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Route To:

Subject: Evaluation of Lenses to Detect Stress (FHP Eval. No. N01-06)

To: Thomas Hofaker, Staff Entomologist

Entomologists have looked for ways to enhance their abilities to detect dead and dying trees for a long time. F. P. Keen reported on the use of aerial photographs taken at different altitudes and with different film and filter combinations in 1927 (Unpublished Reference U140 in Miller, J.M. and F. P. Keen, 1960. Biology and Control of the Western Pine Beetle. USDA Misc. Publ. 800). Many of the aerial survey observers use tinted lenses to enhance their detection of off-color foliage. There have recently been a number of questions about a product sold as Stress Detection Glasses from Spectrum Technologies, Inc. (Trade names are used as a convenience to identify products; no form of endorsement is intended).

The descriptive information available for the Stress Detection Glasses states: "Technology developed by NASA scientists lets you identify stressed plants from a distance, while there is still time to react and correct problems. Drought, pests, disease and other harmful conditions reduce chlorophyll and are not immediately apparent to the unaided eye. The glasses block the green color reflected from the chlorophyll found in normal, healthy vegetation, causing it to look black or gray. Stressed plants appear as yellowish-brown or pink (coral)."

There is no mention of forests or trees in the descriptive literature for the Stress Detection Glasses.

In an effort to determine whether some readily available lenses could assist in the

detection of stressed ponderosa pine, I made a comparative test on August 1, 2001. The test subject was a mature ponderosa pine located approximately 11.5 miles northeast of the town of McCloud, CA. The test tree was on the edge of an active *Heterobasidion annosum* root disease center, and the tree was also girdled at the base by a prescribed burn in the Fall of 2000. The base of the tree was under active attack by the red turpentine beetle, *Dendroctonus valens*.



Figure 1. Base of test tree.

The test tree was just slightly off-color to the naked eye. In all photographs the test tree is on the left, a healthy-appearing tree is in the center, and a recently faded red tree is on the right.

The test group of trees was viewed and photographed with a Kodak brand DC 265 Zoom digital camera.



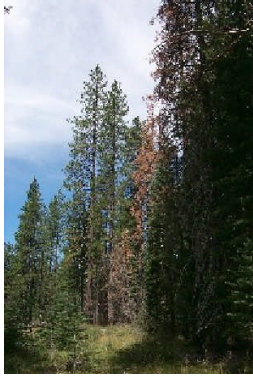


Figure 2. Test tree on left.



Figure 3. Lenses tested.

The group of test trees were viewed with 19 different sunglasses, visors, and filters. A photograph of 18 of the devices is shown below. Due to an oversight, the Y1 yellow camera filter was not photographed.

Characteristics of the lenses tested are displayed in Table 1.

Table 1. Lens Specifications

No.	Color	Polarized	Type	Brand	Origin	Cost	Enhancement	Rank
1	Brown Mirror	No	Sunglasses	?	?	?	Very Slight	8
2	Gray Mirror	No	Sunglasses		3278950 Mexico	?	None	n/a
3	Grn./Gold Mir.	No	Sunglasses	Aden	Taiwan	?	None	n/a
4	Gray/Silv. Mir.	No	Sunglasses	Valley	Taiwan	?	None	n/a
5	Green	No	Sunglasses	Foster Grant	?	?	None	n/a
6	Dark Green	Yes	Sunglasses	?	U.S.	\$0.98	None	n/a
7	Med. Green	No	Ski Visor	?	?	?	None	n/a
8	Light Green	No	Sunglasses	?	?	\$1.00	None	n/a
9	Light Brown	Yes	Sunglasses	?	U.S.	\$0.98	Slight	3
10	Light Brown	Yes	Sunglasses	?	Taiwan	\$0.98	Slight	4
11	Orange-Tan	No	Sunglasses	?	?	\$0.99	Slight	n/a
12	Pink-Orange	No	Sunglasses	Sport	?	\$0.98	Slight	1
13	Yellow	No	Ski Visor	?	?	?	Slight	5
14	Light Yellow	No	Sunglasses	?	?	?	Slight	2
15	Lt.Purple Grad	No	Sunglasses	?	Taiwan	?	None	n/a
16	Violet	No	Sunglasses	Spec.Tech.	Taiwan	\$49.50	Very Slight	6
17	Photo-gray	No	Sunglasses	?	Korea	?	None	n/a
18	Gray	Yes	Cam. Filter	Asahi Pentax	Japan	\$9.99	None	n/a
19	Lt.Yellow Y1	No	Cam. Filter	Asahi Pentax	Japan	?	Very Slight	7

The test group of trees was viewed with each lens or filter. Each lens was evaluated for the degree to which it "lit up" or enhanced the detection of the slightly off-

color tree in the test group. The degree of enhancement was subjectively rated as "None", "Very Slight", or "Slight". The top 8 filters or lenses were given a numerical

rating. From a practical aspect, only the top 3 or 4 devices were worth the effort to purchase and wear under forested conditions. Photographs were taken through some of the devices that provided the greatest degree of enhancement.



Figure 4. Lens 9, Lt. Brown Polarized (U.S.)



Figure 5. Lens 10, Lt. Brown Polarized (Taiwan)



Figure 6. Lens 11, Orange-Tan Sunglasses



Figure 7. Lens 12, Pink-Orange Sunglasses

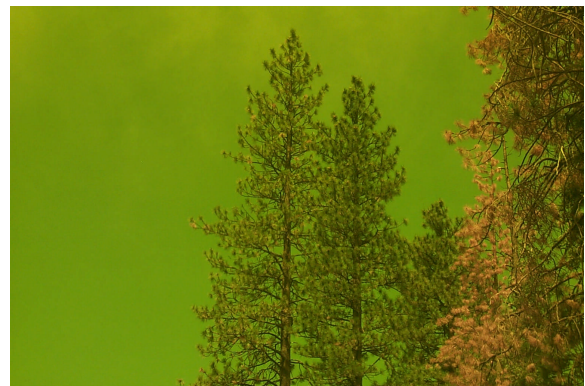


Figure 8. Lens 13, Yellow Ski Visor

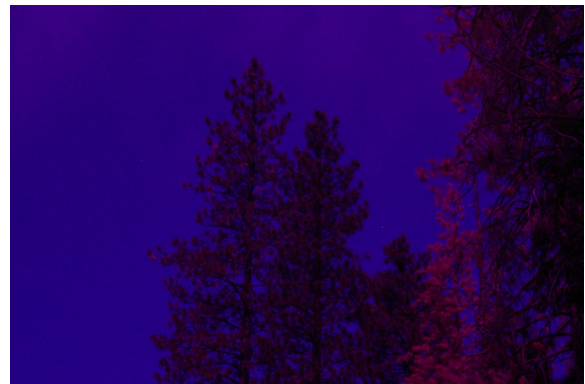


Figure 9. Lens 16, Spectrum Technologies

Conclusions: Several conclusions can be drawn from this test:

1. Some lenses, or filters, can enhance the detection of slightly faded or stressed ponderosa pine foliage.

2. The best lenses to enhance fading ponderosa pine foliage are the "warm" tones (yellow, amber, tan, light brown - lenses 10 through 14, see Figure 3, bottom of second row from left through top of third row from left).

3. Polarizing the lenses doesn't seem to affect their ability to enhance fading (although it generally darkens the lens).

4. The light-to-medium tints are the most practical to wear while driving, flying in

light aircraft, or walking under forested conditions.

5. The Stress Detection Glasses from Spectrum Technologies, Inc. showed no particular advantage at detecting off-color ponderosa pine.

6. The Stress Detection Glasses from Spectrum Technologies, Inc. were too dark to conveniently or safely wear while driving or walking under forested conditions.

The Usual Disclaimer: It is entirely possible that a different observer looking at different trees under different lighting conditions could use the same lenses to arrive at different conclusions.

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Entomologist