

3-D Visualization of Forest Landscape with Fire and Other Disturbances

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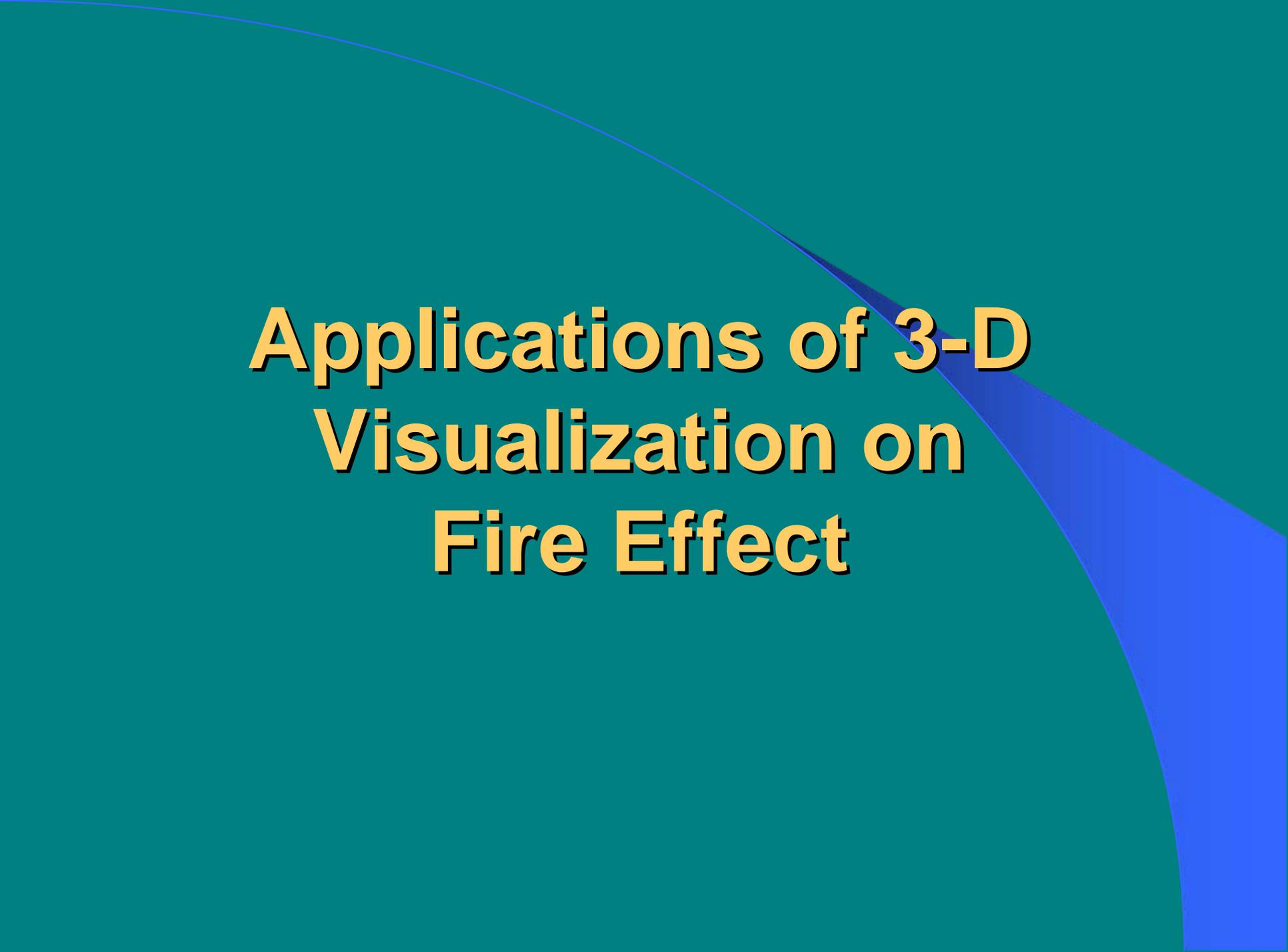
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Project web site

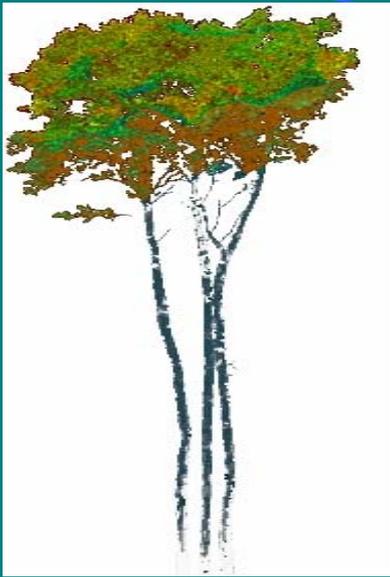
http://research.eeescience.utoledo.edu/lees/research/jfsp/index_files/slide0001.htm



Applications of 3-D Visualization on Fire Effect



Designing Burned Trees with Different Severity



Aspen



Basswood



Basswood



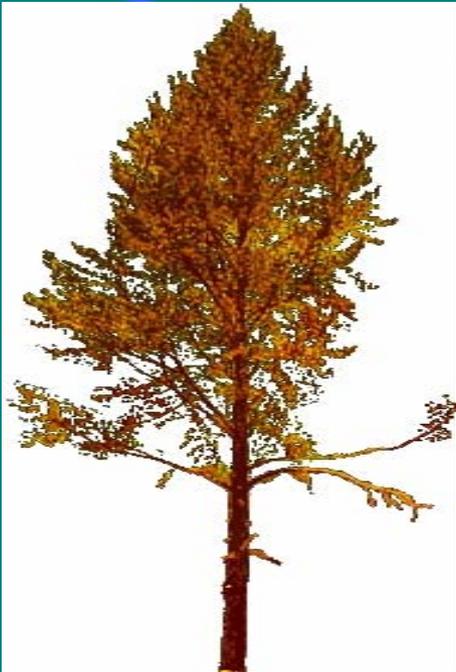
Bigtooth Aspen



Birch



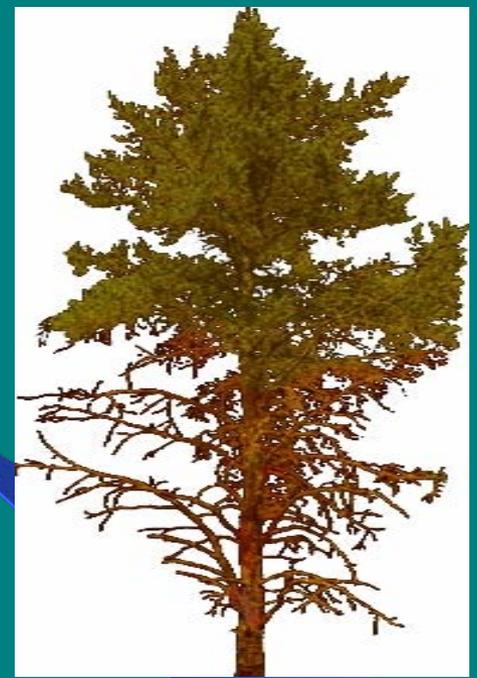
Black Oak



Red Pine



Jack Pine



Jack Pine



Jack Pine



Maple



Red Pine



Pond Pine



Maple



Maple 2



Aspen



Basswood



Bigtooth Aspen



Birch



Black Oak



Red Pine



Jack Pine



Jack Pine



Jack Pine



Longleaf 4-d



Longleaf 5-c



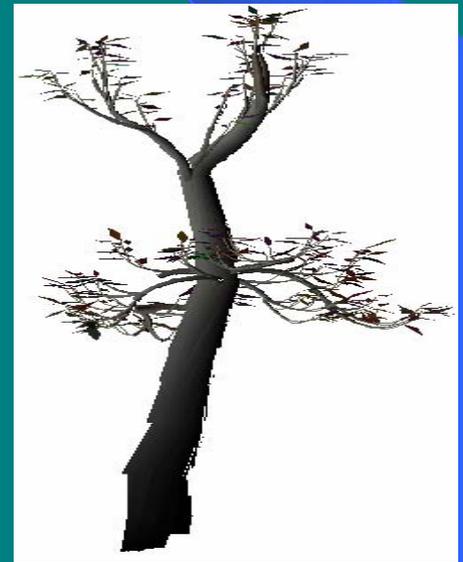
Longleaf pine 5-d



Broadleaf



Broadleaf



Broadleaf



Snag 4-b



Longleaf 3-c



Loblolly Pine
sapling



Loblolly Pine



Snag 1-a



Snag 5-a



Loblolly Pine

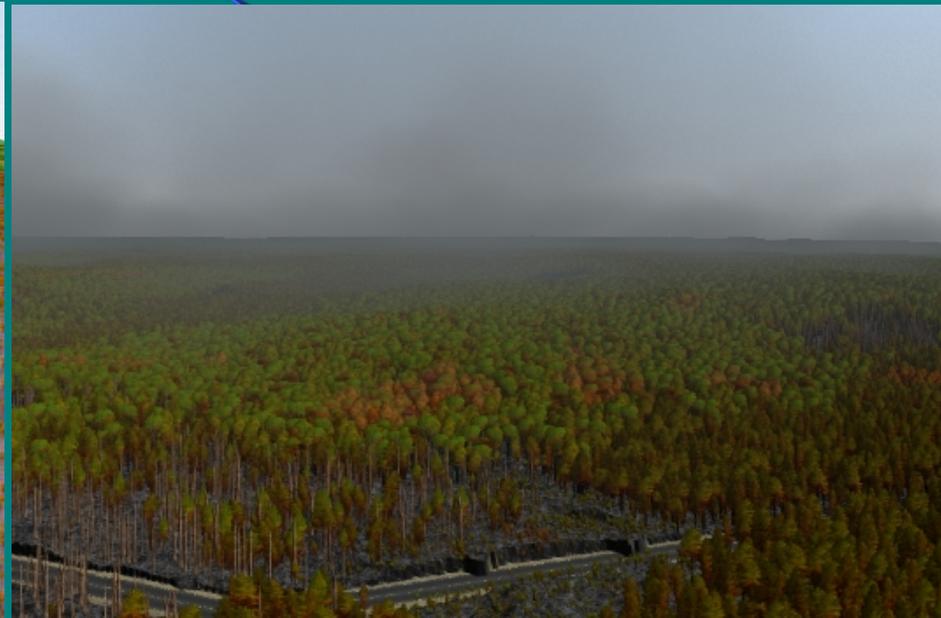
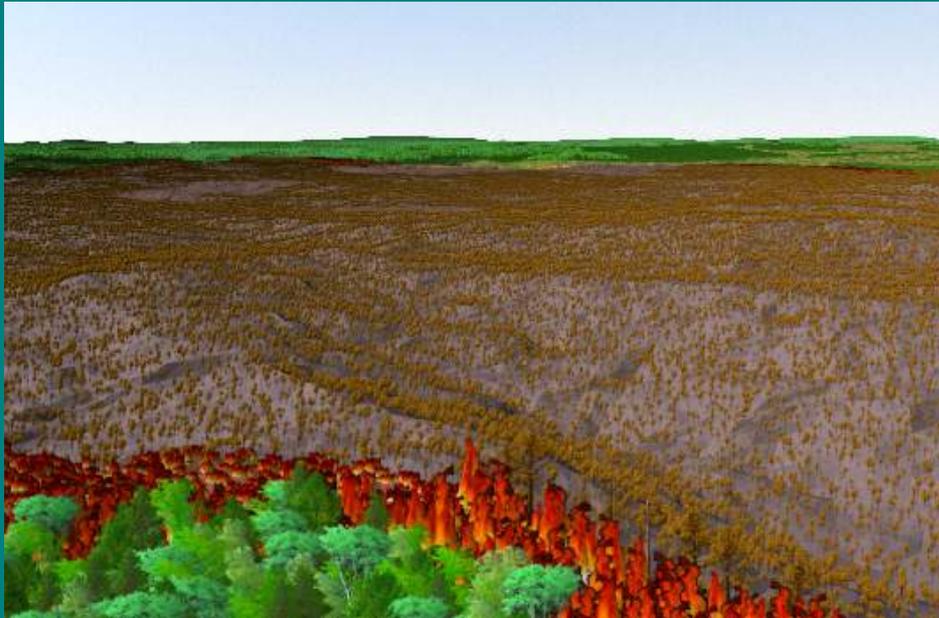


Longleaf 3-d

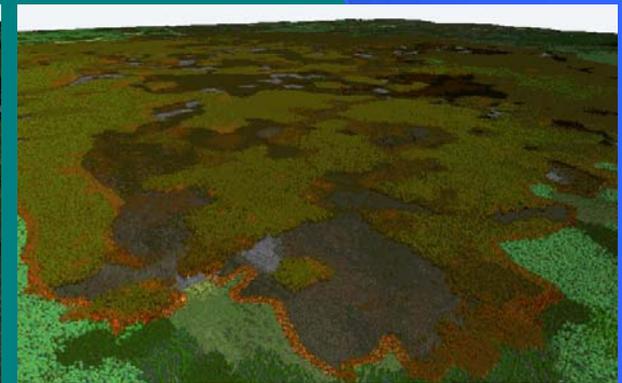
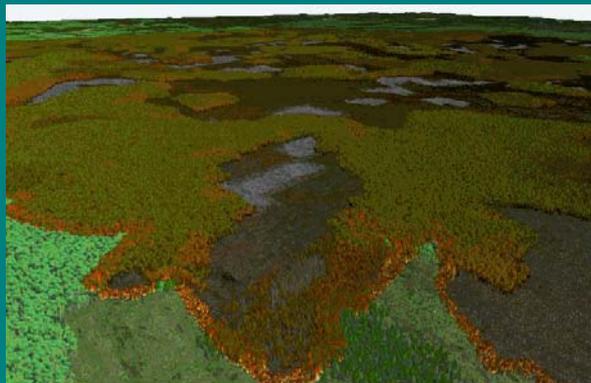
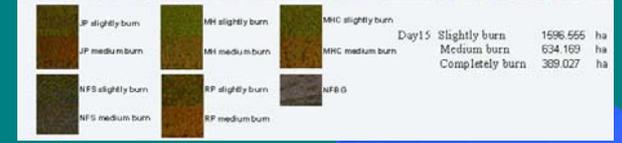
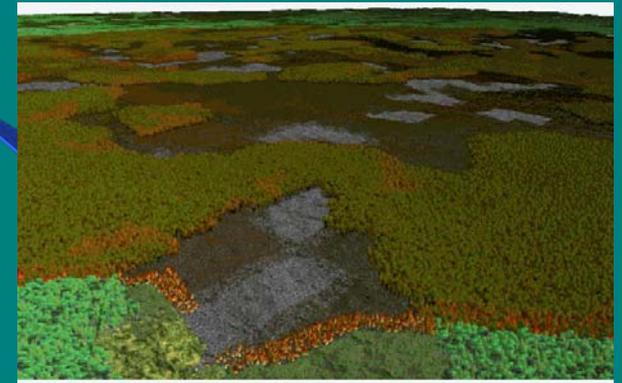
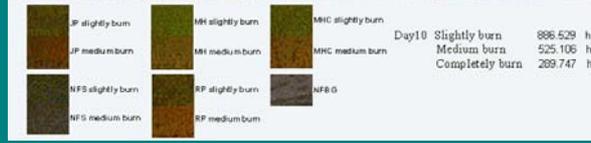
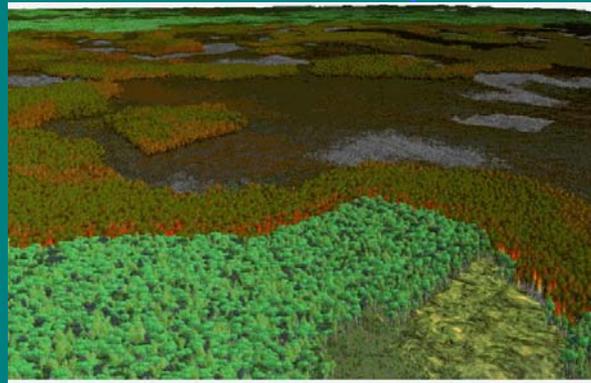
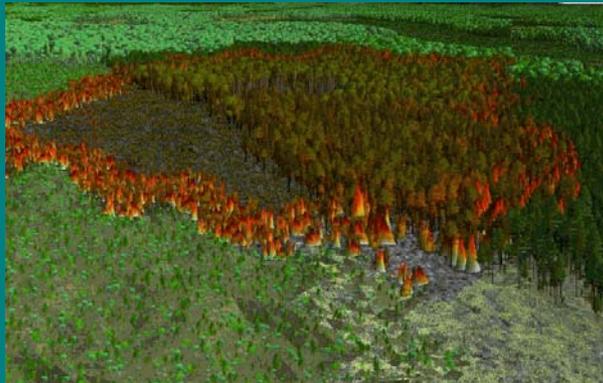


Longleaf 4-c

Visualization examples of burned landscapes



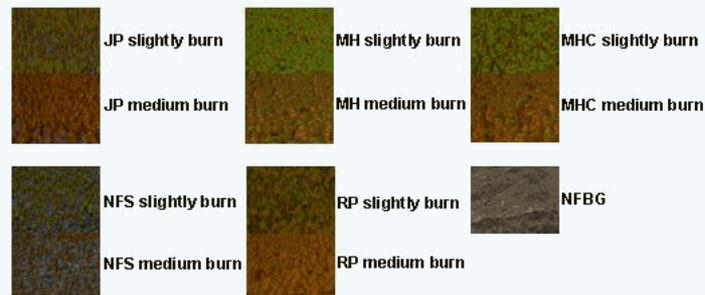
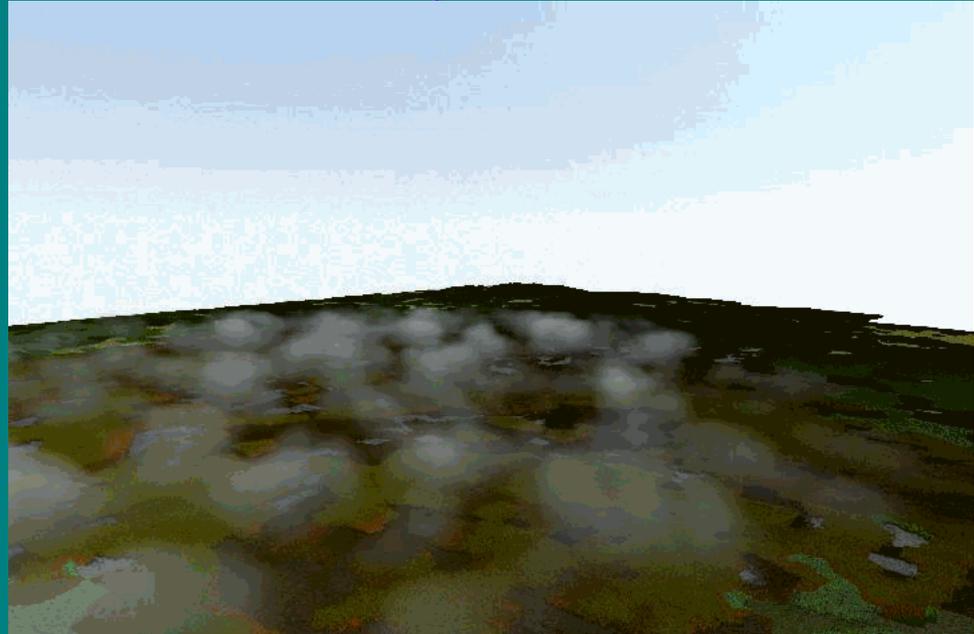
Visualization examples from FARSITE model output:



Northern Fire with Smoke

Visualization of the fire effects in north Chequamegon National Forest after its extinction based on FARSITE model output. The flying path is from southwest to northeast. Camera elevation started from 2000m and descended to 500m, and kept this elevation to the end of the animation. There are 3 burning intensities were shown, slightly burn, medium burn, and completely burn. For the completely burned forest, only snags were shown. Other two burning intensities were differentiated by tree images (see the legend).

Please wait to watch the movie. Be patient, the movie can be slow

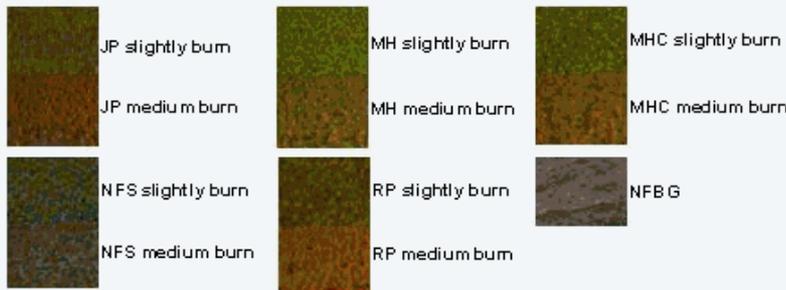
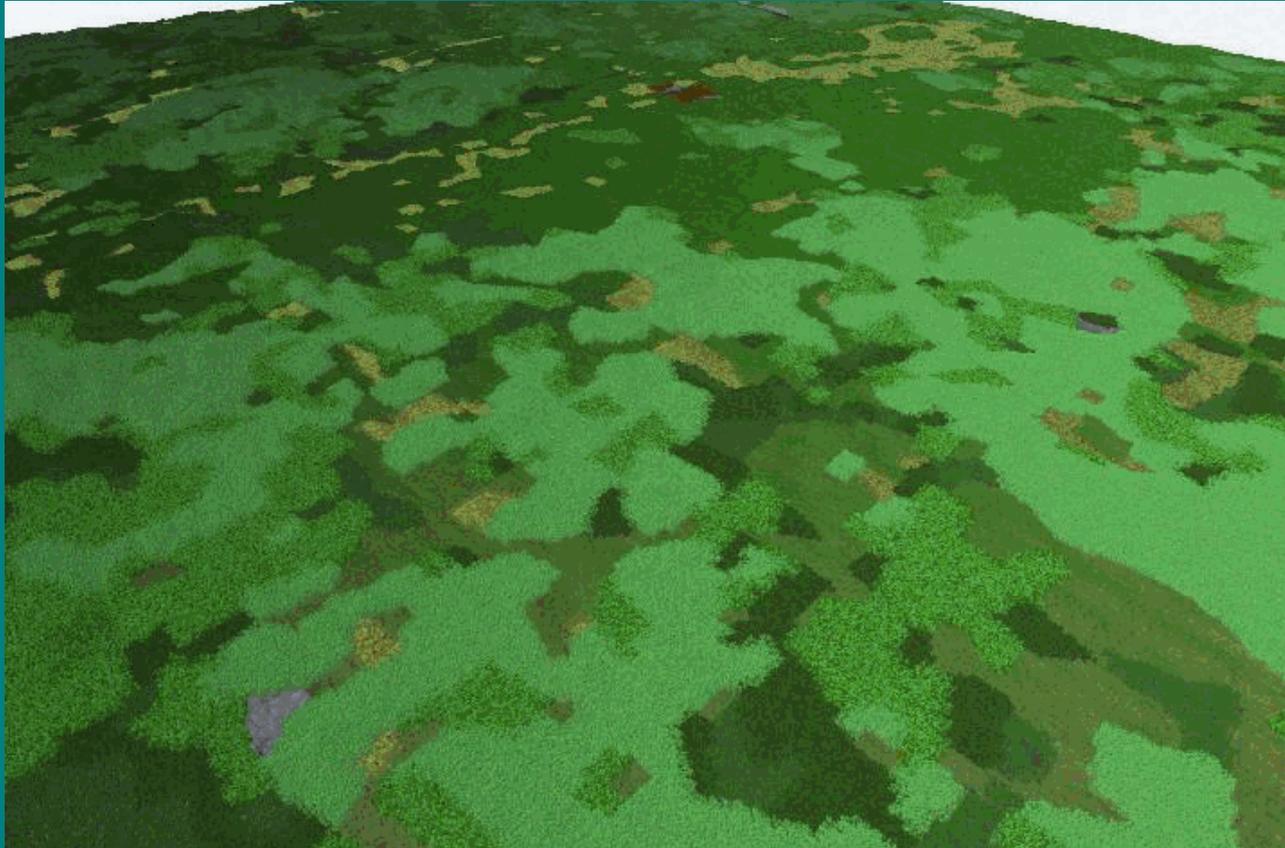


**Fire Severity classification from the output of FARSITE
fire model showing the fire spreading over the
landscape from Day 1 to Day 27**

- 1. Dark shows unburned area**
- 2. Dark gray shows intermediate burned**
- 3. Light gray shows heavier intermediate burned**
- 4. White shows totally burned**

**Please wait to watch the
movie. Be patient, the
movie can be slow**

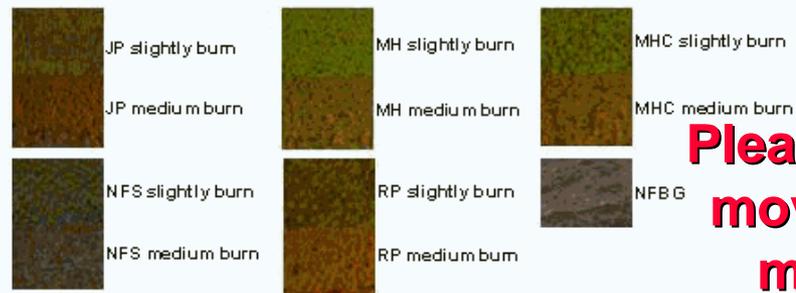
3-D visualization from the output of FARSITE fire model showing the fire spreading over the landscape from Day 1 to Day 27



Day1	Slightly burn	16.401	ha
	Medium burn	5.177	ha
	Completely burn	3.959	ha

Please wait to watch the movie. Be patient, the movie can be slow

3-D visualization of flythrough of the landscape from the output of FARSITE fire model on Day 27



Please wait to watch the movie. Be patient, the movie can be slow

3-D visualization showing not only the flythrough of the landscape, but also the dynamics of the fire spreading over the landscape from Day 1 to Day 27 based on FARSITE fire model



JP slightly burn



JP medium burn



MH slightly burn



MH medium burn



MHC slightly burn



MHC medium burn

Day1	Slightly burn	16.401	ha
	Medium burn	5.177	ha
	Completely burn	3.959	ha

NFS slightly burn

NFS medium burn



RP slightly burn

RP medium burn

NFBG

Please wait to watch the movie. Be patient, the movie can be slow

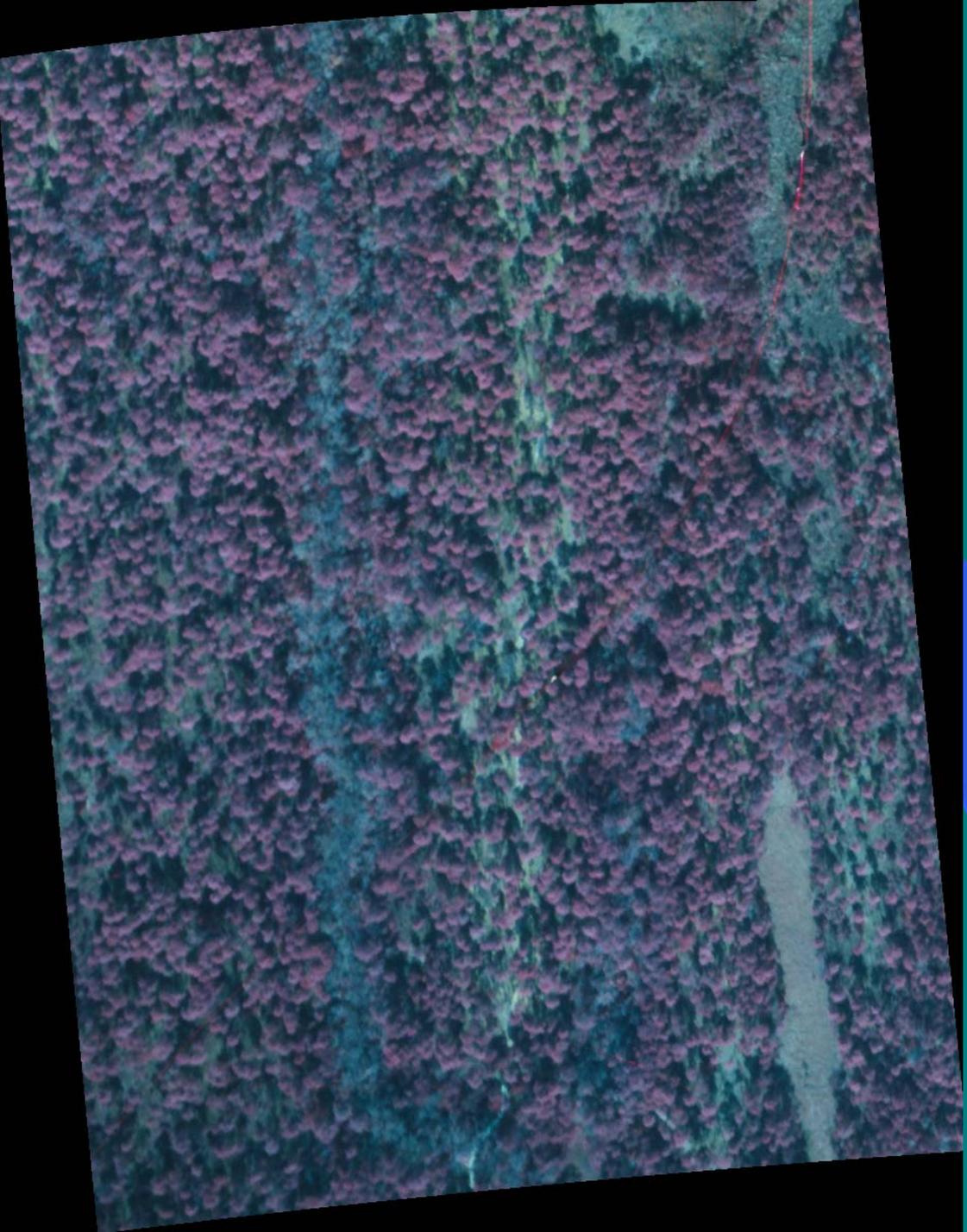


Visualization of past forest conditions from historical aerial photography

This visualization is on Hurricane effect, but the principle works for visualization of fire and other disturbances, too

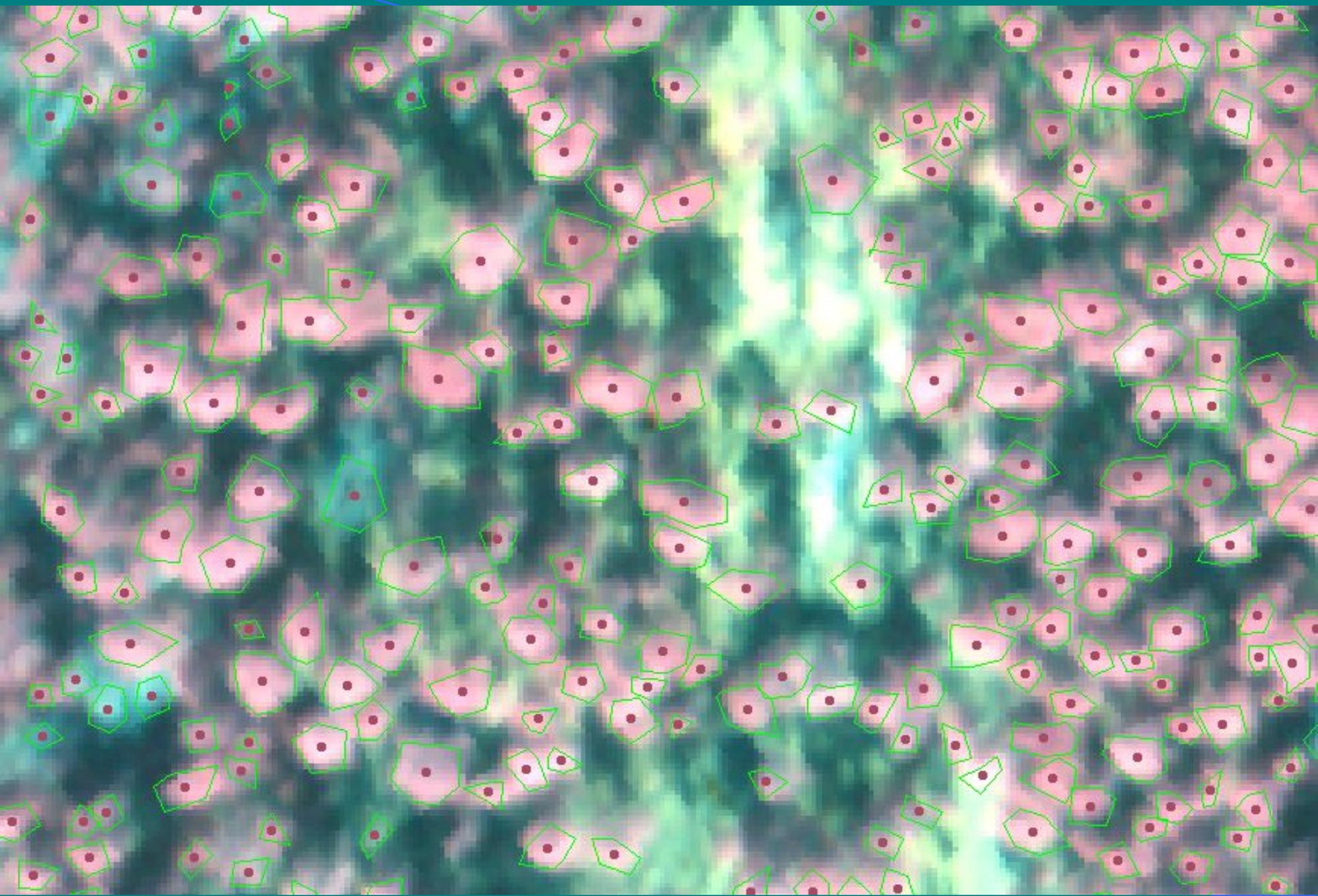


Reproducing a stand as it was in 1976



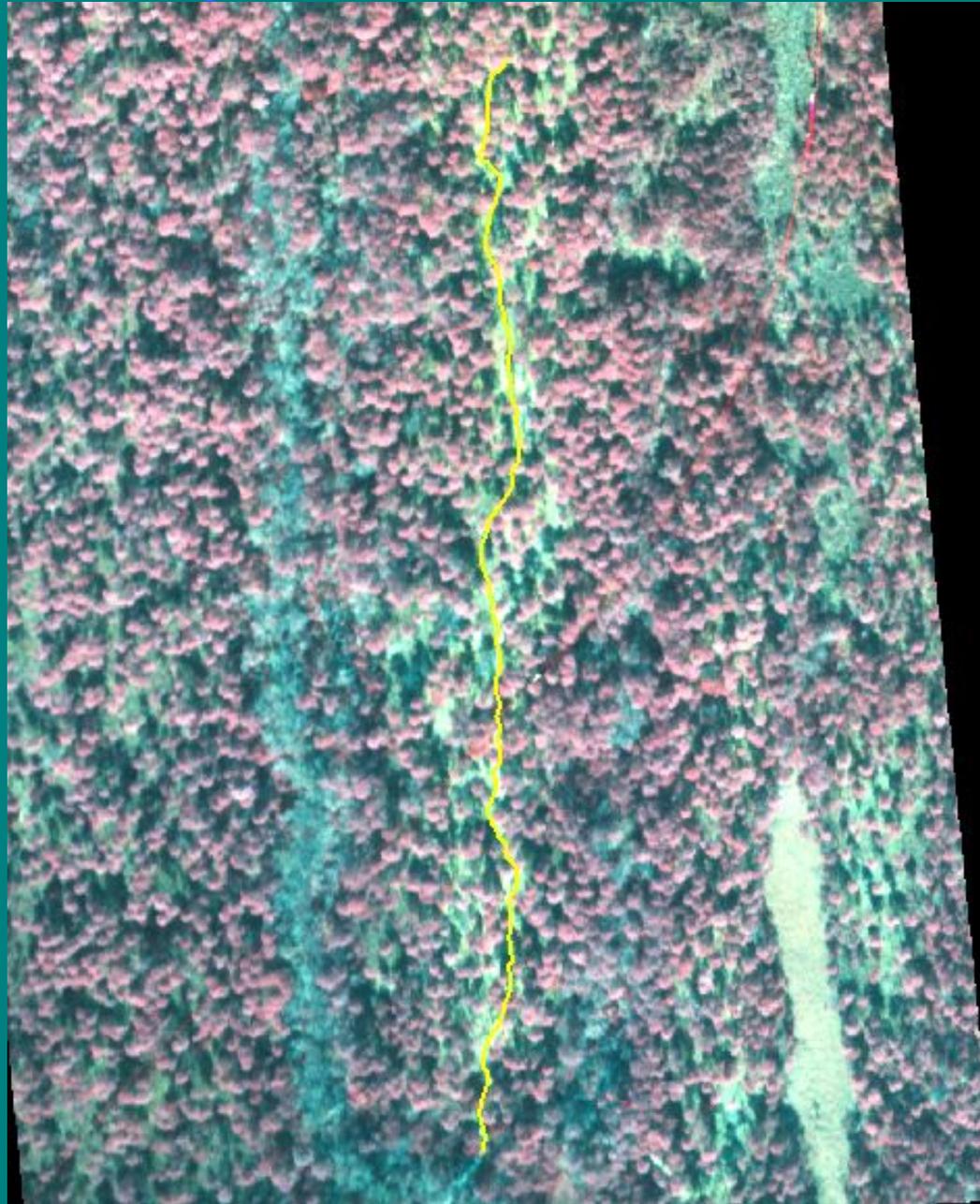
1990 after
Hurricane
Hugo







Drive down the road





Visual Comparison of Hurricane Effect, before and after

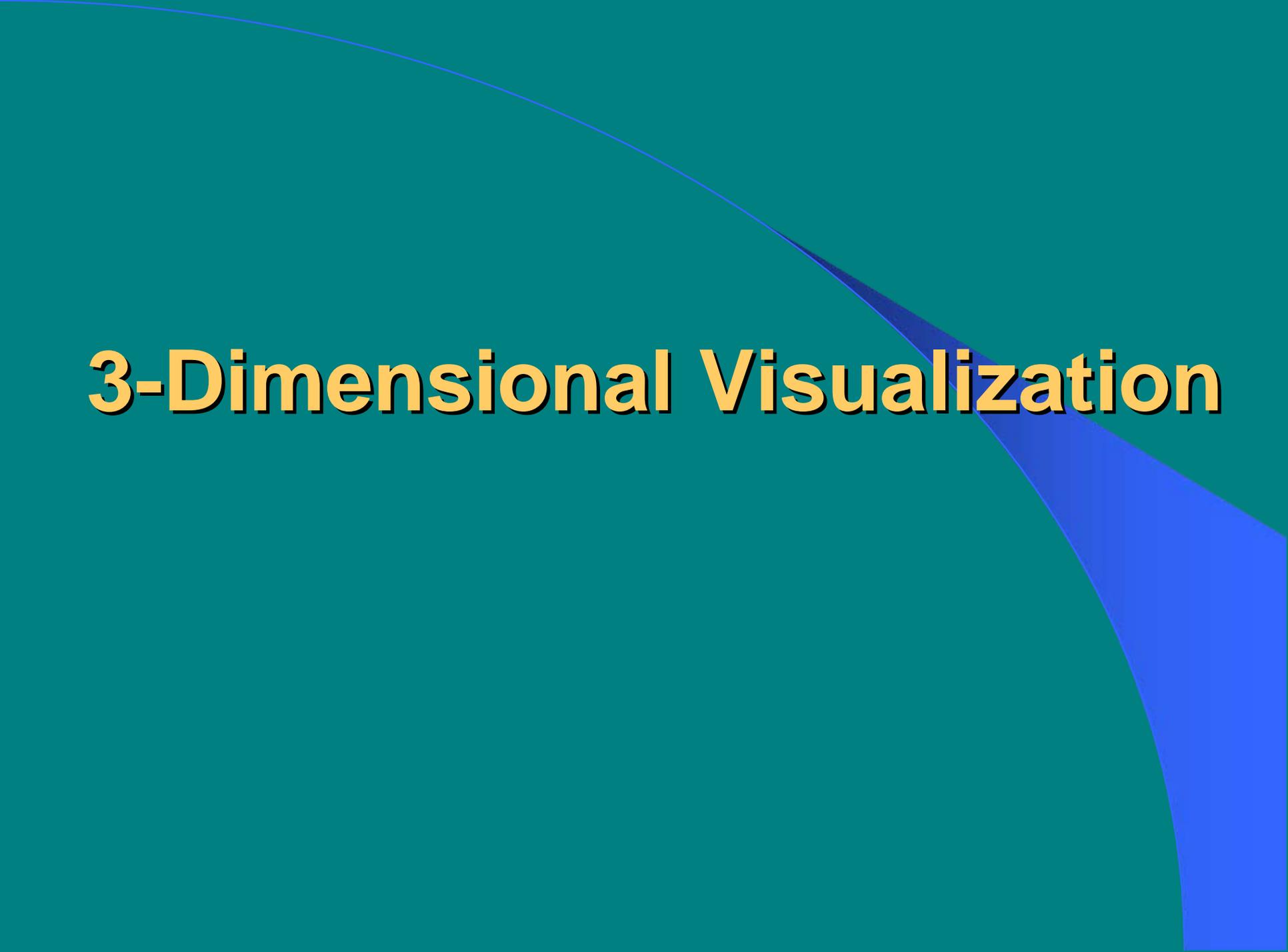
1976

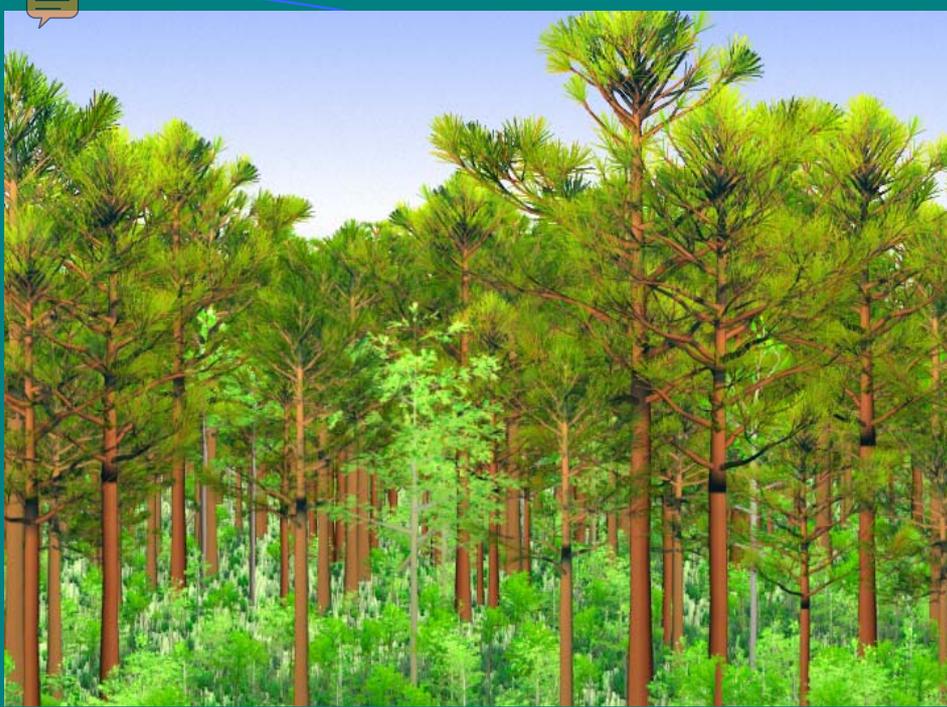
1990



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3-Dimensional Visualization

The background is a solid teal color. On the right side, there is a large, curved, blue shape that resembles a quarter-circle or a sector of a circle, extending from the top right towards the bottom right.



Comparison of Actual Longleaf Forest with a Visualized One Using Computer

Picture from field of longleaf forest at ground level

Visualization of longleaf forest using computer technique:

One obvious advantage is:

We can grow trees on computer with different composition, tree sizes, and densities, in several hours, instead of have to wait 50 years in the field, thus we can do all sorts of experiment on computer.

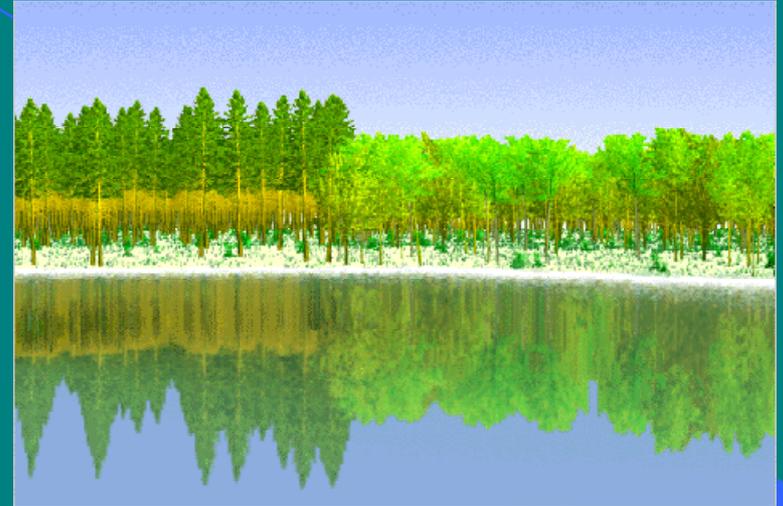


Examples of visualization capability

a) Other objects such as snags, stumps, logs, herbs, shrubs



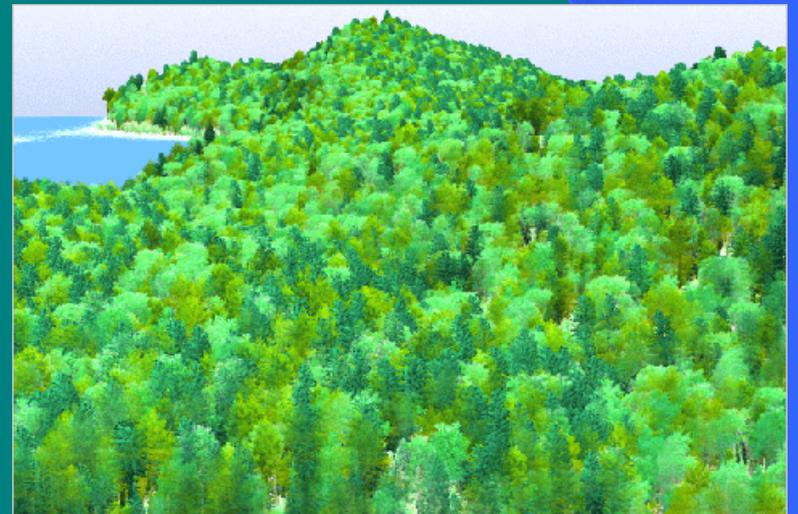
b) Lake (water body)



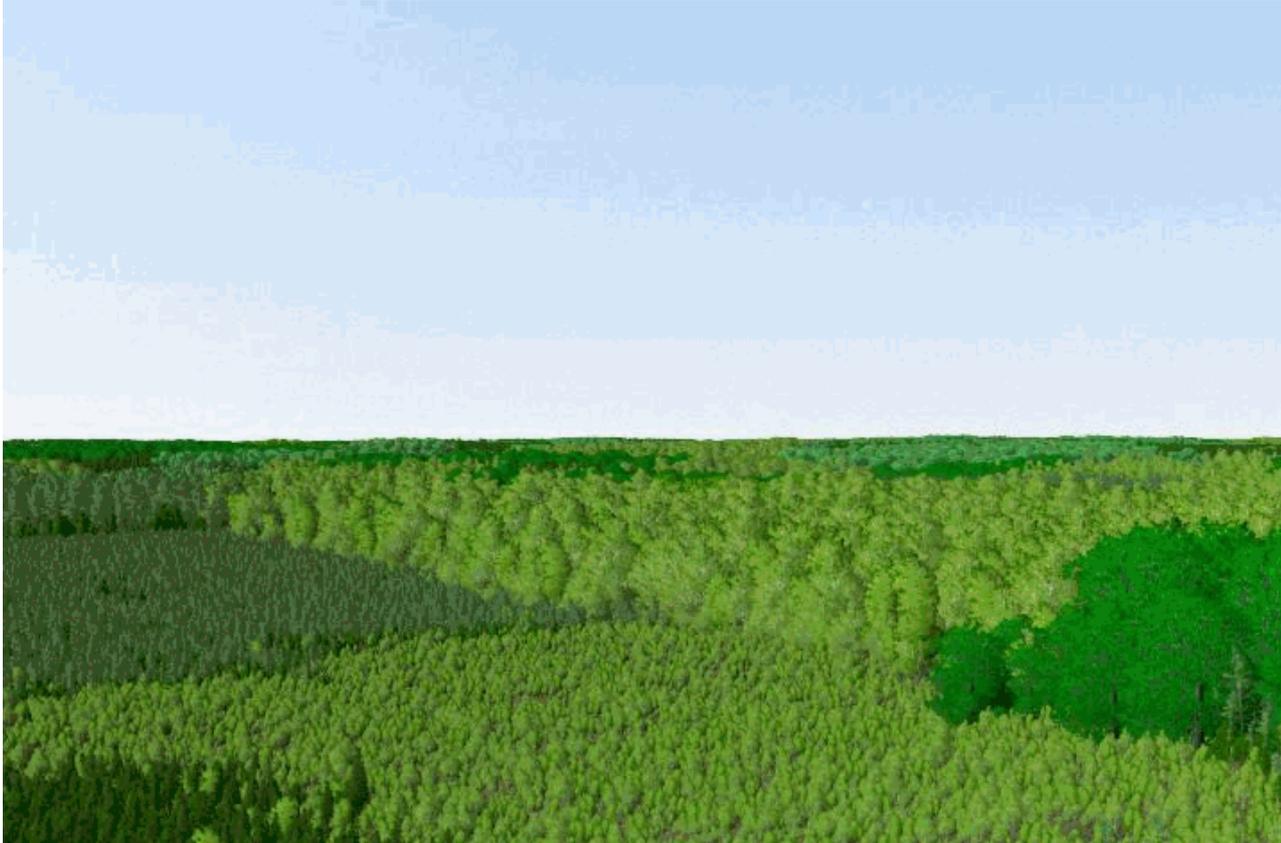
c) Road



d) Topographic visualization

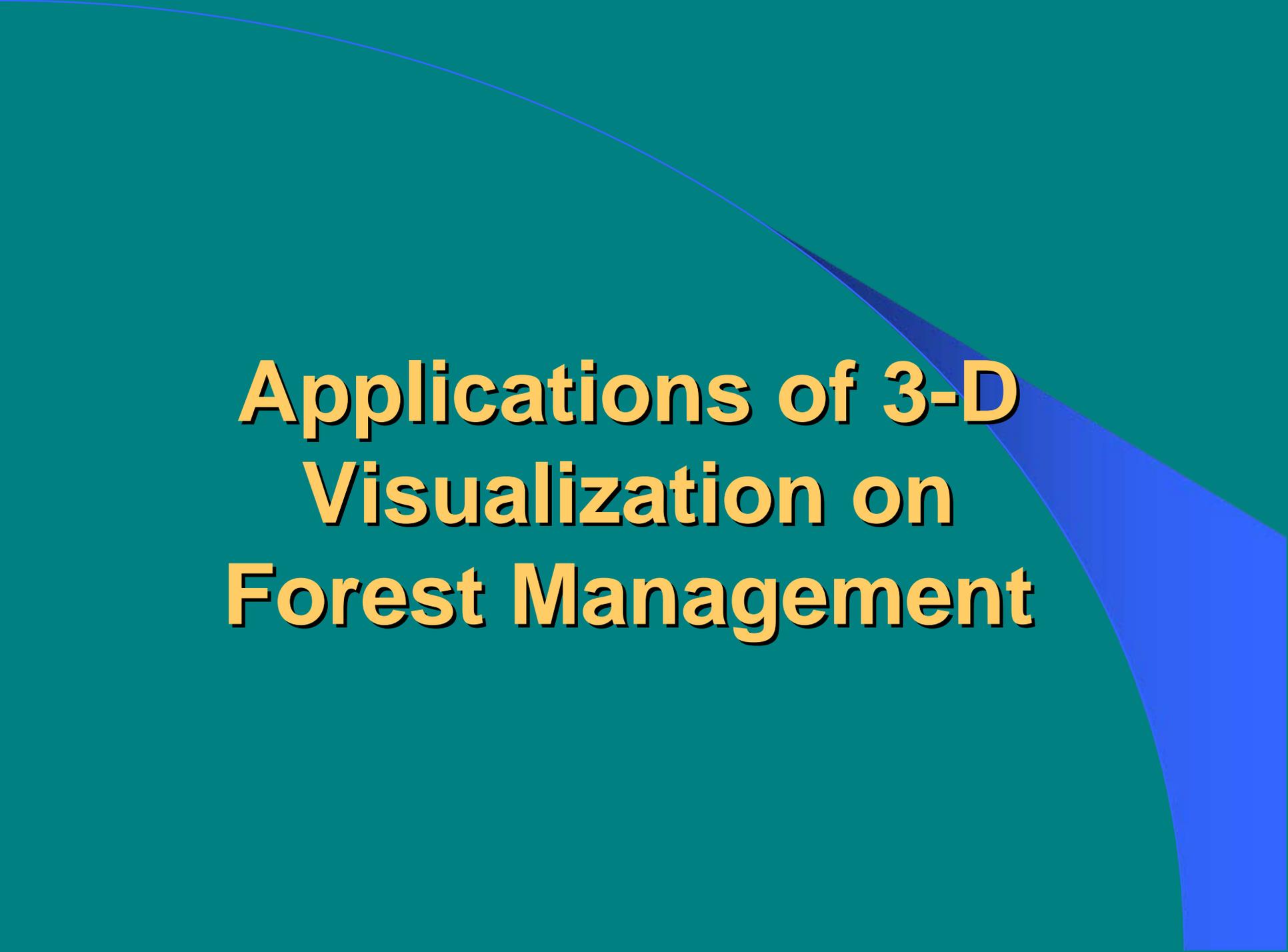


Fly-through Chequamegon National Forest at 500 ft above the terrain



38858.13ha (96020.19ac)

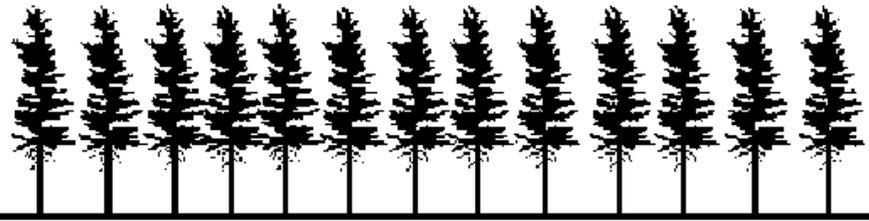
Please wait to watch the movie. Be patient, the movie can be slow



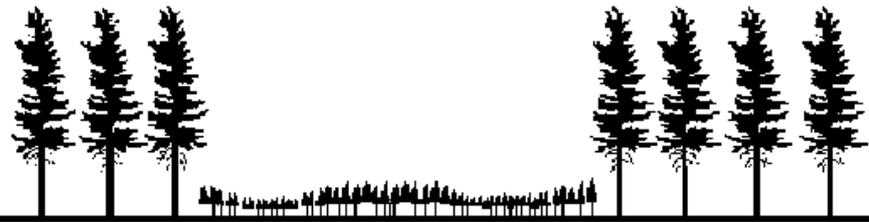
Applications of 3-D Visualization on Forest Management

An example of a system with reserves.

An example of the clearcut and patch cut systems.



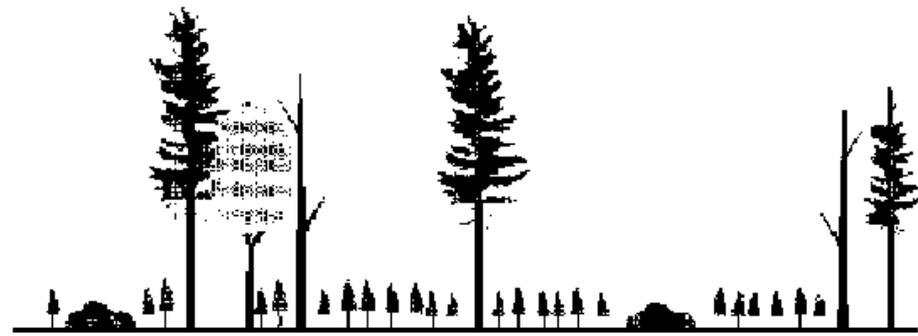
A stand unit is generally cleared, removing the forest overstorey in one harvest at the end of the rotation.



The regeneration period occurs soon after the harvest and is short.



Uncut stand



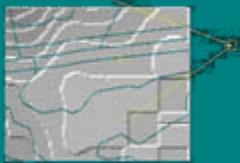
Early after harvest



Several decades after initial harvest

Visualization of Different Cutting Strategies

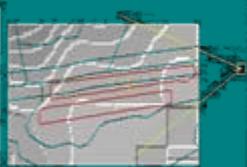
Original Forest



Clear Cutting



Strip Cutting



Patch Cutting



Visual Comparison of Different Cutting Methods at Stand Scale

Walking through the Original Forest



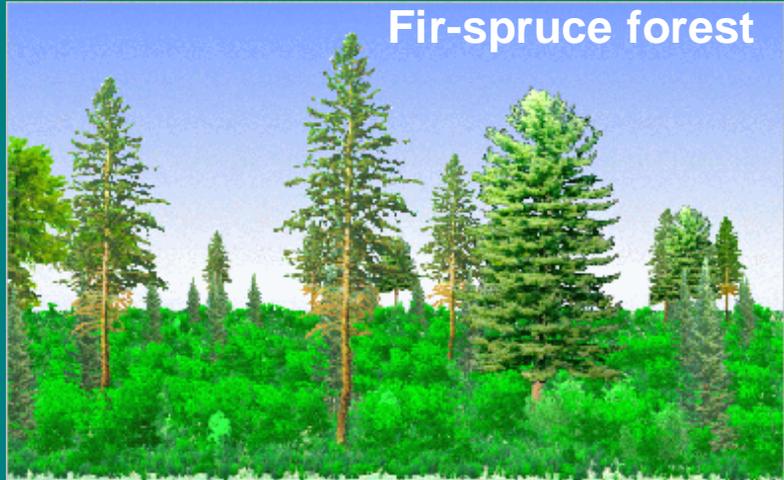
Walking through the Residual Cut Forest



Walking through the Clear Cut Forest



Please wait to watch the movie. Be patient, the movie can be slow



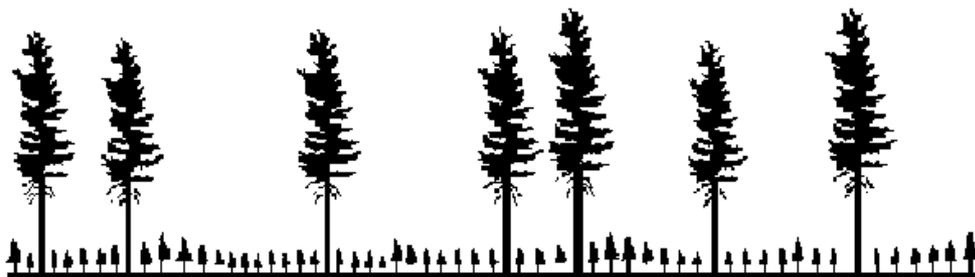
An example of the uniform shelterwood system.



Uncut stand



Preparatory cut



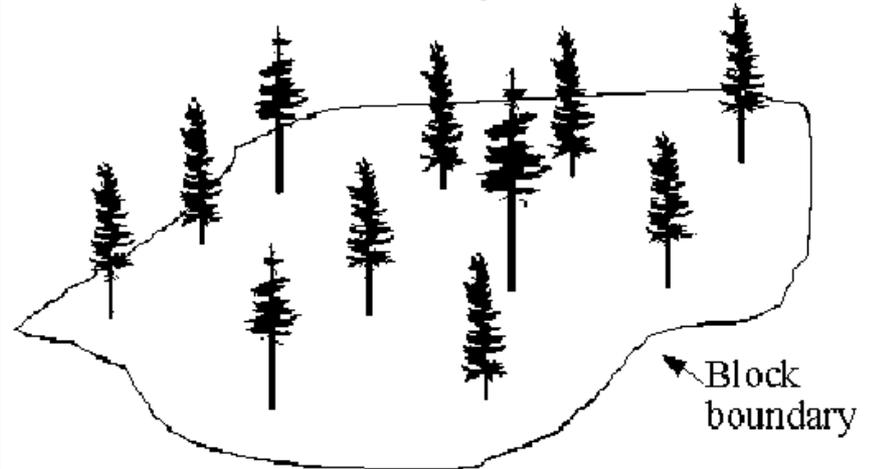
Establishment cut



Removal cut

Examples of uniform and grouped seed tree system variants.

Uniform seed tree system



Grouped seed tree system



Visualization of Shelterwood cutting steps

a) Preparatory cut



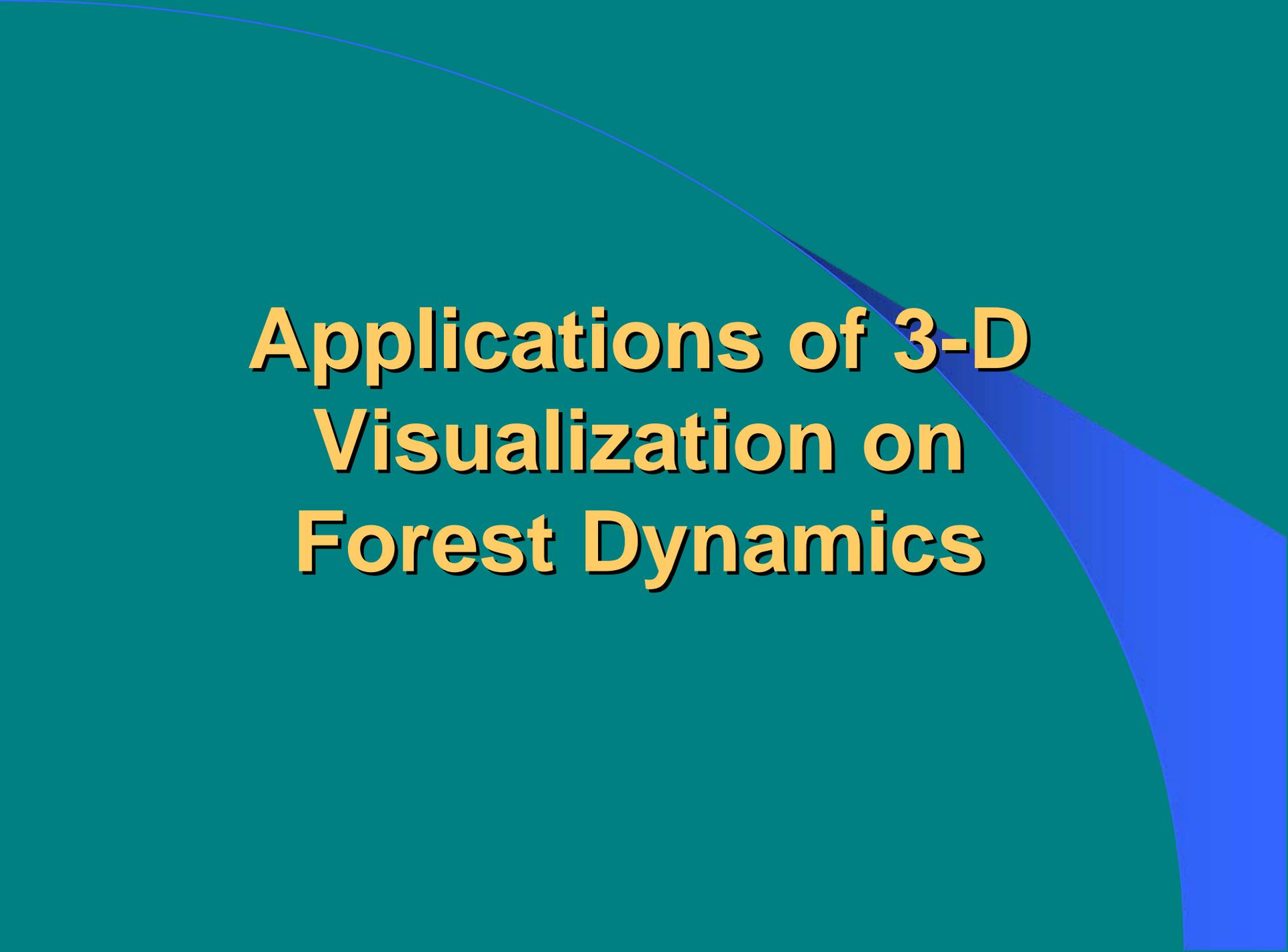
b) Establishment cut



c) Removal cut







Applications of 3-D Visualization on Forest Dynamics

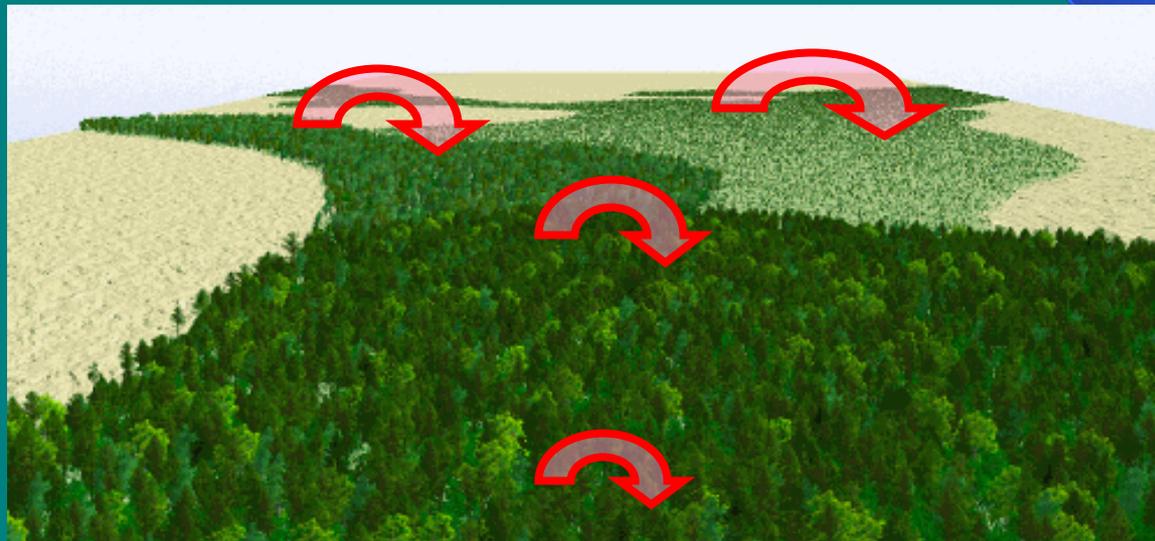
Visualization of 50 Years of Red Pine Forest Growth at Stand Scale



**Please wait to watch the
movie. Be patient, the
movie can be slow**

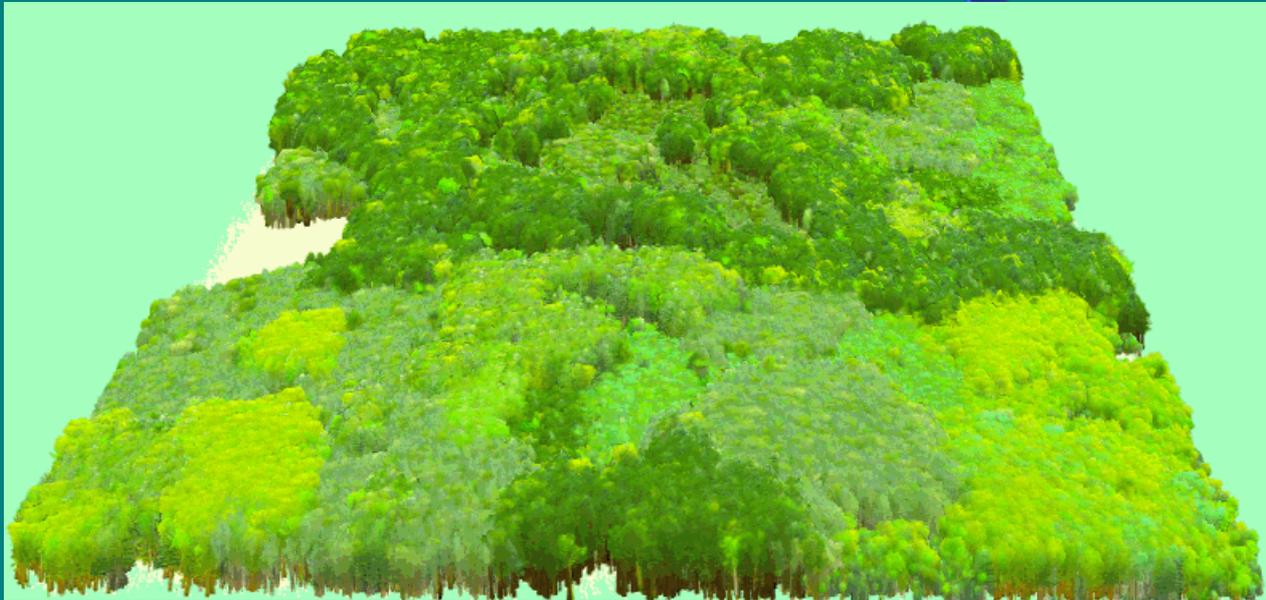
Visualization of 60 Years of Forest Growth

Note: Using four patches of forest; the growth rates are different with different cutting strategies.



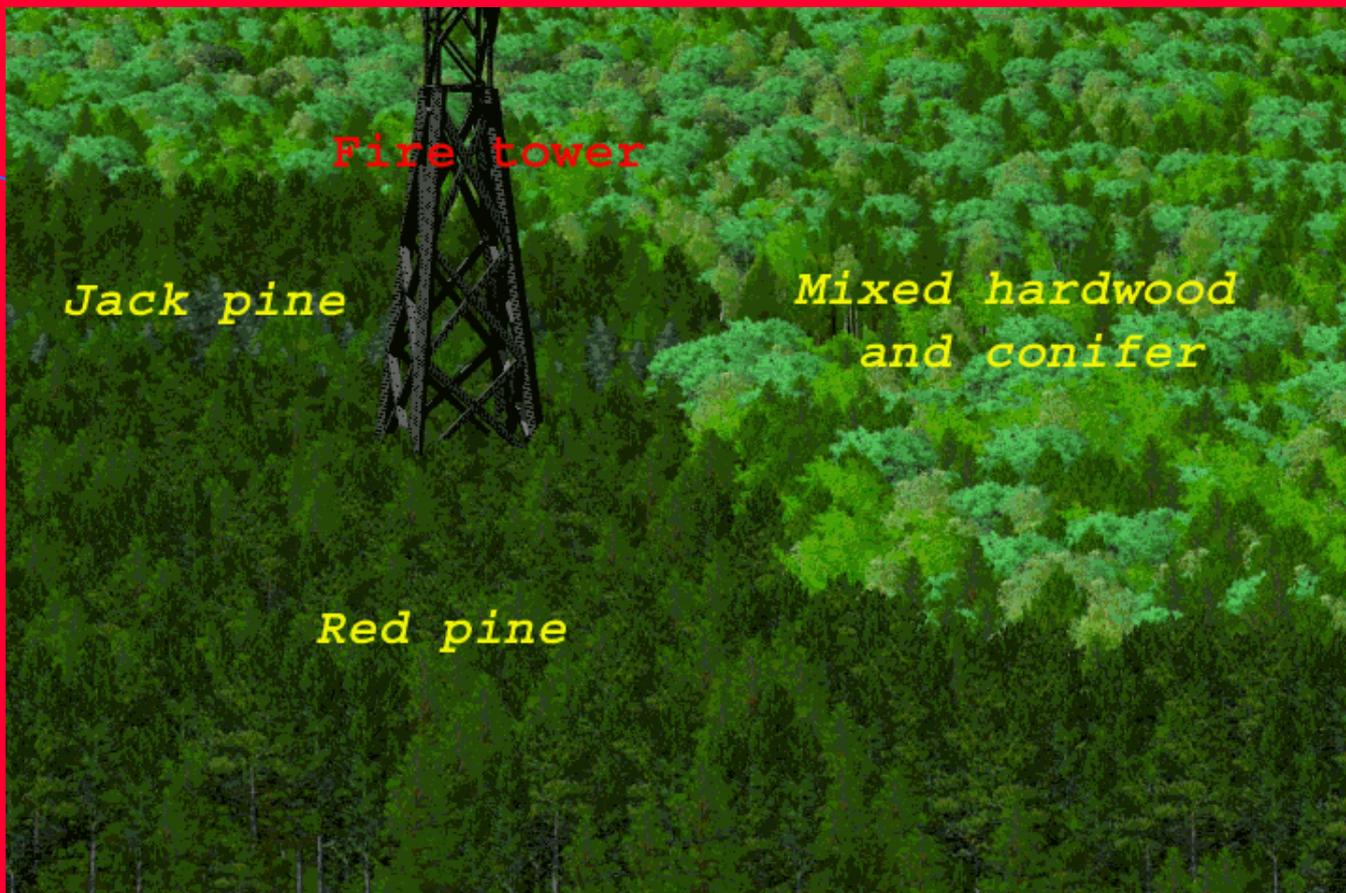
Please wait to watch the movie. Be patient, the movie can be slow

Visualization of Landscape Change During 200 Year Period with the Effects of Fire and Wind



**Please wait to watch the
movie. Be patient, the
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Flying through Chequamegon National Forest after a simulated 27-day forest fire in the northeast



- ❑ **Red labels** showed different 3D objects, rivers, lakes, and roads as well.
- ❑ **Yellow labels** indicate the forest types.
- ❑ **Red arrows** indicate the direction of camera turns after that frame.
- ❑ Trees with brown mixed with green color, brown color, and snags represent low, medium, and high burning intensities, respectively.