

Wednesday_AM_Distribution_ and_Detection_Hoppus



Buckthorn Detection Using Small Format Aerial Photography

- Mike Hoppus: Aerial Photo Program
- Susan Burks: Exotic Species Program
- Terry Helbig: Area Forest Supervisor
- Rick Dunkley: Recreation Supervisor

Minnesota Department of Natural Resources





- *Common Buckthorn*
Rhamnus carthartica
 - In MN for last 150 years
 - Displaces native species
 - Reduces forest regen.
 - Increases soil erosion
 - Helps spread pests

Why Small Format Aerial Photography?

- Rapid – Large Area Assessment
- Map-Like Aerial Perspective
- Quick response time
- Control Over Resolution and other Imagery Characteristics
- Relatively Low Costs per unit Area



Buckthorn

Rhamnus cathartica



Can we detect this invasive using aerial photos?

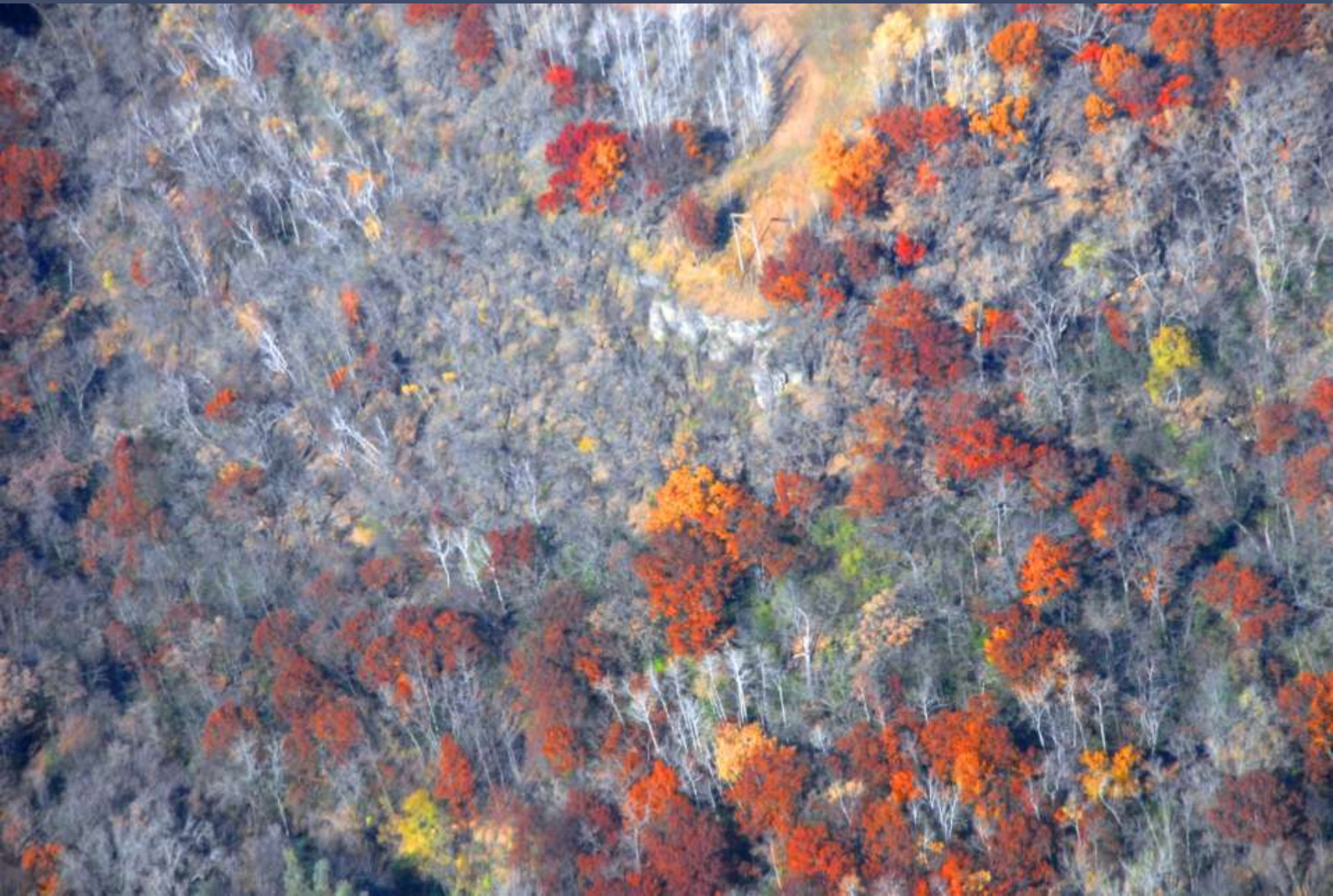
Facts:

Buckthorn is dark green.

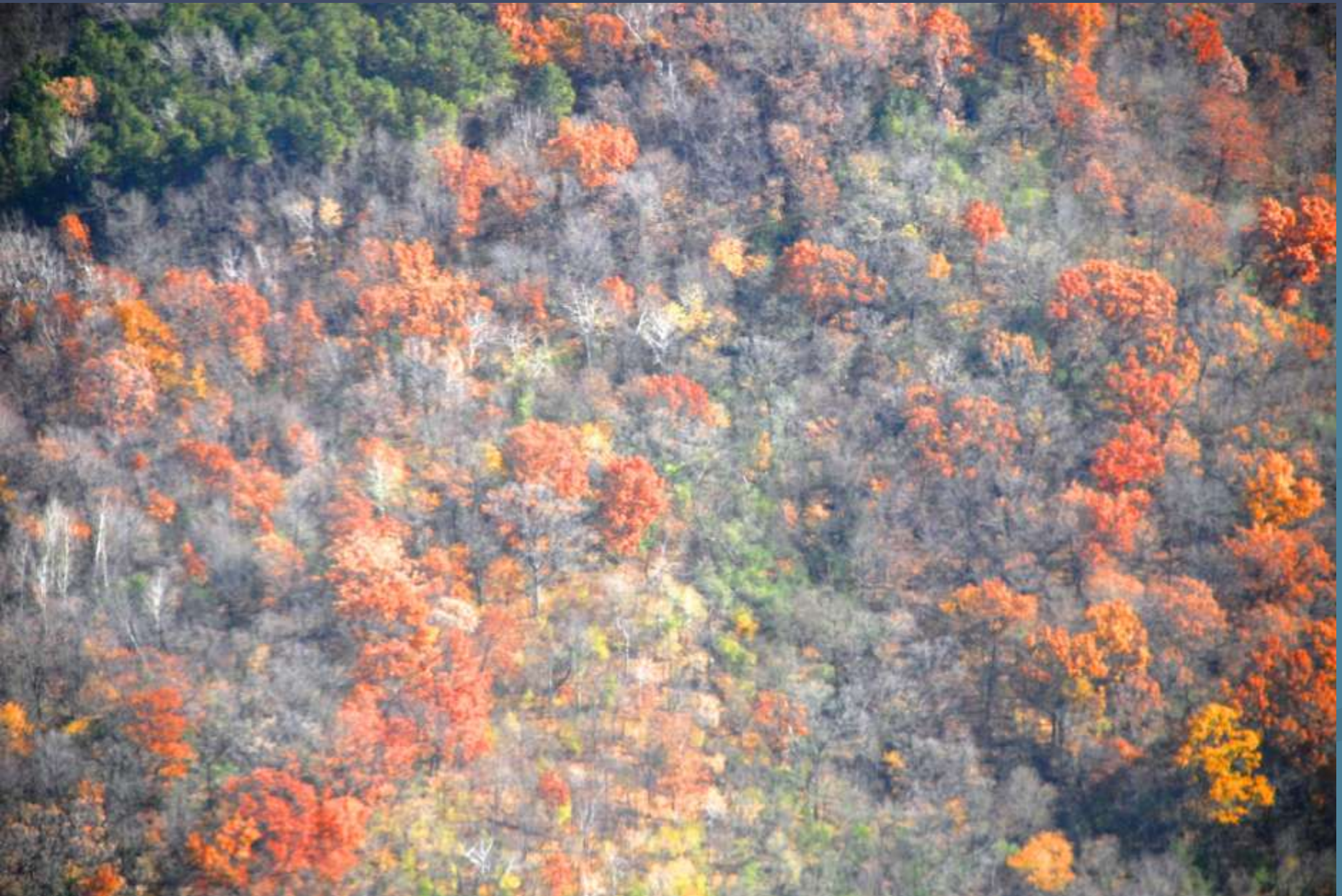
Buckthorn drops its leaves after most other trees and bushes have lost theirs.

There are about 1 to 3 weeks in the fall when buckthorn might be visible from the air.

Green understory brush is common buckthorn.

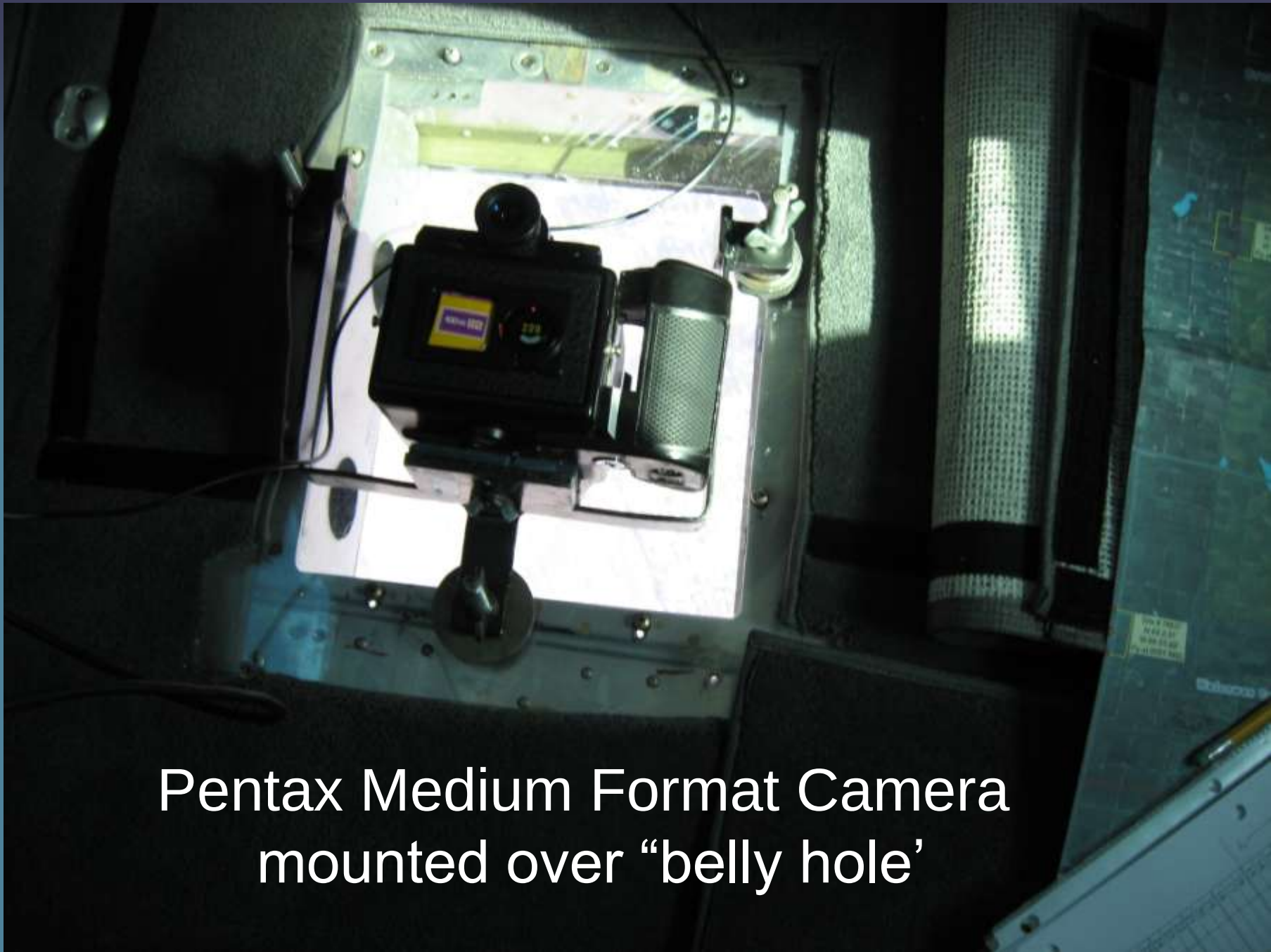


Green understory brush is common buckthorn.

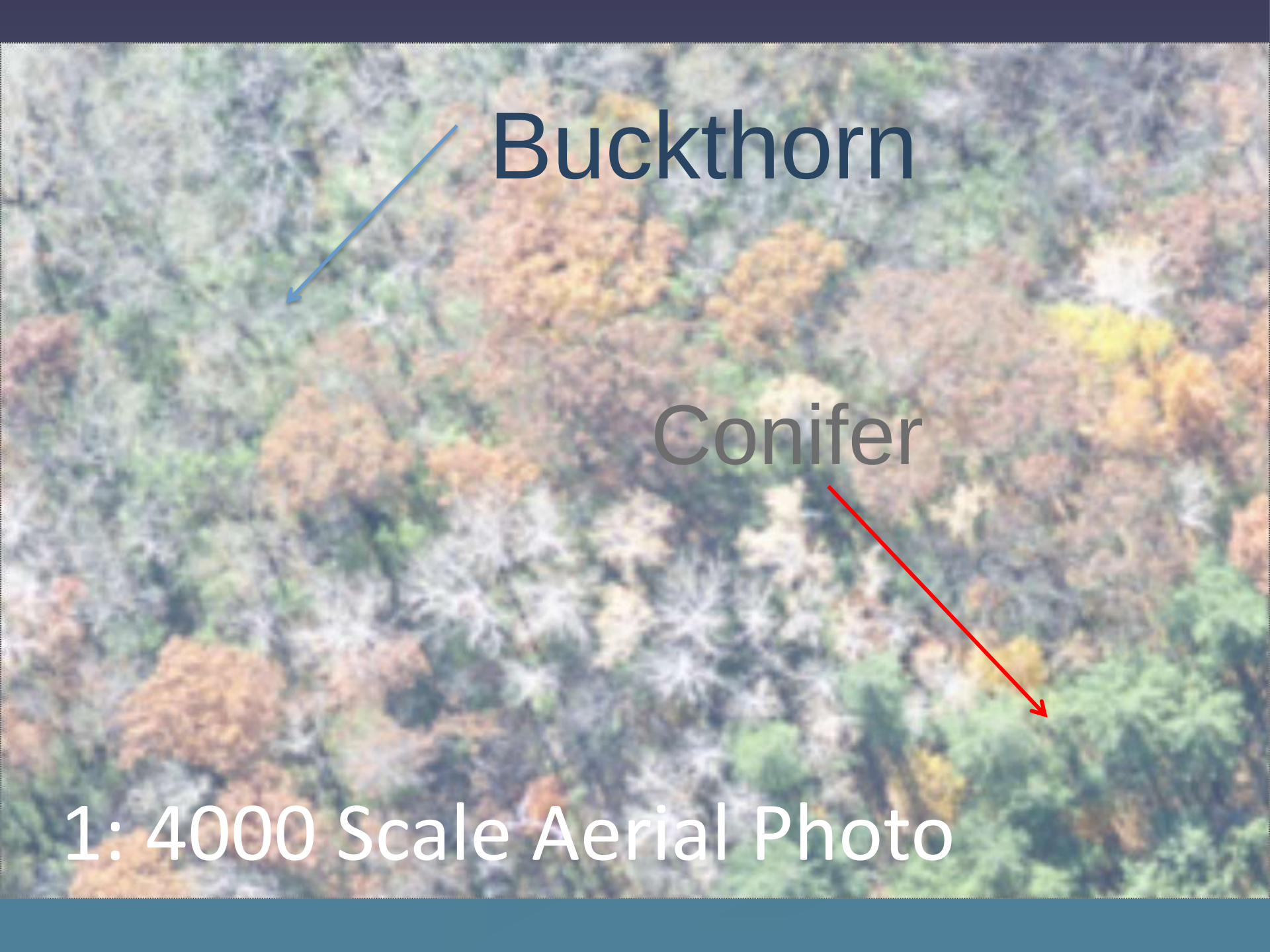




DNR's Cessna 310

A photograph showing a black Pentax medium format camera mounted on a mechanical assembly. The camera is positioned vertically, with its lens pointing upwards. It is mounted on a metal plate that is part of a larger device, possibly a microscope or a specialized camera rig. The device has various components, including a cylindrical lens or filter assembly to the right of the camera. The background is dark and indistinct.

Pentax Medium Format Camera
mounted over “belly hole”

An aerial photograph of a forest canopy. The image shows a mix of green, brown, and yellowish patches, representing different tree species. A blue arrow points from the word 'Buckthorn' to a specific area in the upper left. A red arrow points from the word 'Conifer' to a specific area in the lower right. The text '1: 4000 Scale Aerial Photo' is at the bottom.

Buckthorn

Conifer

1: 4000 Scale Aerial Photo



Buckthorn

This is an aerial photograph of a forest. A yellow text label 'Buckthorn' is centered in the image. Three red arrows point from this label to different parts of the forest: one points to a cluster of trees in the upper left, another points to a cluster in the upper right, and a third points to a cluster in the lower right. A light-colored, winding path or road is visible in the lower left quadrant of the image.

1:8000 Scale Aerial Photo

Can you see Buckthorn?



1: 15840 Scale Aerial Photo

An aerial ortho-rectified photograph of a golf course. The image shows a dense forest of trees with autumn foliage in shades of orange, yellow, and brown. A large, irregularly shaped green area, likely a fairway or green, is highlighted in the upper center. A red arrow points from the text 'Buckthorn' to this green area. In the lower left, there is a large house with a grey roof and a smaller blue building. A dirt road or path winds through the landscape. In the lower right, there is a large, rectangular green area, possibly a pond or a large green. The overall scene is a mix of natural vegetation and man-made structures.

Buckthorn

1:15840 Ortho-rectified Photo

Display Source Selection

Slide 2 of 2

Office Theme

Drawing



Arial

10

B

I

U

A



3 flight lines; of
of stereo aerial
photos...1:15840

Ortho-rectified &
Mosaiced in a GIS.

This is now a Map!

Other layers can be
added...including
Buckthorn



Digital Map of Buckthorn Interpretation

Interpreted Polygons are digitized; then Ortho-rectified; and then layered over the ortho-rectified photos.

The file, printed photos, and/or GPS locations can be taken to the field.



Lessons Learned

1. 1:15840 scale true color aerial photos appear to be an efficient tool to detect and map the presence of buckthorn.
 2. Accurate interpretation appears to require stereo photo pairs and stereoscopic viewing.
- The weather window is short...so aircraft have to be ready to go – with cameras, etc. Planning and preparation is needed.



Survey – Aerial Survey Comparison Results (1:15840scale photos):

Hay Creek Unit:

<u>Ground Plot Type (plants/Ac)</u>	<u>% Plots In Aerial Buckthorn Polygons</u>
1-10	9% (7/70)
11-100	40% (4/10)
101-1000	49% (29/59)
>1000	57% (13/23)

Frontenac Unit:

<u>Ground Plot Type (plants/Ac)</u>	<u>% Plots In Aerial Buckthorn Polygons</u>
1-10	1% (1/60+)
11-100	66% (2/3)
101-1000	94% (14/15)
>1000	100% (34/34)



Conclusion

During that period when the canopy leaves have fallen, and the buckthorn plants still have green leaves, aerial photos can be used to detect and map moderately large areas for buckthorn with reasonable accuracy....

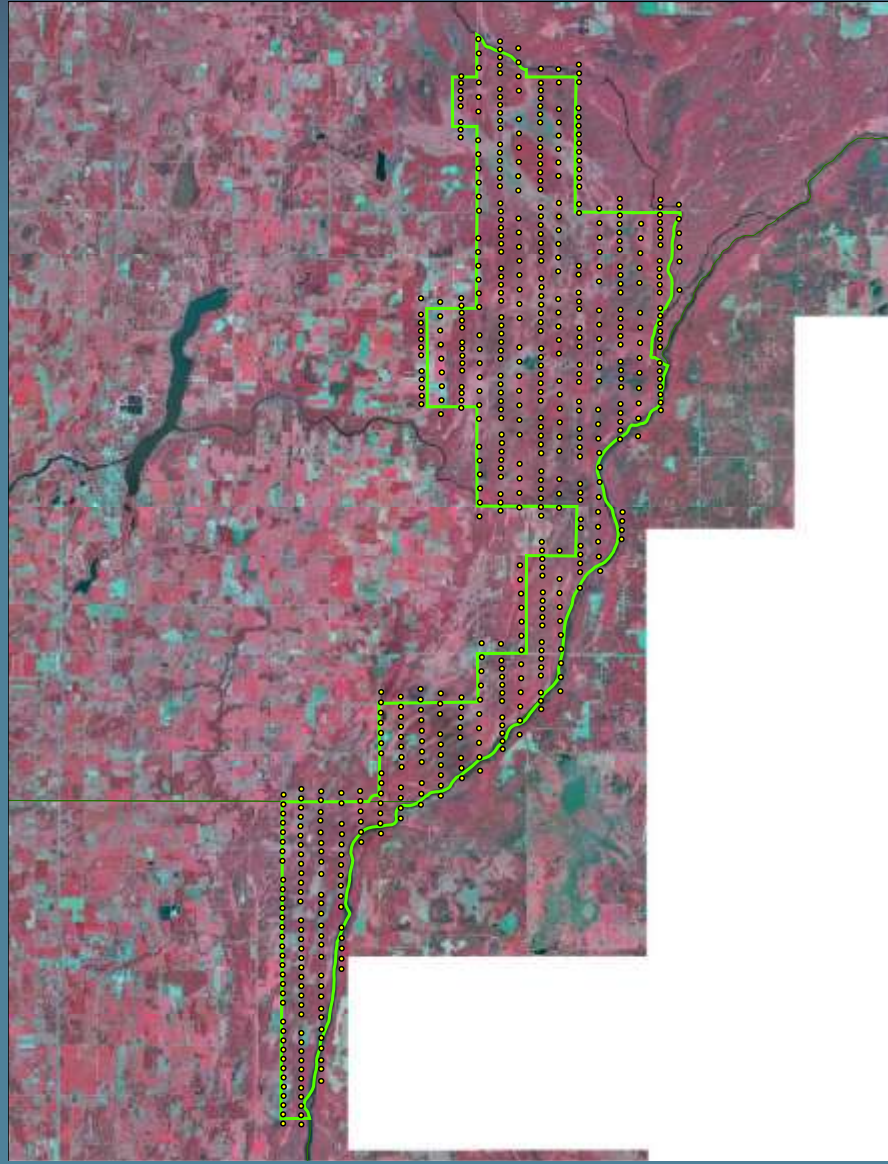
For about \$0.50 per acre...2008 dollars.



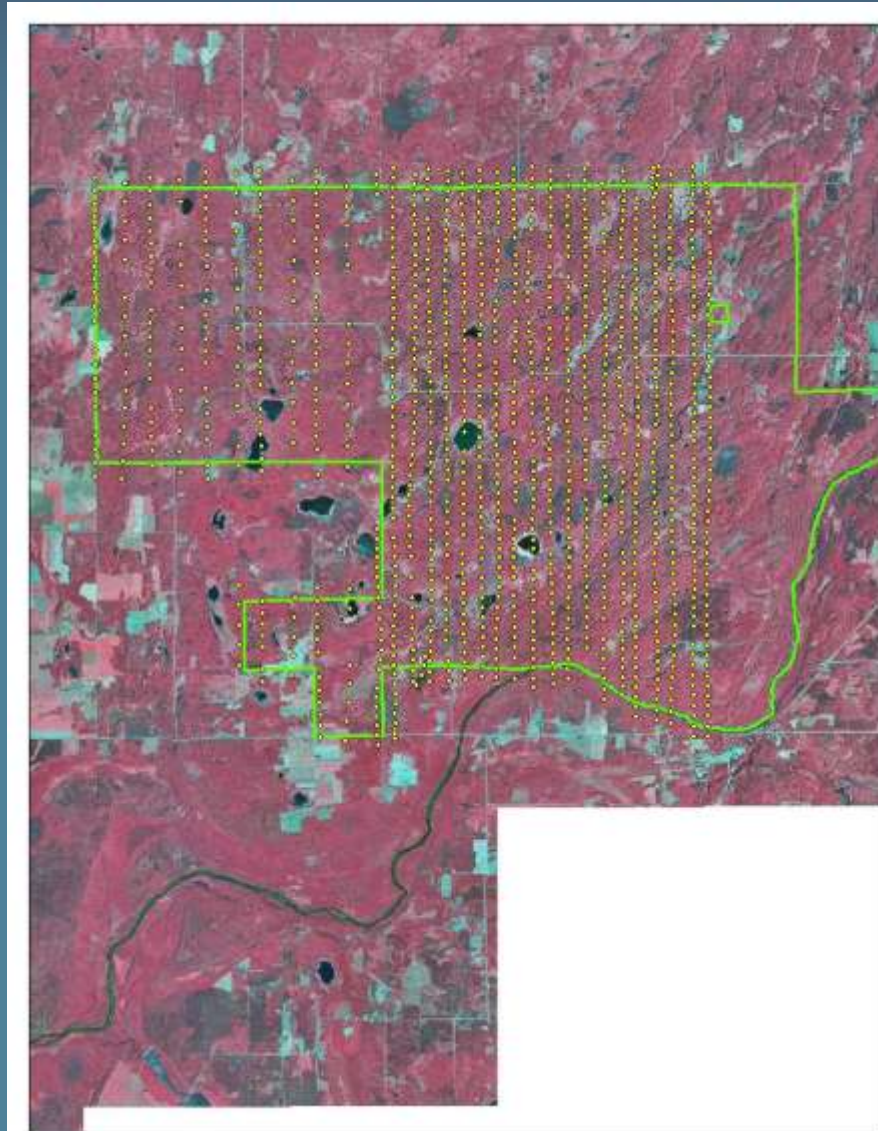
Medium Format Digital Color Infrared Camera



Chengwatana Area Forest – 29,040 Ac. Color IR Digital Camera Photo Index Map



St Croix Area Forest – 35,152 Ac. Color IR Digital Camera Photo Index Map

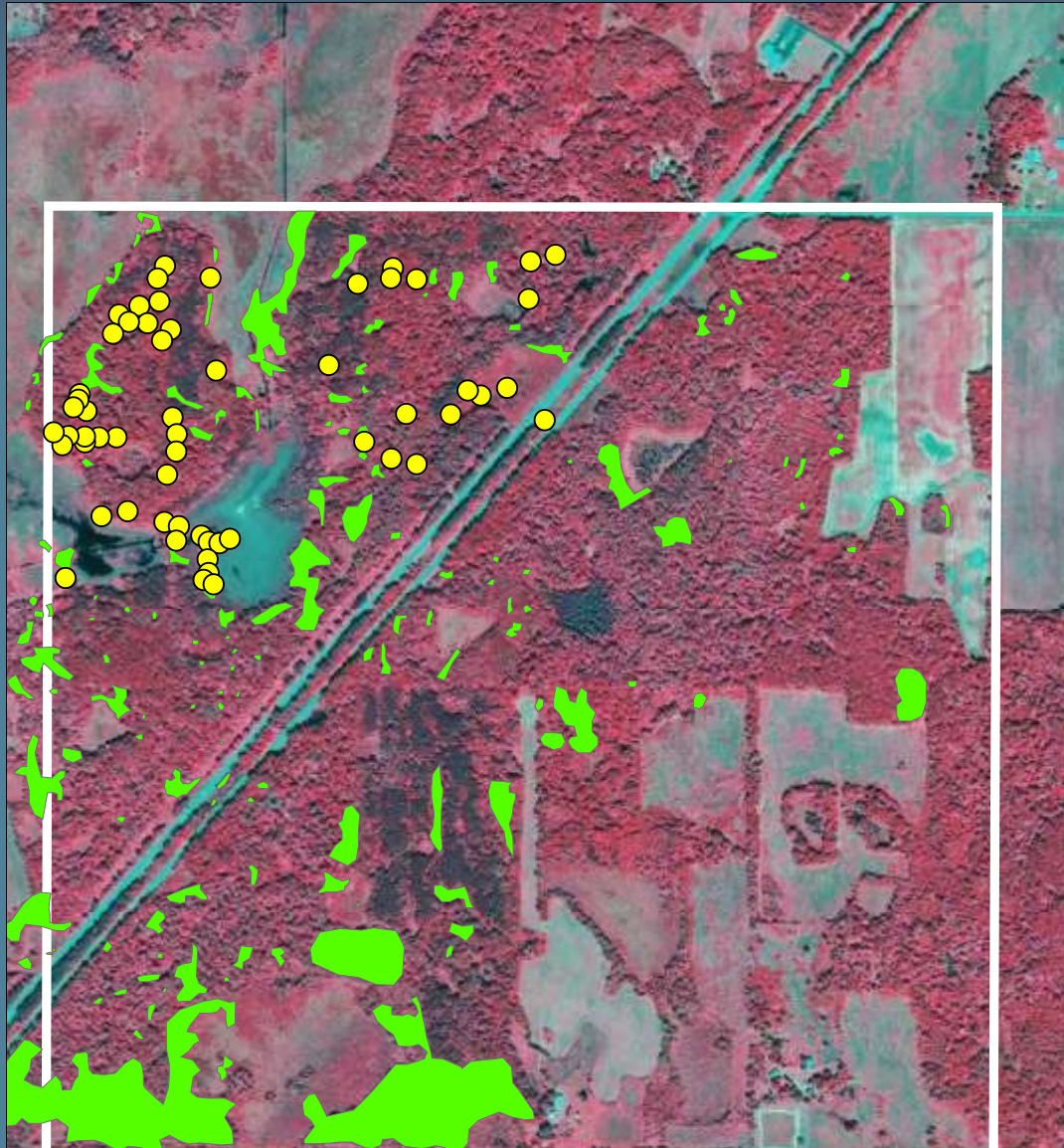


D.A.R. Area Forest – 643 Ac.

Color IR Digital Camera Photo Index



Buckthorn Interpretation (Yellow Dots = < 1 Ac.)



10 % Buckthorn



100% Buckthorn Understory

**Field Accuracy Check
= 90%**

**Major Emphasis:
Eliminate Omission Errors**



Buckthorn Visible as “Red” Understory Brush

Original Scale
1:22,000







Most Recent Lessons Learned

- Medium Scale Color Infrared Digital Photos can be used to successfully detect buckthorn over large areas;
- At scales similar to 1:22000, there is no advantage to interpret beyond “presence-absence of buckthorn plants;
- Interpretation requires stereo viewing and magnification;



Most Recent Lessons Learned (continued)

- Don't rectify the digital photos....transfer the interpreted detail to an ortho-photo-map;
- This buckthorn detection effort cost \$0.24 per acre and took about 120 hours;
- Interpretation does not require special skill...but training is necessary;



A local interpreter would be more cost effective

Finally !!

- The Area Foresters thought the project was a success....more buckthorn was located than they knew existed....young aspen was a detractor
- *“We down loaded these shapes and points into a GPS which was then used in navigating to the locations for ground truthing. Worked very well.”*



Best method should involve a multistage survey...aerial and ground based...!!??

Thank You !