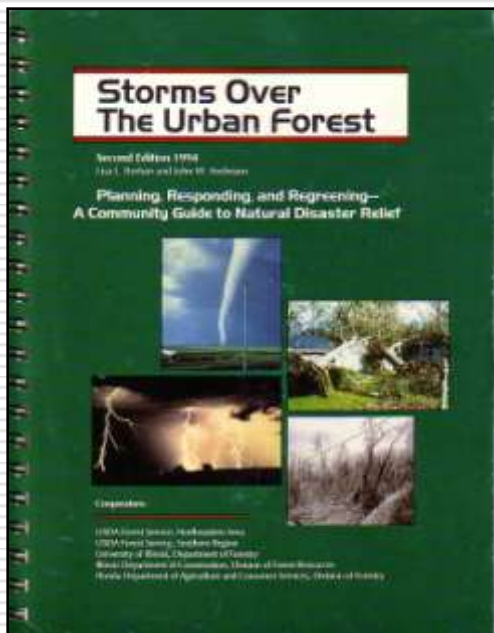
Chapter 7 Tornado Relief - A Case Study

Chapter 8 Notes from Hurricane Andrew

Chapter 10 References

Chapter 11 Appendix - Key Words

<http://www.na.fs.fed.us/urban>



Tree Emergency Plan Worksheet
For Urban and Community Foresters, Community Leaders, Public Works and Parks Departments, Planners, Councils, and other Public Officials

1. Early Warning System/Weather Forecasting Service — Use an early warning procedure to enhance residents' consciousness with the National Weather Service, a local emergency alert, a neighborhood weather watch, or the local police department's emergency alert system. Use groups that already have plans of how to handle such an emergency.

Staff List: _____

Contact Name: _____
Address: _____
Phone: _____
Mobile: _____
Fax: _____
Email: _____ Web: _____

Description of services provided: _____

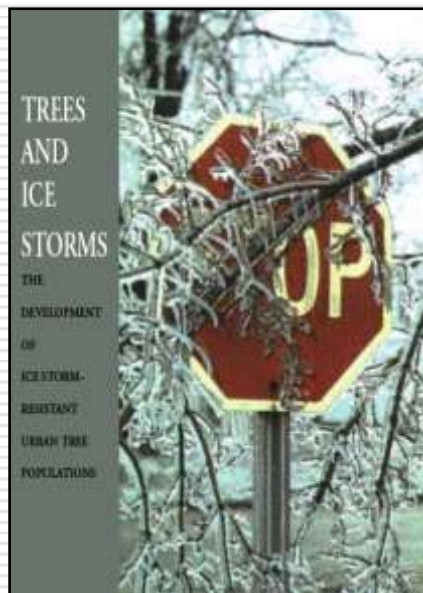
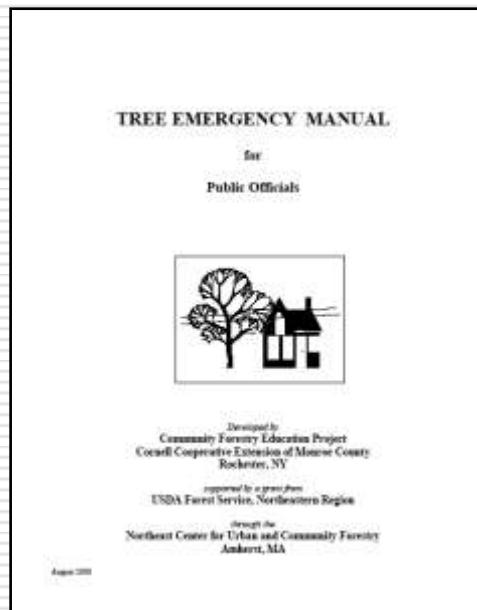
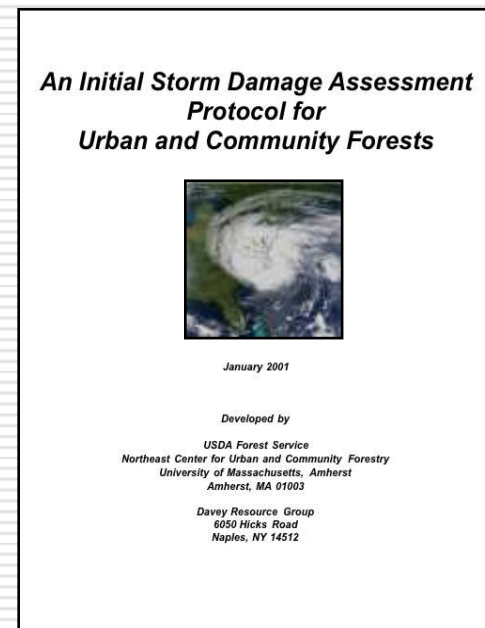
2. Local Emergency Manager — Lead contact for a community and responsible for emergency planning and response activities.

Name: _____ Phone: _____
Residence: _____ Mobile: _____

3. Public Relations Coordinator — This is the individual responsible for primary public relations, media contacts, clear information and communications about the natural disaster. (Must have no knowledge of damage, community issues and capabilities, and be able to make decisions.)

Name: _____ Phone: _____
Residence: _____ Mobile: _____

Alternate(s):
Name: _____ Phone: _____
Residence: _____ Mobile: _____



Tree Emergency Plan Worksheet

For: Urban and Community Foresters, Community Leaders, Public Works and Parks
Departments, Planners, Councils, and other Public Officials

1. Early Warning System/Weather Forecasting Service — Use an early warning procedure to enhance mitigation: communicate with the National Weather Service, a consulting meteorological firm, a designated television weather channel, or the local police department. With a procedure in place, you should have at least three hours of lead time before most tree damaging weather strikes.

Staff Lead: _____

Contact Name: _____

Address: _____

Phone: _____

Mobile: _____

FAX: _____

Email: _____ Web Site: _____

Description of services provided: _____

2. Local Emergency Manager — Lead contact for a community and responsible for emergency planning and response activities.

Name: _____ Phone: _____

Mobile: _____

Role(s): _____

3. Public Relations Coordinator — This is the individual responsible for primary public relations, media contacts, citizen information and communications about the natural disaster. (Must have full knowledge of damage, community issues and capabilities, and be able to make decisions.)

Name: _____ Phone: _____

Mobile: _____

Alternate(s):

Name: _____ Phone: _____

Mobile: _____

Name: _____ Phone: _____

Mobile: _____

Tree Emergency Plan Worksheet

6. Emergency Call Out Procedure — phone contact tree for staff.

Name: _____	Will Contact —	Name: _____
		Phone: _____
		Mobile: _____
		Name: _____
		Phone: _____
		Mobile: _____
		Name: _____
		Phone: _____
		Mobile: _____
Name: _____	Will Contact —	Name: _____
		Phone: _____
		Mobile: _____
		Name: _____
		Phone: _____
		Mobile: _____
		Name: _____
		Phone: _____
		Mobile: _____
Name: _____	Will Contact —	Name: _____
		Phone: _____
		Mobile: _____
		Name: _____
		Phone: _____
		Mobile: _____
		Name: _____
		Phone: _____
		Mobile: _____

<http://www.na.fs.fed.us/urban>

Tree Emergency Plan Worksheet

11. Procedure for Debris Staging and Removal — Identify several areas for staging and processing debris. Establish a contract or agreement securing each site. Choose a processing site that is large, flat, well-drained and accessible to roads that can support truck weights of at least 9 tons per axle. Identify ways to protect significant trees or cultural resources during processing. Potential sites include undeveloped park, industrial, cemetery, fairgrounds, agency and state land. Large parking lots (even paved lots) work well. Remember to consider noise implications near residential areas. Identify multiple sites. Annually reconfirm access and availability to these sites. Make sure the site is large enough for safety considerations (tying debris from tub grinders), if possible, identify sites that can be secured (fencing).

Site 1 – Location: _____

Contact Name/Role: _____

Phone: _____

Mobile: _____

Site 2 – Location: _____

Contact Name/Role: _____

Phone: _____

Mobile: _____

Site 3 – Location: _____

Contact Name/Role: _____

Phone: _____

Mobile: _____

12. Debris and Brush Removal from Private Property — Identify how you will address this issue. A major storm makes it difficult for private property owners to remove brush and debris. Make a decision at the municipal level allowing for debris collection. Determine if your city has adequate equipment and staff available to accomplish this often enormous task. It is critical that you provide guidelines for residents. Specify the types, amounts and piling arrangement of the materials that you will accept. Cities can also assist private homeowners who must contract with private companies for trimming and removal by preparing a list of companies that are licensed, professionally trained and insured.

Person Responsible: _____

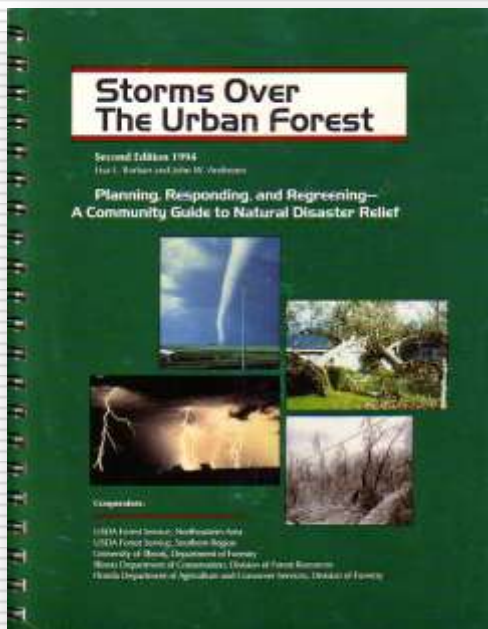
Phone: _____

Mobile: _____

Minor Storm Policy: _____

Major Storm Policy: _____

Listing of available tree care companies: _____



Tree Emergency Plan Worksheet

For Urban and Community Foresters, Community Leaders, Public Works and Parks Departments, Planners, Councils, and other Public Officials

1. Early Warning System/Weather Forecasting Service — Use an early warning procedure to enhance residents' coordination with the National Weather Service, a consulting meteorologist firm, a volunteer weather station, or the local police department. Have a procedure in place, you should have at least three points of contact before other local emergency services arrive.

Staff List: _____

Contact Name: _____
 Address: _____
 Phone: _____
 Mobile: _____
 FAX: _____
 Email: _____ Job: _____

Description of services provided: _____

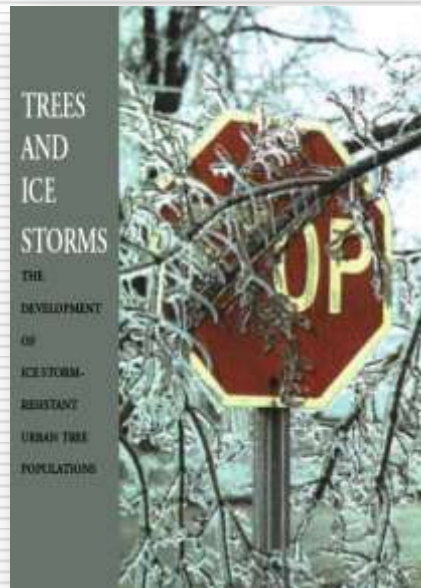
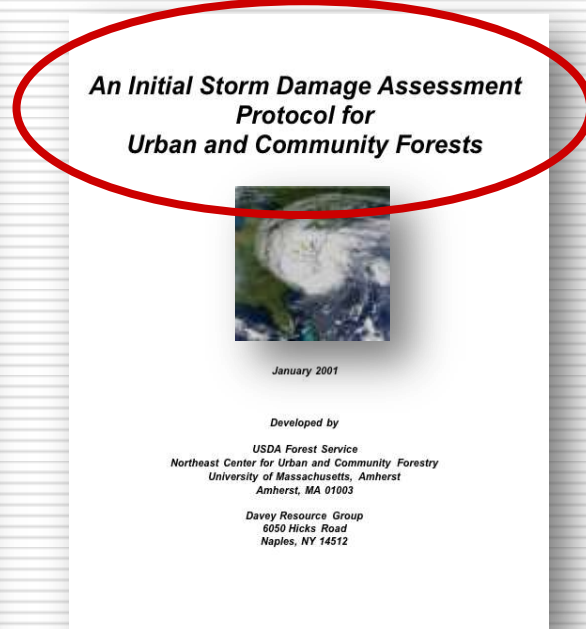
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Name: _____ Phone: _____
 District: _____ Mobile: _____

3. Public Relations Coordinator — This is the individual responsible for primary public relations, media contacts, clear information and communications about the natural disaster. (Must have no knowledge of damage, community losses and casualties, and be able to make decisions.)

Name: _____ Phone: _____
 Mobile: _____

Alternate(s):
 Name: _____ Phone: _____
 Mobile: _____
 Name: _____ Phone: _____
 Mobile: _____





i-Tree

Storm

Estimating Storm Damage Costs

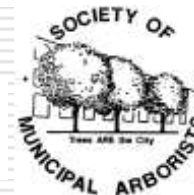
What is i-Tree?

A suite of tools to assess urban vegetation and their ecosystem services and values



Public-Private Partnership

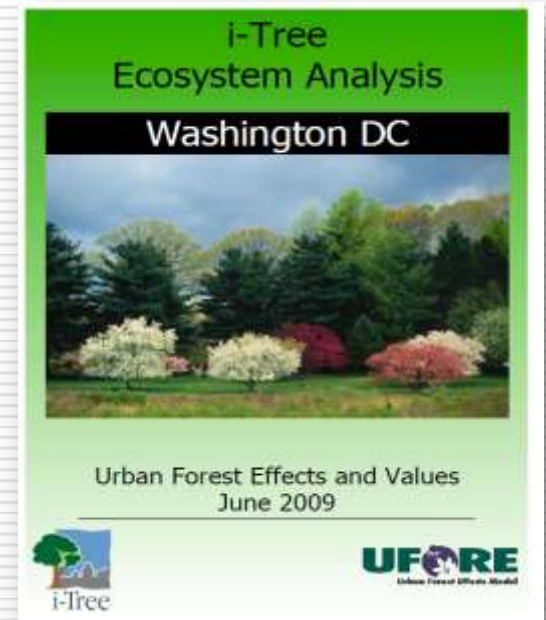
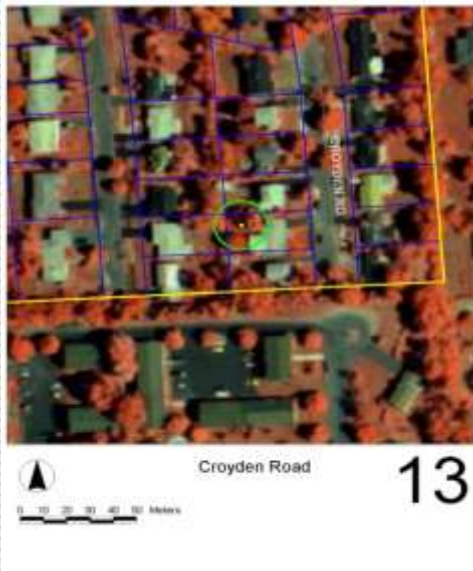
- 🌳 USDA Forest Service
- 🌳 Davey Tree Expert Co.
- 🌳 National Arbor Day Foundation
- 🌳 Society of Municipal Arborists
- 🌳 International Society of Arboriculture
- 🌳 Casey Trees



Goals



- ✿ Simple and low-cost tools and methods to aid in forest planning and management
- ✿ Complete process – start to finish



How Does Storm Work?





- 🌳 Context of Use
- 🌳 Sampling
- 🌳 Data Collection
- 🌳 PDA & Desktop Features

Context of Use



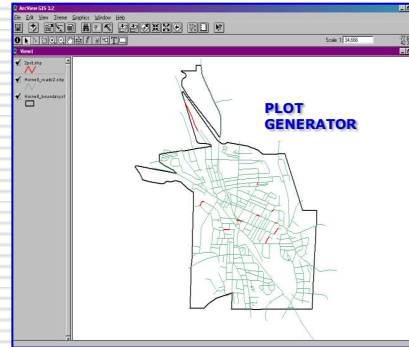
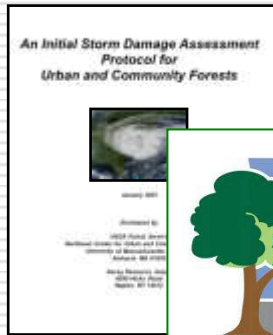
Planning

- Framed by overall natural disaster plan
 -  FEMA funding: Pre-Disaster Mitigation Program
 -  Tree Emergency Plan Worksheet (Burban)

Recovery

- First 24-36 hours
- Response to state emergency agency

The SDAP Process



Random Plots

Form 06
PRE-Storm Field Data Collection Sheet (Populated Areas)

Community Name: _____ Plot Number: _____

ON Street: _____ TO Street: _____

FROM Street: _____ Date: _____

ROW Width (feet): _____ Collected by: _____

Start of plot description: _____

End of plot description: _____

ON Right-of-Way Trees						OFF Right-of-Way Trees					
DBH	Height	Species	Health	Form	Notes	DBH	Height	Species	Health	Form	Notes
10-12	15	Red Oak	Good	Decid		10-12	15	Red Oak	Good	Decid	
13-15	20	Red Oak	Good	Decid		13-15	20	Red Oak	Good	Decid	
16-18	25	Red Oak	Good	Decid		16-18	25	Red Oak	Good	Decid	
19-21	30	Red Oak	Good	Decid		19-21	30	Red Oak	Good	Decid	
22-24	35	Red Oak	Good	Decid		22-24	35	Red Oak	Good	Decid	
25-27	40	Red Oak	Good	Decid		25-27	40	Red Oak	Good	Decid	
28-30	45	Red Oak	Good	Decid		28-30	45	Red Oak	Good	Decid	
31-33	50	Red Oak	Good	Decid		31-33	50	Red Oak	Good	Decid	
34-36	55	Red Oak	Good	Decid		34-36	55	Red Oak	Good	Decid	
37-39	60	Red Oak	Good	Decid		37-39	60	Red Oak	Good	Decid	
40-42	65	Red Oak	Good	Decid		40-42	65	Red Oak	Good	Decid	
43-45	70	Red Oak	Good	Decid		43-45	70	Red Oak	Good	Decid	
46-48	75	Red Oak	Good	Decid		46-48	75	Red Oak	Good	Decid	
49-51	80	Red Oak	Good	Decid		49-51	80	Red Oak	Good	Decid	
52-54	85	Red Oak	Good	Decid		52-54	85	Red Oak	Good	Decid	
55-57	90	Red Oak	Good	Decid		55-57	90	Red Oak	Good	Decid	
58-60	95	Red Oak	Good	Decid		58-60	95	Red Oak	Good	Decid	
61-63	100	Red Oak	Good	Decid		61-63	100	Red Oak	Good	Decid	
64-66	105	Red Oak	Good	Decid		64-66	105	Red Oak	Good	Decid	
67-69	110	Red Oak	Good	Decid		67-69	110	Red Oak	Good	Decid	
70-72	115	Red Oak	Good	Decid		70-72	115	Red Oak	Good	Decid	
73-75	120	Red Oak	Good	Decid		73-75	120	Red Oak	Good	Decid	
76-78	125	Red Oak	Good	Decid		76-78	125	Red Oak	Good	Decid	
79-81	130	Red Oak	Good	Decid		79-81	130	Red Oak	Good	Decid	
82-84	135	Red Oak	Good	Decid		82-84	135	Red Oak	Good	Decid	
85-87	140	Red Oak	Good	Decid		85-87	140	Red Oak	Good	Decid	
88-90	145	Red Oak	Good	Decid		88-90	145	Red Oak	Good	Decid	
91-93	150	Red Oak	Good	Decid		91-93	150	Red Oak	Good	Decid	
94-96	155	Red Oak	Good	Decid		94-96	155	Red Oak	Good	Decid	
97-99	160	Red Oak	Good	Decid		97-99	160	Red Oak	Good	Decid	
100-102	165	Red Oak	Good	Decid		100-102	165	Red Oak	Good	Decid	
103-105	170	Red Oak	Good	Decid		103-105	170	Red Oak	Good	Decid	
106-108	175	Red Oak	Good	Decid		106-108	175	Red Oak	Good	Decid	
109-111	180	Red Oak	Good	Decid		109-111	180	Red Oak	Good	Decid	
112-114	185	Red Oak	Good	Decid		112-114	185	Red Oak	Good	Decid	
115-117	190	Red Oak	Good	Decid		115-117	190	Red Oak	Good	Decid	
118-120	195	Red Oak	Good	Decid		118-120	195	Red Oak	Good	Decid	
121-123	200	Red Oak	Good	Decid		121-123	200	Red Oak	Good	Decid	
124-126	205	Red Oak	Good	Decid		124-126	205	Red Oak	Good	Decid	
127-129	210	Red Oak	Good	Decid		127-129	210	Red Oak	Good	Decid	
130-132	215	Red Oak	Good	Decid		130-132	215	Red Oak	Good	Decid	
133-135	220	Red Oak	Good	Decid		133-135	220	Red Oak	Good	Decid	
136-138	225	Red Oak	Good	Decid		136-138	225	Red Oak	Good	Decid	
139-141	230	Red Oak	Good	Decid		139-141	230	Red Oak	Good	Decid	
142-144	235	Red Oak	Good	Decid		142-144	235	Red Oak	Good	Decid	
145-147	240	Red Oak	Good	Decid		145-147	240	Red Oak	Good	Decid	
148-150	245	Red Oak	Good	Decid		148-150	245	Red Oak	Good	Decid	
151-153	250	Red Oak	Good	Decid		151-153	250	Red Oak	Good	Decid	
154-156	255	Red Oak	Good	Decid		154-156	255	Red Oak	Good	Decid	
157-159	260	Red Oak	Good	Decid		157-159	260	Red Oak	Good	Decid	
160-162	265	Red Oak	Good	Decid		160-162	265	Red Oak	Good	Decid	
163-165	270	Red Oak	Good	Decid		163-165	270	Red Oak	Good	Decid	
166-168	275	Red Oak	Good	Decid		166-168	275	Red Oak	Good	Decid	
169-171	280	Red Oak	Good	Decid		169-171	280	Red Oak	Good	Decid	
172-174	285	Red Oak	Good	Decid		172-174	285	Red Oak	Good	Decid	
175-177	290	Red Oak	Good	Decid		175-177	290	Red Oak	Good	Decid	
178-180	295	Red Oak	Good	Decid		178-180	295	Red Oak	Good	Decid	
181-183	300	Red Oak	Good	Decid		181-183	300	Red Oak	Good	Decid	
184-186	305	Red Oak	Good	Decid		184-186	305	Red Oak	Good	Decid	
187-189	310	Red Oak	Good	Decid		187-189	310	Red Oak	Good	Decid	
190-192	315	Red Oak	Good	Decid		190-192	315	Red Oak	Good	Decid	
193-195	320	Red Oak	Good	Decid		193-195	320	Red Oak	Good	Decid	
196-198	325	Red Oak	Good	Decid		196-198	325	Red Oak	Good	Decid	
199-201	330	Red Oak	Good	Decid		199-201	330	Red Oak	Good	Decid	
202-204	335	Red Oak	Good	Decid		202-204	335	Red Oak	Good	Decid	
205-207	340	Red Oak	Good	Decid		205-207	340	Red Oak	Good	Decid	
208-210	345	Red Oak	Good	Decid		208-210	345	Red Oak	Good	Decid	
211-213	350	Red Oak	Good	Decid		211-213	350	Red Oak	Good	Decid	
214-216	355	Red Oak	Good	Decid		214-216	355	Red Oak	Good	Decid	
217-219	360	Red Oak	Good	Decid		217-219	360	Red Oak	Good	Decid	
220-222	365	Red Oak	Good	Decid		220-222	365	Red Oak	Good	Decid	
223-225	370	Red Oak	Good	Decid		223-225	370	Red Oak	Good	Decid	
226-228	375	Red Oak	Good	Decid		226-228	375	Red Oak	Good	Decid	
229-231	380	Red Oak	Good	Decid		229-231	380	Red Oak	Good	Decid	
232-234	385	Red Oak	Good	Decid		232-234	385	Red Oak	Good	Decid	
235-237	390	Red Oak	Good	Decid		235-237	390	Red Oak	Good	Decid	
238-240	395	Red Oak	Good	Decid		238-240	395	Red Oak	Good	Decid	
241-243	400	Red Oak	Good	Decid		241-243	400	Red Oak	Good	Decid	
244-246	405	Red Oak	Good	Decid		244-246	405	Red Oak	Good	Decid	
247-249	410	Red Oak	Good	Decid		247-249	410	Red Oak	Good	Decid	
250-252	415	Red Oak	Good	Decid		250-252	415	Red Oak	Good	Decid	
253-255	420	Red Oak	Good	Decid		253-255	420	Red Oak	Good	Decid	
256-258	425	Red Oak	Good	Decid		256-258	425	Red Oak	Good	Decid	
259-261	430	Red Oak	Good	Decid		259-261	430	Red Oak	Good	Decid	
262-264	435	Red Oak	Good	Decid		262-264	435	Red Oak	Good	Decid	
265-267	440	Red Oak	Good	Decid		265-267	440	Red Oak	Good	Decid	
268-270	445	Red Oak	Good	Decid		268-270	445	Red Oak	Good	Decid	
271-273	450	Red Oak	Good	Decid		271-273	450	Red Oak	Good	Decid	
274-276	455	Red Oak	Good	Decid		274-276	455	Red Oak	Good	Decid	
277-279	460	Red Oak	Good	Decid		277-279	460	Red Oak	Good	Decid	
280-282	465	Red Oak	Good	Decid		280-282	465	Red Oak	Good	Decid	
283-285	470	Red Oak	Good	Decid		283-285	470	Red Oak	Good	Decid	
286-288	475	Red Oak	Good	Decid		286-288	475	Red Oak	Good	Decid	
289-291	480	Red Oak	Good	Decid		289-291	480	Red Oak	Good	Decid	
292-294	485	Red Oak	Good	Decid		292-294	485	Red Oak	Good	Decid	
295-297	490	Red Oak	Good	Decid		295-297	490	Red Oak	Good	Decid	
298-300	495	Red Oak	Good	Decid		298-300	495	Red Oak	Good	Decid	
301-303	500	Red Oak	Good	Decid		301-303	500	Red Oak	Good	Decid	
304-306	505	Red Oak	Good	Decid		304-306	505	Red Oak	Good	Decid	
307-309	510	Red Oak	Good	Decid		307-309	510	Red Oak	Good	Decid	
310-312	515	Red Oak	Good	Decid		310-312	515	Red Oak	Good	Decid	
313-315	520	Red Oak	Good	Decid		313-315	520	Red Oak	Good	Decid	
316-318	525	Red Oak	Good	Decid		316-318	525	Red Oak	Good	Decid	
319-321	530	Red Oak	Good	Decid		319-321	530	Red Oak	Good	Decid	
322-324	535	Red Oak	Good	Decid		322-324	535	Red Oak	Good	Decid	
325-327	540	Red Oak	Good	Decid		325-327	540	Red Oak	Good	Decid	
328-330	545	Red Oak	Good	Decid		328-330	545	Red Oak	Good	Decid	
331-333	550	Red Oak	Good	Decid		331-333	550	Red Oak	Good	Decid	
334-336	555	Red Oak	Good	Decid		334-336	555	Red Oak	Good	Decid	
337-339	560	Red Oak	Good	Decid		337-339	560	Red Oak	Good	Decid	
340-342	565	Red Oak	Good	Decid		340-342	565	Red Oak	Good	Decid	
343-345	570	Red Oak	Good	Decid		343-345	570	Red Oak	Good	Decid	
346-348	575	Red Oak	Good	Decid		346-348	575	Red Oak	Good	Decid	
349-351	580	Red Oak	Good	Decid		349-351	580	Red Oak	Good	Decid	
352-354	585	Red Oak	Good	Decid		352-354	585	Red Oak	Good	Decid	
355-357	590	Red Oak	Good	Decid		355-357	590	Red Oak	Good	Decid	
358-360	595	Red Oak	Good	Decid		358-360	595	Red Oak	Good	Decid	
361-363	600	Red Oak	Good	Decid		361-363	600	Red Oak	Good	Decid	
364-366	605	Red Oak	Good	Decid		364-366	605	Red Oak	Good	Decid	
367-369	610	Red Oak	Good	Decid		367-369	610	Red Oak	Good	Decid	
370-372	615	Red Oak	Good	Decid		370-372	615	Red Oak	Good	Decid	
373-375	620	Red Oak	Good	Decid		373-375	620	Red Oak	Good	Decid	
376-378	625	Red Oak	Good	Decid		376-378	625	Red Oak	Good	Decid	
379-381	630	Red Oak	Good	Decid		379-381	630	Red Oak	Good	Decid	
382-384	635	Red Oak	Good	Decid		382-384	635	Red Oak	Good	Decid	
385-387	640	Red Oak	Good	Decid		385-387	640	Red Oak	Good	Decid	
388-390	645	Red Oak	Good	Decid		388-390	645	Red Oak	Good	Decid	
391-393	650	Red Oak	Good	Decid		391-393	650	Red Oak	Good	Decid	
394-396	655	Red Oak	Good	Decid		394-396	655	Red Oak	Good	Decid	

Components



Data Collection- Paper

Form EA
POST-Storm Field Data Collection Sheet (Populated Areas)

Community Name: _____ Plot Number: _____

ON Street: _____ FROM Street: _____ TO Street: _____

Date: _____ Plot Length (Miles): _____

ROW Width (feet): _____ Collected by: _____

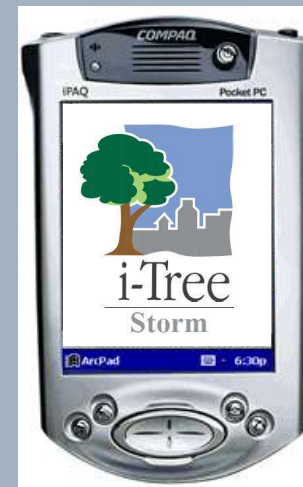
Start of plot description: _____

End of plot description: _____

ROW Trees ONLY										ROW > 50' Trees*	
Tree Removals					Tree Pruning					Debris Estimate*	
DBH Class (Inches)	Total Number of Trees	Total Volume (cu ft)	Total Value (\$)	Total Weight (tons)	DBH Class (Inches)	Total Number of Trees	Total Volume (cu ft)	Total Value (\$)	Total Weight (tons)	Debris Estimate (CUBIC YARDS)	Debris Estimate (TONS)
6-12	3.2				0-25						
13-19	5.1				1.0						
20-24	7.7				1.5						
25-30	10.2				2.0						
31-36	12.5				3.0						
37-42	20.4				4.0						
43+	29.0				6.0						
Total											

* Approximate values based on weight of debris in this case and plot width.
* Rate of debris in a group that is within 10% of the edge of the plot.
* Closest to the center line of the plot.
* Plots larger than 100 ft x 100 ft, report on edge (chain line) or 100 ft chain line.
* Plots smaller than 100 ft x 100 ft, report on edge (chain line) or 100 ft chain line.
* Average = Total / Number of 100-foot plots in a row.

Data Collection- PDA



PLOT GENERATOR

Blockade Information from the Diagram

Blockade Number	On Street	From Street	To Street
1	Main Street	First Street	West Street
2	First Street	Main Street	Maple Street
3	Maple Street	East Street	First Street
4	West Street	Main Street	Maple Street
5	Maple Street	First Street	West Street

Sampling Tools

Data Storage & Processing

Community: _____ Report Date: 1/12/2005

Note: numbers on this page were generated by a "Storm Damage Estimate Template" so provided 2004 by the USDA Forest Service and Damage Resource Group with your storm-related observations or random plots

ESTIMATED COST OF TREE DAMAGE \$0

COMMUNITY VALUES

Street Miles	Population	Pruning Cost/acre	Block Cost/acre
0	0	0	0

Estimate components

Item	Value
10 Street Miles Sampled	0
Removals	0
Total Removals (Cost)	0
Pruning	0
Total Pruning (Cost)	0
Total Pruning (Cost)	0
Total Pruning (Cost)	0
Total Pruning (Cost)	0
Total Pruning (Cost)	0
Total Pruning (Cost)	0
Total Pruning (Cost)	0

DETAILED POST-STORM CALCULATION 1: Removals and Hazard Pruning

DBH Class (Inches)	Tree Removal		Tree Pruning		Total Rows for Removal	Total Rows for Pruning
	Total of Removal Rows	Removal Rows per Tree	Total Rows for Pruning	Pruning Rows per Tree		
6-12	0	0	0	0	0	0
13-19	0	0	0	0	0	0
20-24	0	0	0	0	0	0
25-30	0	0	0	0	0	0
31-36	0	0	0	0	0	0
37-42	0	0	0	0	0	0
43+	0	0	0	0	0	0
All Rows	0	0	0	0	0	0
Total	0	0	0	0	0	0

Plot Info

Plot: _____

Plot Area: _____

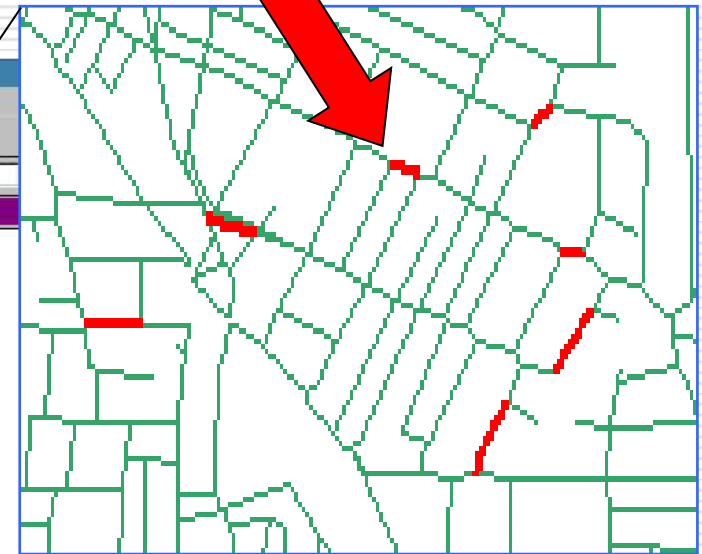
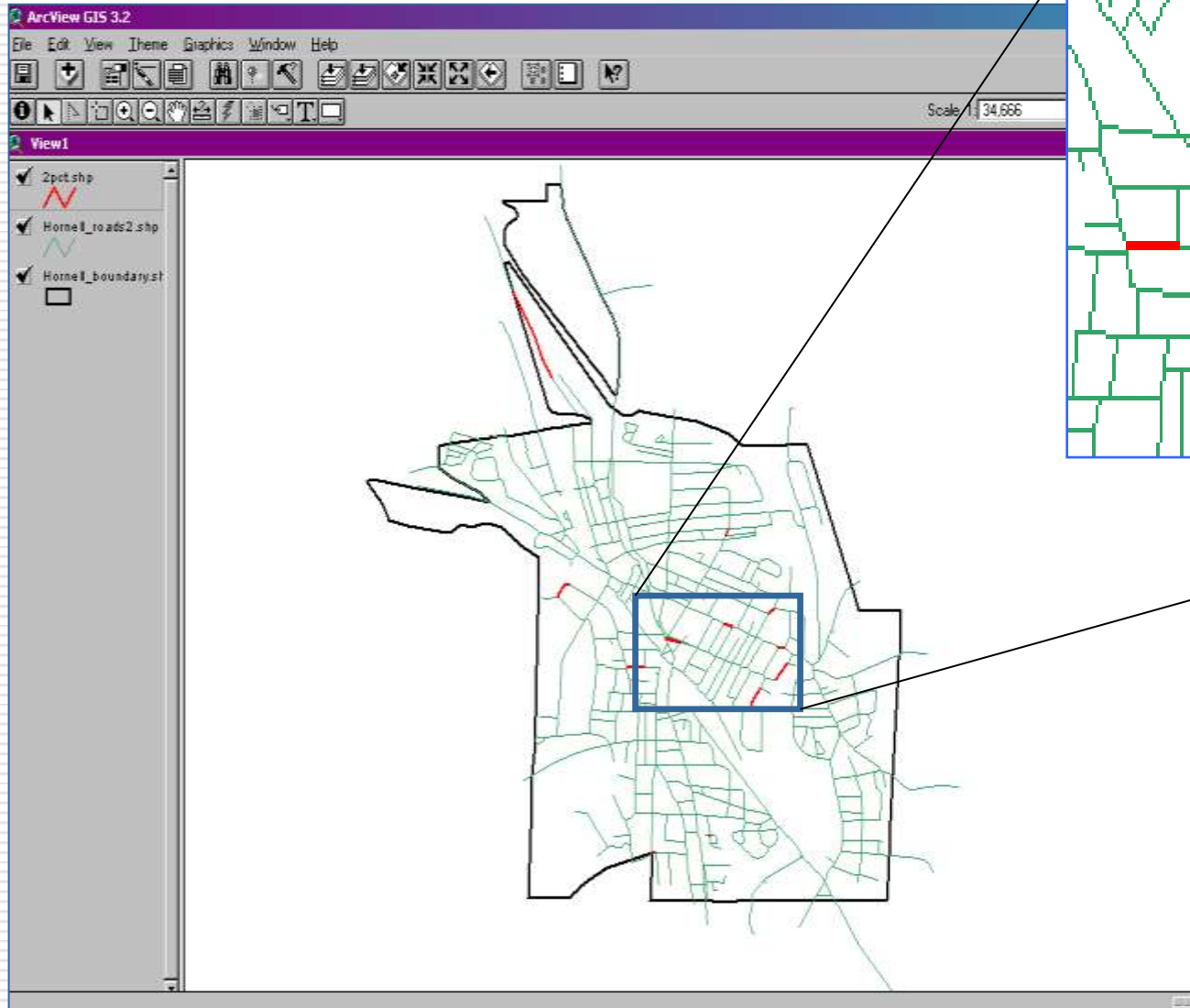
Reporting



Sampling Methods

- 🌳 2-3% of blockside mileage
 - Blockside = street segment between road/street corners or ends
- 🌳 Manual Method or Computerized Process
 - Random selection
 - 10 blockside minimum needed for analysis

Map of Sample Plots



Data Collection

Form 5A
POST-Storm Field Data Collection Sheet (Populated Areas)

Community Name ¹ :			
ON Street:		Plot Number ¹ :	
FROM Street:			
TO Street:			
Date:		Plot Length (ft/mi):	
ROW Width (feet):		Collected by:	

Start of plot description:
End of plot description:

ROW Trees ONLY								ROW + 50' Trees ²			
Tree Removals				Tree Pruning				Debris Estimate ³			
DBH Class	Tally Number of Removal Trees	Total All Removal Trees	Time Per Tree (hours)	Total Hours for Removal (to tally tree x time per tree)	Tally Hazard Prune Trees	Total All Hazard Prune Trees	Time Per Tree (hours)	Total Hours for Pruning (to tally tree x time per tree)	Rate in 100-Foot Segments	CROWN LOSS	CUBIC YARDS
6-12			3.2				0.75		0-100		
13-18			5.1				1.0		101-200		
19-24			7.7				1.5		201-300		
25-30			10.2				2.0		301-400		
31-36			12.5				3.0		401-500		
37-42			20.4				4.0		501-600		
43+			28.0				5.0		601-700		
Totals									701-800		
¹ If plot information was recorded during set up, is still the same and plot number.									Extra ⁴		
² Rate all trees as a group that fall within 50 feet of the edge of the right-of-way.									Total CL		
³ Choose either Crown Loss or Cubic Yards for the whole plot.									Average ⁴		
⁴ For plots longer than 800 feet, report average (Crown Loss) or total (Cubic Yards) of the remainder of the plot beyond 800 feet in the correct column here.									Total CY		
⁵ Average = Total ÷ Number of 100-foot segments examined.											



Overview: Pre-storm setup

- Create random sample
 - Before emergency!
 - Use electronic or manual means
- Measure tree density and size class
 - Within ROW
 - Also 50' back from ROW edge
- Take final steps
 - Pre-Storm report form: useful estimate
 - Storage for future use

Data collection: paper forms

- In disaster work, good reason to keep paper as option
 - Electricity not a concern
 - Damage possibility minimal
 - Reduces training needed
- Forms for many different situations
- Copies in User's Manual, or on web

Form 5A
POST-Storm Field Data Collection Sheet (Populated Areas)

Community Name ¹	
ON Street:	Plot Number ²
FROM Street:	
Date:	Plot Length (ft/mi):
ROW Width (feet):	Collected by:

Start of plot description:

ROW + 50' Trees ONLY						ROW + 50' Trees ¹	
DBH Range	Tally Number of Trees	Total All Removal Time Per Tree	Total Hours for Removal (all trees = time per tree)	Tally Hazard Prune Trees	Total All Hazard Prune Time Per Tree (hours)	Total Hours for Hazard Prune (all trees = time per tree)	Rate in 100-Foot Segments
6-12		3.2			0.75		0-100
13-18		5.1			1.0		101-200
19-24		7.0			1.2		201-300
25-30		12.5			3.0		401-500
31-42		20.4			4.0		501-600
Totals							701-800

¹ If plot information was recorded during set up, just fill in name and plot number.

² Rate all trees as a group that fall within 50 feet of the edge of the right-of-way.

³ Choose either Crown Loss or Cubic Yards for the whole plot.

⁴ For plots longer than 800 feet, report average (Crown Loss) or total (Cubic Yards) of the remainder of the plot beyond 800 feet in the appropriate column here.

⁵ Average = Total ÷ number of 100-foot segments examined.

Extra ³	
Total CL	
Average ⁵	
Total CY	

Form 5A
POST-Storm Field Data Collection Sheet (Populated Areas)

Community Name ¹ :			
ON Street:		Plot Number ¹ :	
FROM Street:			
TO Street:			
Date:			
ROW Width (feet):		Plot Length (ft/mi):	
Collected by:			

Start of plot description:

End of plot description:

ROW Trees ONLY								ROW + 50' Trees ²			
Tree Removals				Tree Pruning				Debris Estimate ³			
DBH Class	Tally Number of Removal Trees	Total All Removal Trees	Time Per Tree (hours)	Total Hours for Removal (tally trees x time per tree)	Tally All Hazard Prune Trees	Total All Hazard Prune Trees	Time Per Tree (hours)	Total Hours for Prune (tally trees x time per tree)	Rate in 100-Foot Segments	CROWN LOSS	CUBIC YARDS
6-12			3.2				0.75		0-100		
13-18			5.1				1.0		101-200		
19-24			7.7				1.5		201-300		
25-30			10.2				2.0		301-400		
31-36			12.5				3.0		401-500		
37-42			20.4				4.0		501-600		
43+			28.0				5.0		601-700		
Totals									701-800		
¹ If plot information was recorded during set up, just fill in name and plot number.								Extra ⁴			
² Rate all trees as a group that fall within 50 feet of the edge of the right-of-way.								Total CL			
³ Choose either Crown Loss or Cubic Yards for the whole plot.								Average ⁵			
⁴ For plots longer than 800 feet, report average (Crown Loss) or total (Cubic Yards) of the remainder of the plot beyond 800 feet in the correct column here.								Total CY			
⁵ Average = Total ÷ number of 100-foot segments examined.											

Form 5B
POST-Storm Field Data Collection Sheet (Rural Areas)

Community Name ¹ :	
ON Road:	Plot Number ¹ :
Intersection nearest to plot start:	
Approximate distance to intersection:	
Date:	
ROW Width (feet):	Plot Length (feet):
Collected by:	

Start of plot:

End of plot:

ON Right-of-Way Trees (Count trees on both sides of the road)							
Tally of hazardous removal ROW trees	Total Number of hazardous removal ROW trees	Avg. Time ⁶ per Removal	Total Hours Removal (tally trees x time per removal)	Tally of hazardous prune ROW trees	Total Number of hazardous prune ROW trees	Avg. Time ⁶ per Prune	Total Hours Hazard Prune (tally trees x time per prune)
		6.2				2.5	
Totals							

Debris estimate ⁴		
Rate in 100-Foot Segments	Crown Loss	Cubic Yards
0-100		
101-200		
201-300		
301-400		
401-500		
501-600		
601-700		
701-800		
Extra ⁵		
Total CL		
Average ⁵		
Total CY		

¹ If road and plot information was recorded during set up, just fill in name and plot number.

² On rural roads, removals are only recorded for large trees already in failure. Time has been reduced 50% from the urban rate, and excludes stump removal.

³ On rural roads, time per prune is for pruning of broken or hazardous branches greater than 4 inches only. Time has been reduced 50% from urban rate, and does not include other pruning.

⁴ Choose Crown Loss or Cubic Yards for the plot. Estimate Crown Loss with one of these values: 12.5 (0-25%), 37.5 (25-50%), 62.5 (51-75%), or 87.5 (76-100%).

⁵ For plots longer than 800 feet, report average (Crown Loss) or total (Cubic Yards) of the rest of the plot beyond 800 feet in the correct column here.

⁶ Average = Total CL ÷ # of 100' segments

Data Collection: Desktop Interface

- Manage Users
- Community Values
- Reference Data
 - TIGER
 - manual
- ROW Info
- Export Data



The screenshot displays the i-Tree Storm desktop interface. At the top, the i-Tree logo is shown with the text "i-Tree Storm" and "A Storm Damage Assessment Tool". Below the logo, there is a "Select Analysis:" dropdown menu set to "storm". The main section is titled "Setup Questions: i-Tree Storm" and contains several questions with input fields and buttons.

1. What is your cost per CY3 for total debris management?

2. Tree removal

3. Tree pruning

4. What is the street mileage of all roads you manage?

5. What was the source of your tree density numbers?

6. What sampling method did you use?

7. How did you get your post-storm information?

8. How many hours does it take to remove and prune a tree for each size class?

DBH class	Removal Hours	Pruning Hours
8-12	5.75	2.75
13-18	6.50	3.00
19-24	7.50	3.50
25-30	10.00	4.00
31-36	12.50	4.50
37-42	15.00	5.00
43+	18.00	6.00
Null		
(All Trees)	6.25	2.50

Data Collection: Desktop Interface

Setup Questions: i-Tree Storm

1. What is your cost per CuYd for total debris management?

Help

2. Tree removal

Hourly rate?

3. Tree pruning

Hourly rate?

4. What is the street mileage of all roads you manage?

Help

5. What was the source of your tree density numbers?

6. What sampling method did you use?

7. How did you get your post-storm information?

8. How many hours does it take to remove and prune a tree for each size class?

DBH class	Removal Hours	Pruning Hours
6-12	3.70	0.75
13-18	5.10	1.00
19-24	7.70	1.50
25-30	10.20	2.00
31-36	12.50	3.00
37-42	20.40	4.00
43+	28.00	5.00
Rural (All Trees)	6.20	2.50

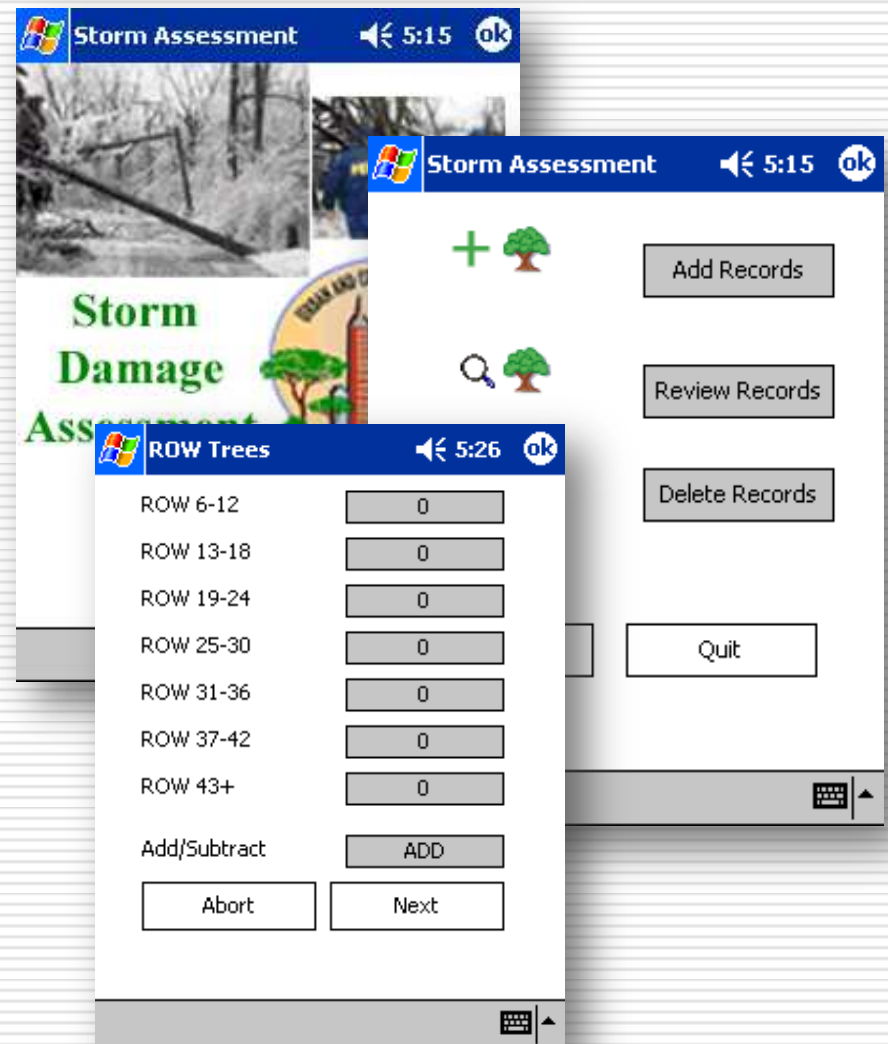
PDA Setup Interface

- Management of process, data and applications
- Simple, intuitive



Data collection: PDA

- Installed on handheld through Start menu
- Data uploaded automatically during synchronization



Estimating Costs

i-Tree Storm



Community: Burlington

Report Date: 22-Jul-09

This report was generated by i-Tree Storm v3.0.

Source: <http://www.itreetools.org>

COMMUNITY VALUES			Sampling
Correct numbers to right as needed	Street Miles	125.0	TL
	Removal Cost/hr	\$55.00	
	Pruning Cost/hr	\$55.00	% Street Miles
	Brush Cost/cu yd	\$15.00	1.6%
Based on Sample Data	Tree density per 100' (ROW + 50')	5.6	No. Samples
Precision Level *	Low		20

* Precision Level indicates overall reliability of input data (see User's Manual)

STORM DAMAGE COST ESTIMATE		\$10,079,769
Component	Estimate	± SE *
Removals	94,240	832
Total Removal Hours	94,240	10,852
Total Removal Cost	\$5,183,174	\$596,865
Hazard Prune	7,100	665
Total Pruning Hours	14,769	1,407
Total Pruning Cost	\$812,322	\$77,397
Total Debris cu yds	272,285	27,155
Total Debris Cost	\$4,084,273	\$407,325

* SE of Total Debris cu yds is calculated only on direct CY estimates; crown loss estimates are ignored

DETAILED POST-STORM CALCULATION: Hazard Removal and Pruning

DBH Class (inches)	ON Right-of-Way Trees							
	Hazard Tree Removal				Hazard Tree Pruning			
	Total of Removal Trees	Removal Time per Tree	Total Hours for Removal	Total Hours SE	Total of Prune Trees	Hazard Prune Time per Tree	Total Hours for Hazard Prune	Total Hours SE
6-12	9	3.70	33.3	±19.11	8	0.75	6.0	±1.35
13-18	29	5.10	147.9	±29.67	26	1.00	26.0	±5.76
19-24	25	7.70	192.5	±38.47	24	1.50	36.0	±7.87
25-30	31	10.20	316.2	±56.31	23	2.00	46.0	±10.02
31-36	24	12.50	300.0	±52.68	12	3.00	36.0	±9.36
37-42	12	20.40	244.8	±103.78	12	4.00	48.0	±11.48
43+	9	28.00	252.0	±99.33	7	5.00	35.0	±8.73
All Rural	0	6.20	0.0	±0.00	0	2.50	0.0	±0.00
Totals	139		1486.7	±171.20	112		233.0	±22.20



Storm User's Manual

Storm User's Manual

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What kinds of storms do you anticipate? Ice storms, hurricanes and floods, smaller-scale disasters?

Different disaster types present different damage and debris profiles, requiring some adjustment to the use of Storm.

Ice Storms: Ice storms tend to have relatively widespread and uniform damage, and the debris is almost exclusively vegetative. Furthermore, the ice-laden debris usually remains at its initial landing place and is not moved around by natural forces. These characteristics permit quick, accurate estimates of potential and actual damage and costs from a small random sample.

What Type of Storm?

Hurricanes and floods: Hurricanes and many floods also produce widespread damage, and Storm will work well to produce a quick estimate of actual damage and costs. A Hurricane Adaptation has been incorporated into Storm that makes use of actual data and practices from a 10% random sample of communities in Florida following the 2004-2005 hurricane seasons. For pre-storm assessments, the Hurricane Adaptation version (beta) predicts average vegetative debris loads based on street mileage and a choice of three damage levels. Because general averages are used, the estimates tend to be more accurate at the larger scale than at the very local level.

What Type of Storm?

Smaller-Scale Disasters: Smaller-scale disasters, including tornados, derechos (straight-line storms associated with thunderstorms), and some floods, present sampling problems since they affect smaller areas. To estimate the damage caused by smaller-scale disasters, the following procedure may be used:

Determine the rough geographic area affected by the disaster. It may be necessary to assess this based on a quick survey of the area, for example, by driving toward the area from different directions and noting where the damage begins, or by using aerial data if available.

Draw a boundary around the affected area on a street map or in the GIS file used for sampling.

Determine the total street miles in the affected area using the scaled map or standard GIS tools.

Establish a suitable sample of the street segments in the area.

What Type of Storm?

Does your community include rural (unpopulated) roads?

Data collection for rural roads differs slightly from data collection in populated areas. This is mainly because in populated areas FEMA will reimburse costs for debris that can be hauled to the curbside by residents, so trees 50 ft beyond the right-of-way are included in estimations of potential debris. There are manual forms specifically for rural areas and rural plots can be identified in the plot list and PDA.

Rural Roads?

Springfield Massachusetts

June 1, 2011 Tornado



INFORMATIONAL BRIEF

3.0

June 23, 2011

Kipling Street
East Forest Park
Springfield, MA



Tornado Damage Quick Facts Impacts on Springfield's Street Trees

On June 1, 2011 a series of three tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 136 to 165 mph, according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 39 miles from Westfield to Charlton, killing three people and injuring 200. In Springfield, the tornadoes impacted city's South End, Six Corners, East Forest Park and Sixteen Acres neighborhoods.

In the neighborhoods of Springfield affected by the storms, damage to the street trees was extensive, destroying or severely many of the public trees growing in these areas. A team of US Forest Service and City of Springfield personnel conducted a preliminary review of the streets in these neighborhoods, and an initial summary of the storm impacts was developed.

A preliminary review of the storm damage to Springfield public street trees follows here:

- 87 miles of the 540 total miles of city streets were impacted by the storms;
- 16.1 % of Springfield's streets showed some damage to the public trees growing on them;
- Approximately 1,340 of the 3,830 streets trees, growing in the impacted areas, were destroyed or severely damaged, necessitating removal;
- Immediate impacts include the reduction of rainwater interception by 2,444,252 gallons;
- Reduced storage of 7,220,361 pounds of carbon;
- Approximately 331,232 pounds of sequestered CO₂ has been lost.

For more information please contact:



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i-Tree Streets Analysis of Springfield Tornado Impact Zone



Annual Loss in Benefits of Springfield's Street Trees

Annual Benefits of Impact Zone Street Trees

Benefit	Quantity	Impact Zone Value	Loss Value
Energy Saved			
Electricity (MWh)	360.6	\$18,393	\$4,598
Natural Gas (therms)	129,018.6	\$85,439	\$29,903
Total (\$)		\$103,832	\$34,501
Carbon Dioxide			
CO ₂ Sequestered (lbs)	946,377	\$3,123	\$1,093
CO ₂ Released (lbs)	-244,714	-\$808	-\$283
CO ₂ Avoided (lbs)	1,086,259	\$3,585	\$1,255
Total (lbs, \$)	1,787,922	\$5,900	\$2,065
Air Quality			
Avoided pollutants* (lbs)	4954	\$21,451	\$7,508
Deposited pollutants** (lbs)	4264	\$22,958	\$8,035
BVOC emitted (lbs, \$)	-1,140	-\$2,634	-\$922
Total (lbs, \$)	8,078	\$41,775	\$14,621
Storm Water			
Rainfall intercepted (gal)	6,983,576	\$55,872	\$19,555
Aesthetic/Other			
Added Property Value		\$140,569	\$49,199
TOTAL VALUE		\$347,948	\$121,782

*NO 2, SO 2, VOC, PM10 **O 3, NO 2, PM10, SO 2



An Initial Report on the Status of Street Trees in Springfield, Massachusetts



Tornado Damage to Springfield's Street Trees

June 2011

prepared for:

The City of Springfield, Massachusetts

prepared by:

Alex Sherman, City of Springfield
Rob Dill, City of Springfield
Edward Casey, City of Springfield



David V. Bloniarz, USDA Forest Service
Northern Research Station



INFORMATIONAL BRIEF

July 7, 2011

Arcadia
Boulevard
Springfield, MA



Tornado Damage Quick Facts

Impacts on Springfield's Urban Forest

On June 1, 2011 a series of three tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 136 to 165 mph, according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 39 miles from Westfield to Charlton, killing three people and injuring 200. In Springfield, the tornadoes impacted city's South End, Six Corners, East Forest Park and Sixteen Acres neighborhoods.

In the neighborhoods of Springfield affected by the storms, damage to the urban forest canopy was extensive, destroying or severely many of the trees growing in these areas. A team of US Forest Service and City of Springfield personnel conducted a preliminary review of the streets in the impacted neighborhoods, and utilized i-Tree modeling software to analyze the impacts of the storms on the urban forest, and an initial summary of the damage was developed.

A preliminary review of the storm damage to Springfield's urban tree canopy follows here:

- Based on initial estimates, over 13,000 trees were destroyed or severely damaged;
- Immediate impacts include the reduction of rainwater interception by over 7.5 million gallons per year;
- Reduced storage of over 30 million pounds of carbon annually;
- Approximately 1.4 million pounds of sequestered CO₂ has been lost.

For more information please contact:



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Canopy Analysis of Springfield Tornado Zone



i-Tree Canopy Analysis of Springfield Tornado Zone

- Based on initial estimates, over 13,000 trees were destroyed or severely damaged;
- Immediate impacts include the reduction of rainwater interception by over 7.5 million gallons per year;
- Reduced storage of over 30 million pounds of carbon annually;
- Approximately 1.4 million pounds of sequestered CO₂ has been lost.



SPRINGFIELD TORNADO IMPACTS ON TREE CANOPY, TEMPERATURE & HUMIDITY



Fall 2011
USDA Forest Service
Northern Research Station



TREE CANOPY LOSS IN THE TORNADO
IMPACT ZONE WAS EXTENSIVE, WITH MANY
LARGE SHADE TREES DESTROYED.

The June 2011 Massachusetts tornado profoundly altered the landscape over a wide geographic area.

On June 1, 2011 a series of tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 136 to 165 mph,

according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 69 miles from Westfield to Charlton, killing

three people and injuring 200. In Springfield, the tornadoes impacted city's South End, Upper Hill, Metro Center, Six Corners, East Forest Park and Sixteen Acres neighborhoods.



CANOPY LOSS



TREE FAILURE

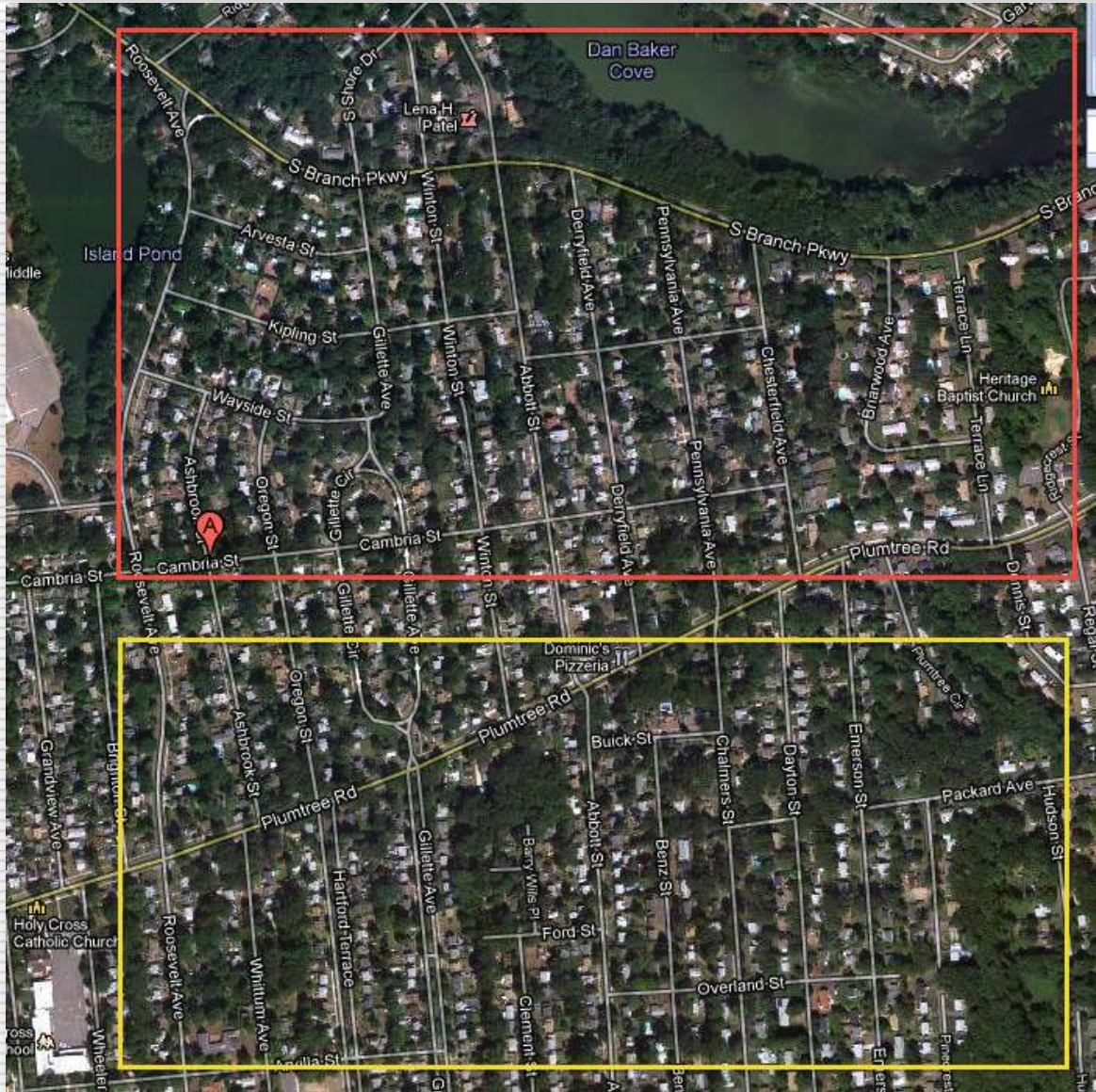


STRUCTURE DAMAGE

Micro-climate Changes in Springfield's Tornado Zone



Micro-climate Changes in Springfield's Tornado Zone



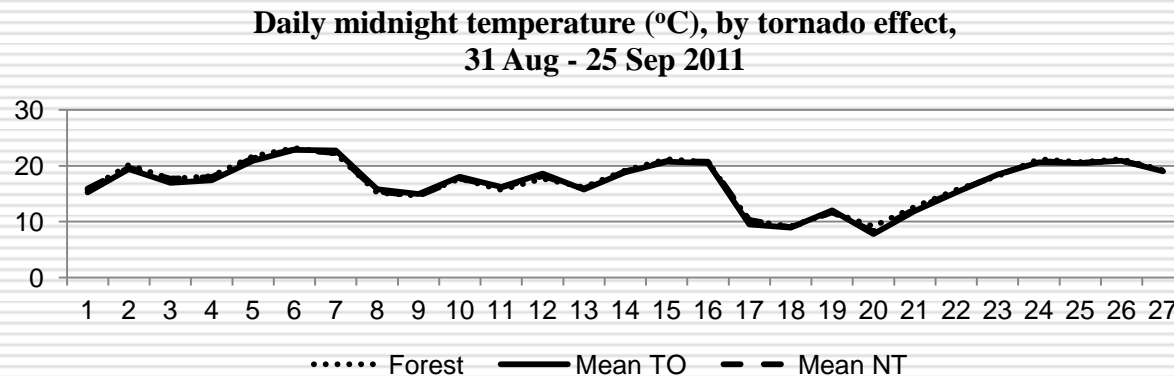
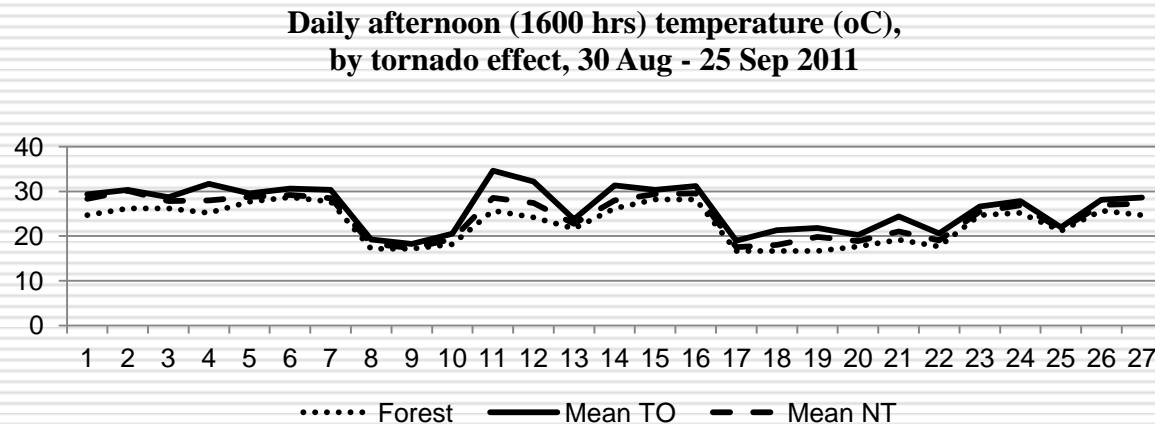
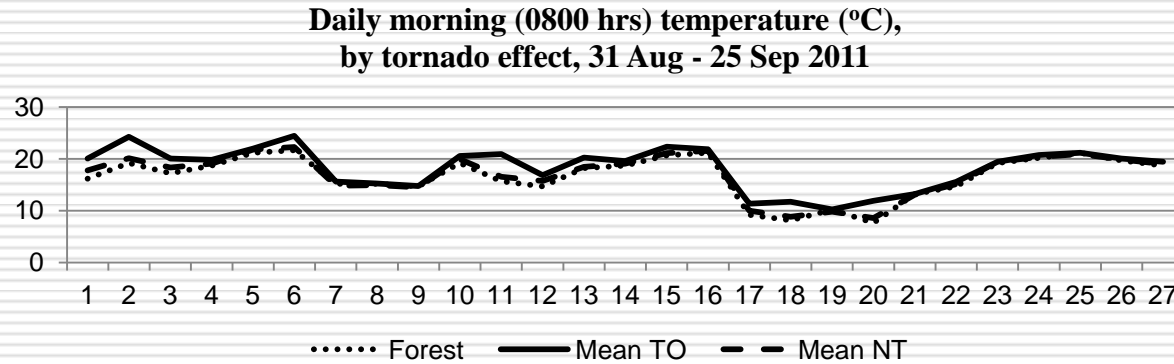
Micro-climate Changes in Springfield's Tornado Zone



Micro-climate Changes in Springfield's Tornado Zone

	Tornado	Non-tornado	Forest
% canopy cover	0.8	44.2	99.7
Morning (0800 hrs)			
Temperature	18.2	17	16.6
%RH	95.4	96	99.4
Afternoon (1600 hrs)			
Temperature	26.4	24.6	22.9
%RH	64.3	67.1	80
Midnight			
Temperature	17	17.1	17
%RH	97.2	95.2	97.6

Figure 2. Daily street-side temperatures (°C) by time of day, East Forest Park, Springfield, MA, 30 Aug – 26 Sep 2011.



Urban Forest Strike Team



Urban Forest Strike Team



Assessing Storm Damage in Urbanized Landscapes: Preparation, Response & Recovery



David Bloniarz, USDA Forest Service





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June 1, 2011: Springfield in Nature's Crosshairs



On June 1, 2011 a series of three tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 136 to 165 mph, according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 35 miles from Westfield to Chatham, killing three people and injuring 200.

The main path of the storm followed a track through the city of Springfield, MA impacting many of its neighborhoods including the South End, Sox Corners, Old Hill, Upper Hill,

East Forest Park and Sixteen Acres neighborhoods. The tornado resulted in major damage to city infrastructure including many buildings and dwellings, power lines, and public shade trees. In the neighborhoods of Springfield affected by the storm, damage to the street trees was extensive, destroying or severely damaging many of the public trees growing in these areas.

The Tornado has left a mark on the City of Springfield that will take many years to erase. This is no more evident than with the loss of the tree resource within the impact zone. The landscape will never be the same as before the storm and it will take many years to recover the canopy cover lost in some areas. While this loss is a tragedy, with reforestation efforts and proper management, the urban forest in these areas can be healthier than it ever has been. There is a great opportunity to apply the latest knowledge and professional practices of urban forestry to ensure healthy and vigorous trees will once again line the streets of the neighborhoods affected.



With your help, Springfield will be able to regreen the devastated neighborhoods and restore its urban forest canopy. Please join in the effort by planting a tree in your own yard, helping to plant trees along our streets and in our parks, or donate your time or funds to neighborhood greening efforts. With your help, Springfield's urban forest will be restored...one tree at a time.

USEFUL LINKS

- [City of Springfield Official Tornado Recovery Website](#)
- [Massachusetts DCR Urban & Community Forestry](#)
- [Massachusetts Tree Wreckers & Foresters Association](#)
- [Springfield Arbor Allies](#)
- [Urban Extension - Nursery & Urban Forestry](#)
- [USDA Forest Service Urban & Community Forestry](#)

RECENT POSTS

- [US Forest Service Completes Tree Survey Work](#)
- [Court Square to get 4 New Oak Trees](#)
- [First Tree Planted in Regreening Springfield Effort](#)
- [PeopleLink Donates \\$80,000 for Regreening Efforts](#)
- [Tree Survey Work Underway Along South End Streets](#)

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