Aardenburg Imaging
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Tested System:
ID#: 331

Printer: Canon Pixma Pro-1

Inks/Colorants: Canon OEM PGI-29

Media: Red River Palo Duro Soft Gloss

Coating(s): no additional coating

Sample set: AaI_20160923_SN001

Testing Status: 200 Megalux hours total light exposure
Light Fade Testing is complete. Dark storage samples continue to be updated.

Conservation Display Ratings (CDR) Summary to Date:

Sample(s) exposed to light, measured immediately
Lower limit: 47 Megalux hours (for weakest 10% of the color patches)
Upper limit: 66 Megalux hours (for average of all the color patches)

Light exposed samples measured after 3 to 4 years dark storage
Lower limit: 47 Megalux hours (for weakest 10% of the color patches)
Upper limit: 66 Megalux hours (for average of all the color patches)

Dark Storage control sample, no light exposure, measured after 4 years
Lower limit: excellent condition, not exceeding lower CDR limit
Upper limit: excellent condition, not exceeding upper CDR limit

*Note: a CDR with narrow range (typically less than 2:1) indicates relatively even overall fading of the image. A wide range indicates faster fading in certain local colors/tones prior to general fading of most colors/tones in the entire image. Compare ratings for different systems directly and/or use the table on page 2 to estimate time (years) on display.

* Please read document AaI_2009_0118_TA-01.pdf, **"An Overview of the AaI&A Conservation Display Ratings"**,

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Section I: Process Description

This section contains a description of the tested print process, typically comprised of an inkjet printer, a specific set of inks, and a specific choice of media. However, the test report may also describe other photographic and/or photomechanical printing processes such as conventional chromogenic color processes, alternative B&W processes, dye subimation, xerographic processes, etc., and the tested samples may also include additional coatings or laminates applied to the print surface at a later stage in the fabrication. This section may also contain illustrations and other documentation about the the process as well.

Canon Pixma Pro-1, Canon OEM PGI-29 , Red River Palo Duro Soft Gloss, no additional coating

Sample Set:	**AaI_20160923_SN001**	**Batch #:**	Q1
Printer:	Canon Pixma Pro-1		
Ink:	Canon OEM PGI-29		
Media:	Red River Palo Duro Soft Gloss		
Coating(s):	no additional coating		
Test Print Prepared by:	AaI&A		
Printed:	September 23, 2016		
Initial Print colors measured	November 29, 2016		
Test Started:	November 30, 2016		
Test Image:	AaI_StandardColorSet(v2)forSRGB.tif		
RIP/Driver settings:	OEM driver, manual feed, Quality = "high", CO = overall, PP abrasion = on		
Media Setting	Photo Paper Plus Semigloss		
Profile:	AaI_Pro-1, OEMink_RRPDSGR_PPPSG_HQ_Coo.icc		
Profile type:	custom		
Rendering intent:	Perceptual		

Paper White and Maximum Printed Black Values (M0 readings)

Optical brighteners Present? *no*	**L***		**a***		**b***	
	UV inc	UV exc	UV inc	UV exc	UV inc	UV exc
M0 Media Whitepoint Color ISO 13655-2009:	98.7	98.7	0.2	0.2	0.7	0.7
	UV-inc/UV-exc ΔL*, Δa*, Δb* respectively					
	0.0		0.0		0.0	
L* = 98.7 a* = 0.2 b* = 0.7	*Calculated differences, especially for Δb*, indicate the role and magnitude of fluorescence on original paper color*					

Maximum Printed Black	**L***	**a***	**b***	Optical Density (Dmax)
	3.2	-0.3	-2.6	2.45

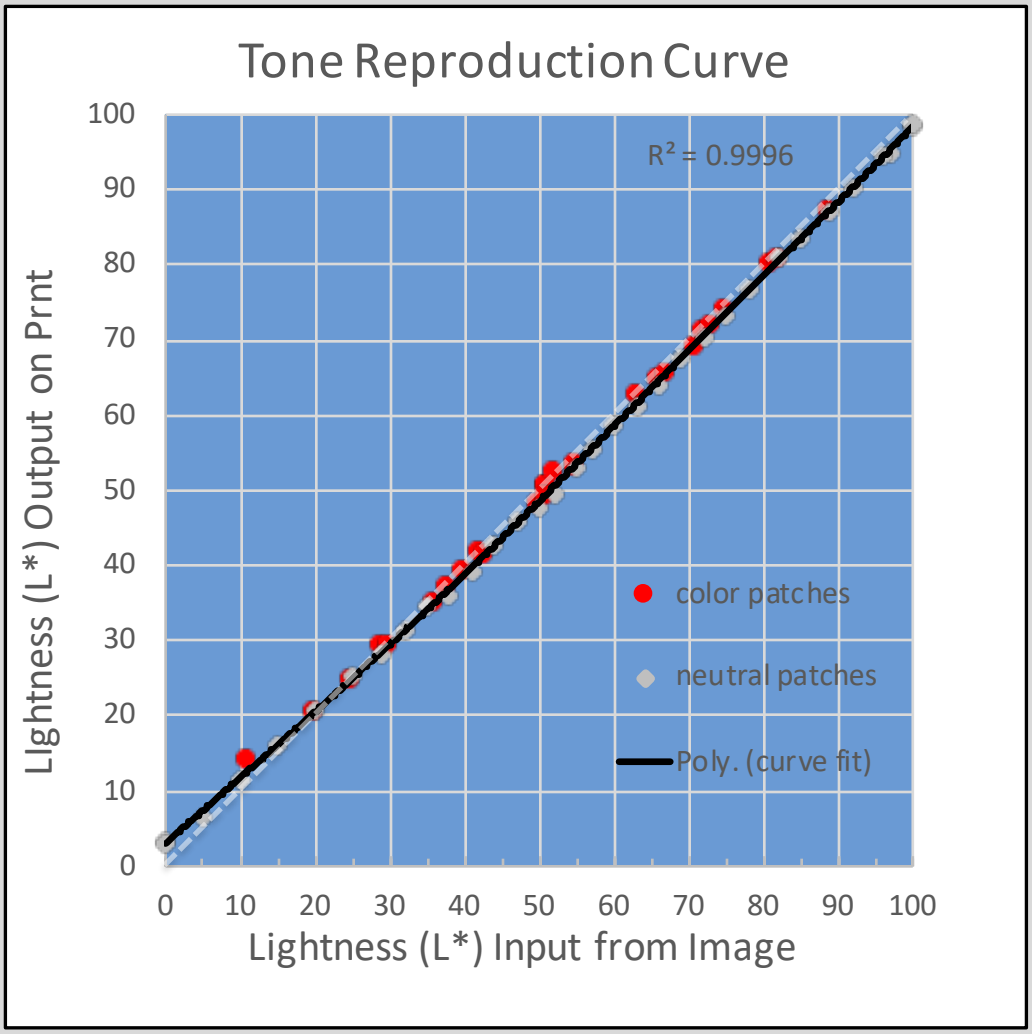
Paper White and Maximum Printed Black Values (M1 readings)

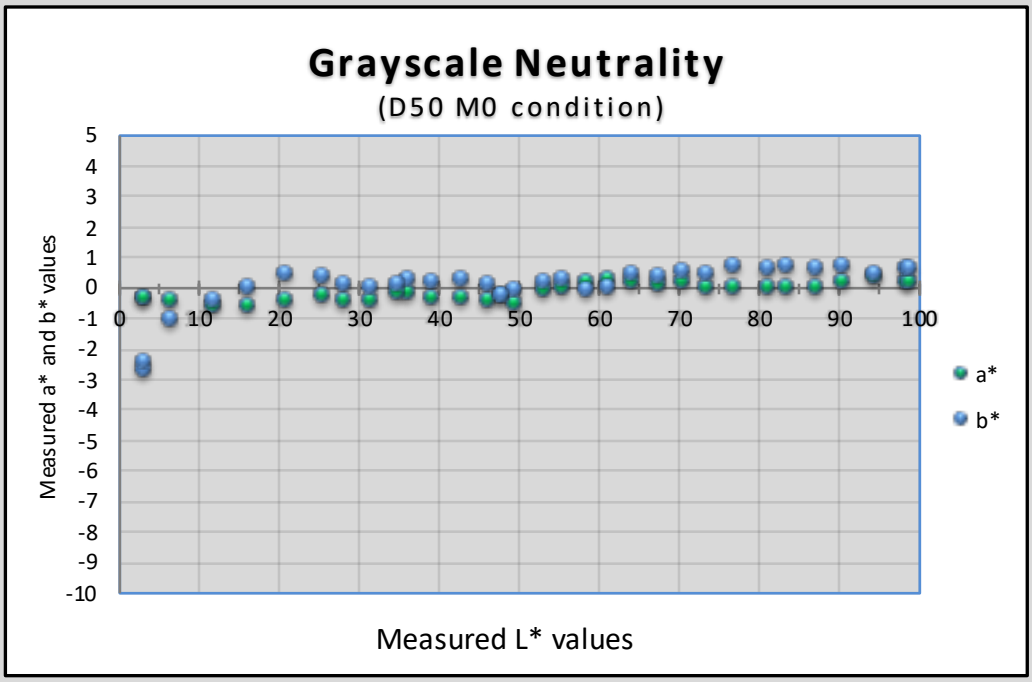
	L*		**a***		**b***	
	UV inc	UV exc	UV inc	UV exc	UV inc	UV exc
M1 Media Whitepoint Color ISO 13655-2009:	98.7	98.7	0.2	0.2	0.7	0.7
	UV-inc/UV-exc ΔL*, Δa*, Δb* respectively					
	0.0		0.0		0.0	
L* = 98.7 a* = 0.2 b* = 0.7	*Calculated differences, especially for Δb*, indicate the role and magnitude of fluorescence on original paper color*					

Maximum Printed Black	**L***	**a***	**b***	Optical Density (Dmax)
	3.2	-0.3	-2.6	2.45

Light source:	Phillips Colortone F40T12/C50 – 5000˚K full spectrum fluorescent. Color rendering Index (CRI) =92)
Light Exposure Cycle:	~12klux illumination, 24 hours per day
Average Temperature:	24.9˚C over full test duration, 25.2˚C during light exposure.
Average Relative humidity:	53.7%RH over full test duration, 53.5%RH during light exposure.
CIELAB measurements:	D50 2˚ observer, Xrite i1Pro2, M0,M1, and M2 conditions where applicable

Initial Image Reproduction – Tone Curve and Grayscale Neutrality

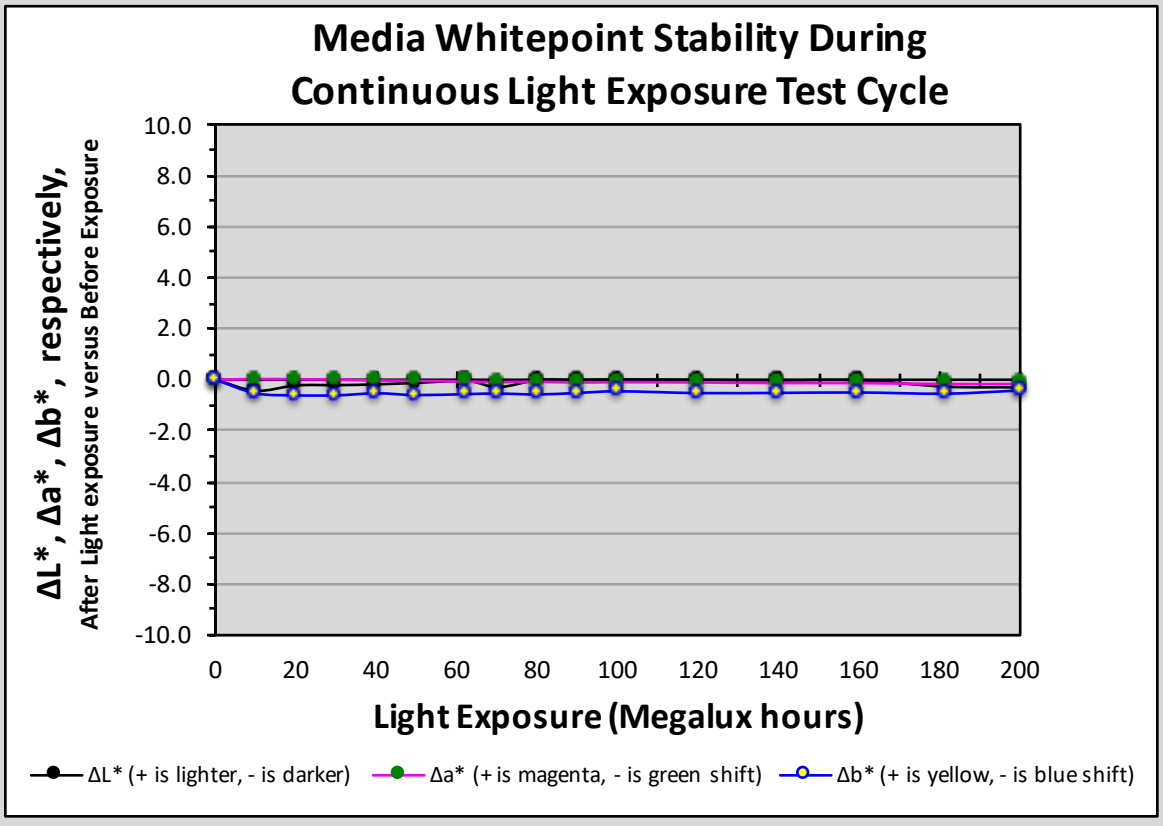


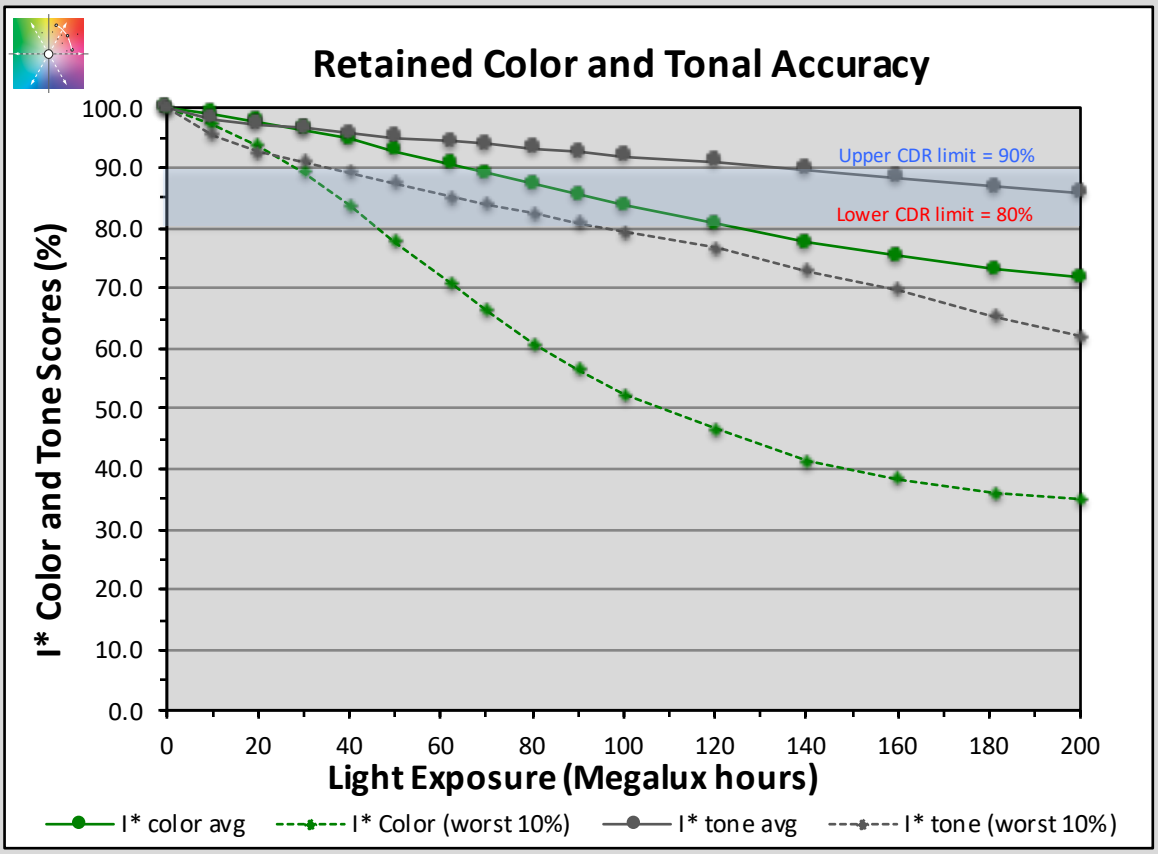


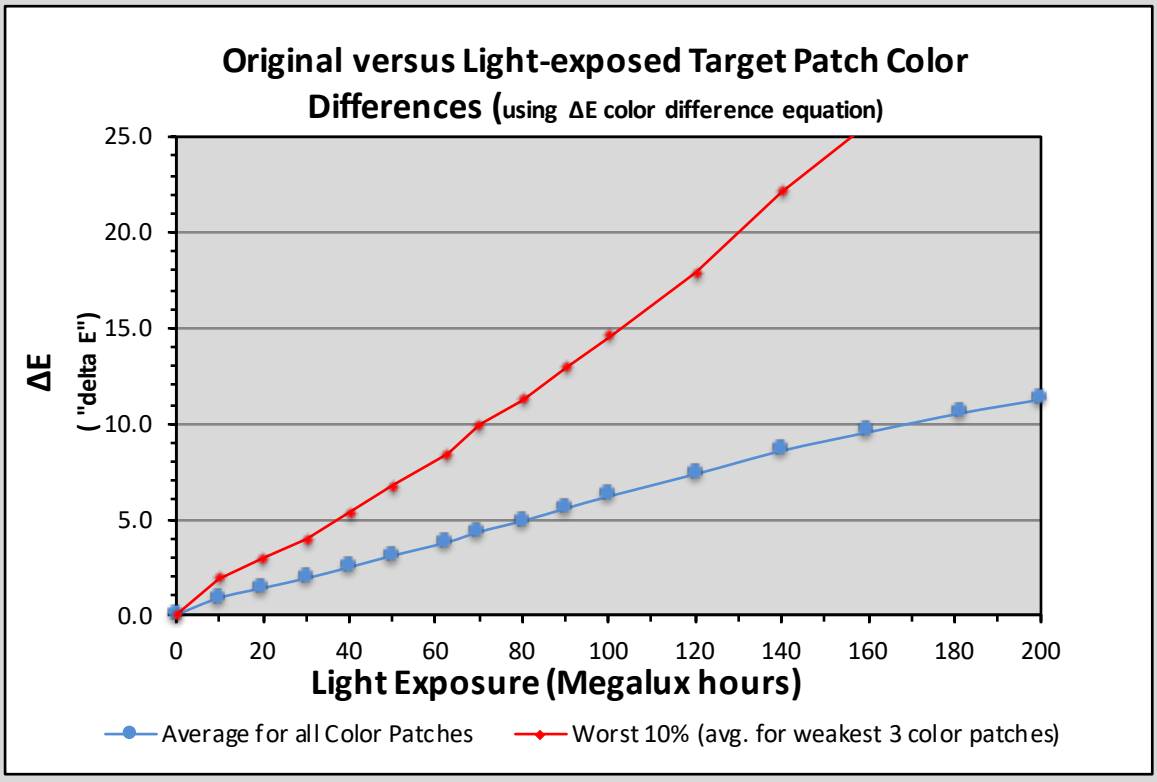
Section II: Accelerated Light Fade test results

This section of the report contains the light exposure test results measured immediately after each exposure interval is completed. Samples are pulled directly from the light fade test unit, measured within a few hours using an Xrite i1 Pro2 spectrophotometer, and then returned to the test unit for additional ongoing exposure. This methodolody is a traditional scientific approach to light fastness testing of photographic materials, and provides insight to the fade resistance of the image forming colorants as well as the fade and discoloration resistance of the media when exposed to continuous illumination on display. However, it does not acccount for any photochemical reaction products which may require longer time periods at ambient room temperature and relative humidity levels to form additional staining or yelowing appearance. Some reaction products are metastable and thus light bleachable, appearing and/or reappearing only over time when the print is displayed under significantly lower average illumination levels or stored in the dark when not continuously on display. See section III for test conditions designed to track this other potential media yellowing issue.

Canon Pixma Pro-1, Canon OEM PGI-29 , Red River Palo Duro Soft Gloss, no additional coating

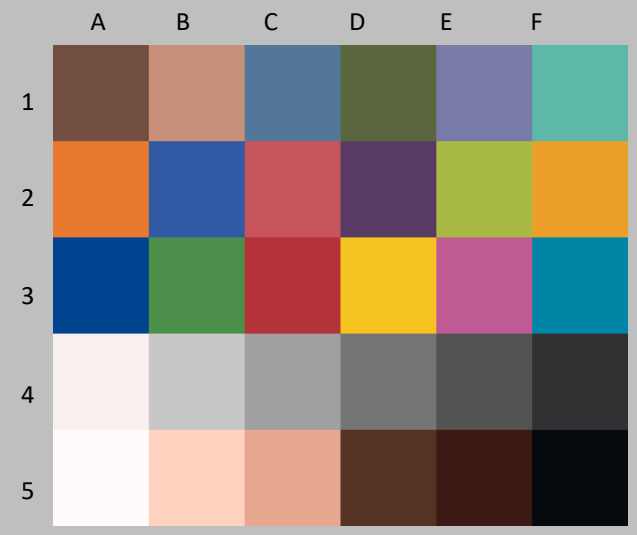




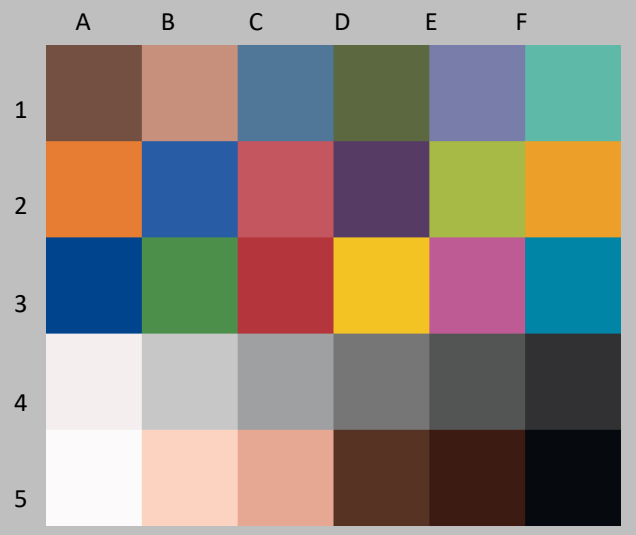


Canon Pixma Pro-1, Canon OEM PGI-29 , Red River Palo Duro Soft Gloss, no additional coating

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



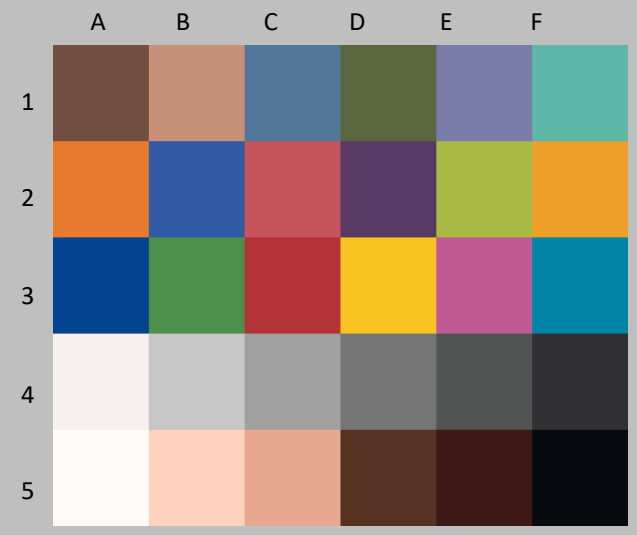
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	98.5	0.8	37.3	37.6	13.1	12.4	14.1	13.7
B1	Light Skin	97.7	1.1	64.7	64.8	17.4	16.6	19.7	19.0
C1	Blue sky	99.5	0.6	48.6	48.8	-4.4	-5.0	-21.7	-21.6
D1	Foliage	100.0	0.5	41.7	41.8	-12.8	-13.2	21.3	21.1
E1	blue flower	98.9	0.8	53.5	53.7	8.7	7.9	-24.2	-23.9
F1	bluish green	100.0	0.4	69.2	69.3	-31.9	-31.7	0.0	-0.4
A1	orange	97.4	2.3	62.7	63.3	35.9	33.7	56.9	56.4
B2	purplish blue	98.0	1.4	39.3	39.6	9.6	8.4	-44.3	-43.6
C2	moderate red	98.0	1.5	50.8	51.0	45.4	44.3	18.0	17.0
D2	purple	99.2	0.7	29.6	29.7	20.7	20.0	-20.1	-19.9
E2	yellow green	99.8	0.6	72.1	72.0	-22.9	-23.0	55.6	55.0
F2	orange yellow	98.4	1.7	71.5	71.9	19.3	17.6	66.8	66.6
A3	blue	97.9	1.5	29.4	29.6	12.1	10.8	-47.1	-46.4
B3	green	100.0	0.4	53.8	53.9	-36.8	-36.8	29.9	29.5
C3	red	97.8	1.8	42.0	42.3	50.6	49.6	27.4	26.0
D3	yellow	99.3	1.0	81.0	81.0	3.8	2.9	78.1	77.5
E3	magenta	99.1	1.0	52.6	52.6	47.0	46.1	-12.9	-13.0
F3	cyan	100.0	0.5	50.9	51.1	-21.5	-21.8	-27.2	-27.0
A4	white	100.0	0.6	95.4	95.1	0.6	0.5	1.6	1.1
B4	neutral 8	100.0	0.4	80.2	80.2	-0.6	-0.9	0.5	0.2
C4	neutral 6.5	100.0	0.4	65.8	65.9	-0.9	-1.1	-0.5	-0.7
D4	neutral 5	100.0	0.4	49.6	49.7	-0.3	-0.6	0.2	0.0
E4	neutral 3.5	100.0	0.4	35.3	35.6	-0.6	-0.9	-0.5	-0.5
F4	black	100.0	0.3	20.9	21.0	0.4	0.1	-1.0	-0.8
A5	paper white	99.7	0.7	98.8	98.4	0.3	0.3	0.7	0.2
B5	Skin highlight L*=88	96.7	1.1	87.5	87.4	11.9	11.2	14.8	14.0
C5	Skin highlight L* =75	97.4	1.3	74.2	74.1	20.2	19.4	21.4	20.4
D5	Skin shadow L*=28	98.0	1.0	25.0	25.3	14.5	13.6	16.7	16.8
E5	Skin shadow L*=13	99.0	0.8	14.3	14.6	16.1	15.5	12.3	12.6
F5	Maximum Black	99.7	0.5	3.2	3.0	-0.3	-0.4	-2.7	-2.2

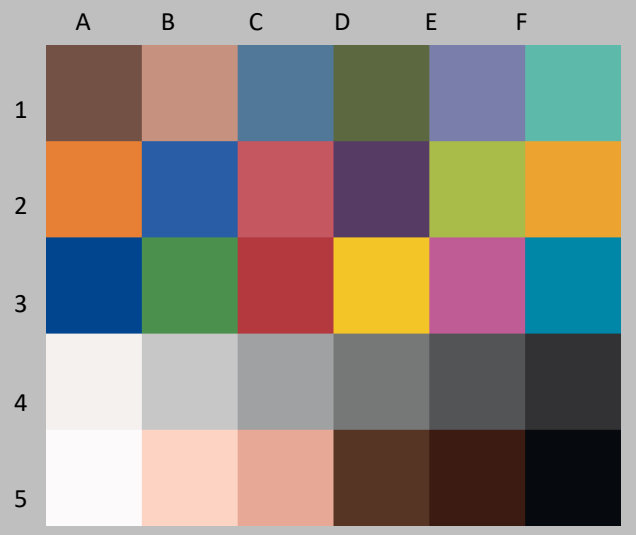
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	99.0	98.2	0.9
Worst 10% (3 lowest scoring patches)	97.2	95.4	1.9

10 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



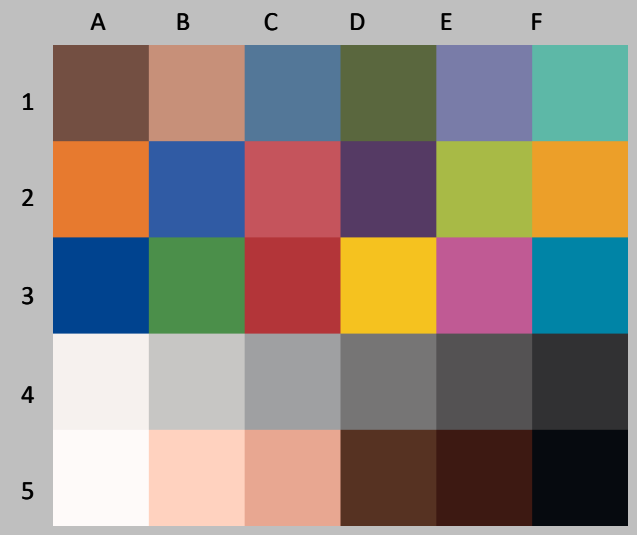
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	96.5	1.4	37.3	38.0	13.1	12.2	14.1	13.3
B1	Light Skin	94.9	1.9	64.7	65.3	17.4	16.5	19.7	18.2
C1	Blue sky	99.1	0.9	48.6	49.1	-4.4	-5.1	-21.7	-21.7
D1	Foliage	98.5	1.0	41.7	42.2	-12.8	-13.3	21.3	20.6
E1	blue flower	98.5	1.1	53.5	54.1	8.7	7.8	-24.2	-23.9
F1	bluish green	97.7	1.4	69.2	69.7	-31.9	-31.6	0.0	-1.2
A1	orange	95.9	3.5	62.7	64.0	35.9	32.8	56.9	55.9
B2	purplish blue	97.5	1.7	39.3	39.9	9.6	8.2	-44.3	-43.5
C2	moderate red	96.7	2.2	50.8	51.4	45.4	44.0	18.0	16.4
D2	purple	98.9	0.9	29.6	30.0	20.7	19.9	-20.1	-19.9
E2	yellow green	98.4	1.5	72.1	72.4	-22.9	-23.2	55.6	54.1
F2	orange yellow	97.1	2.7	71.5	72.5	19.3	16.9	66.8	65.9
A3	blue	97.2	1.9	29.4	29.9	12.1	10.4	-47.1	-46.3
B3	green	98.7	1.2	53.8	54.3	-36.8	-37.0	29.9	28.8
C3	red	96.5	2.6	42.0	42.8	50.6	49.3	27.4	25.3
D3	yellow	98.2	2.0	81.0	81.5	3.8	2.4	78.1	76.7
E3	magenta	98.8	1.1	52.6	53.0	47.0	46.0	-12.9	-13.2
F3	cyan	100.0	0.8	50.9	51.5	-21.5	-21.9	-27.2	-27.3
A4	white	98.9	0.6	95.4	95.4	0.6	0.5	1.6	1.0
B4	neutral 8	98.7	0.7	80.2	80.6	-0.6	-0.9	0.5	-0.1
C4	neutral 6.5	99.6	0.7	65.8	66.2	-0.9	-1.1	-0.5	-0.9
D4	neutral 5	100.0	0.7	49.6	50.1	-0.3	-0.7	0.2	-0.2
E4	neutral 3.5	100.0	0.7	35.3	35.8	-0.6	-1.0	-0.5	-0.7
F4	black	100.0	0.6	20.9	21.3	0.4	-0.1	-1.0	-1.0
A5	paper white	98.8	0.6	98.8	98.6	0.3	0.3	0.7	0.1
B5	Skin highlight L*=88	92.2	2.0	87.5	87.8	11.9	11.0	14.8	13.1
C5	Skin highlight L* =75	94.2	2.3	74.2	74.6	20.2	19.2	21.4	19.4
D5	Skin shadow L*=28	96.6	1.4	25.0	25.7	14.5	13.2	16.7	16.7
E5	Skin shadow L*=13	96.3	1.3	14.3	14.7	16.1	15.4	12.3	13.3
F5	Maximum Black	98.6	0.6	3.2	3.1	-0.3	-0.4	-2.7	-2.1

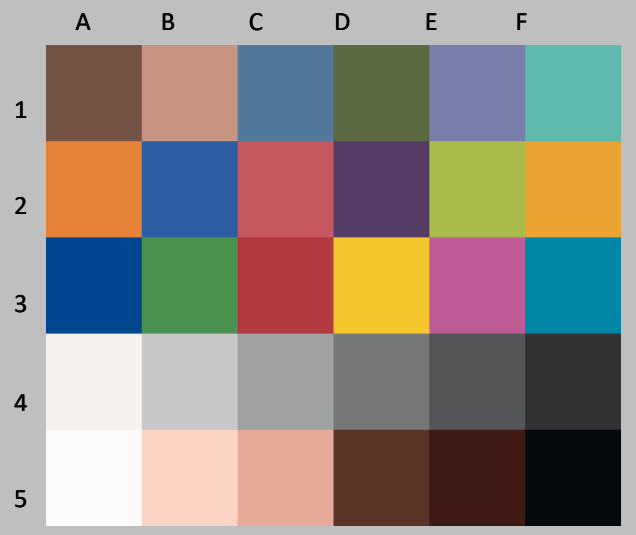
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	97.8	97.2	1.4
Worst 10% (3 lowest scoring patches)	93.8	92.6	2.9

20 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



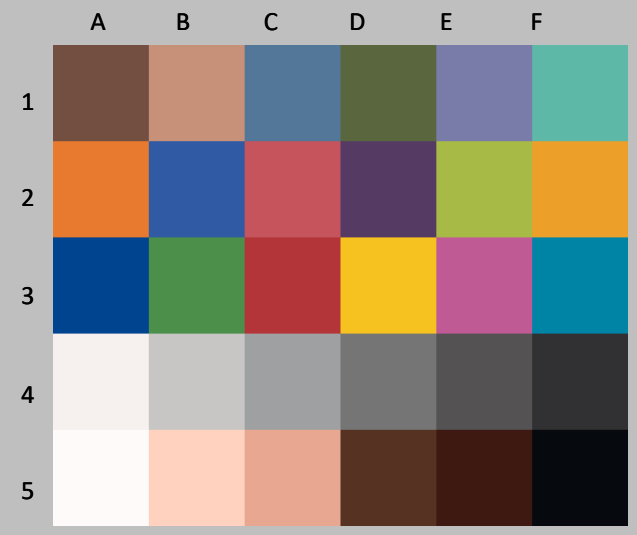
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	94.0	1.9	37.3	38.3	13.1	12.1	14.1	12.8
B1	Light Skin	91.5	2.8	64.7	65.4	17.4	16.4	19.7	17.1
C1	Blue sky	99.1	1.0	48.5	49.2	-4.5	-5.2	-21.9	-21.8
D1	Foliage	95.8	1.7	41.7	42.4	-12.9	-13.4	21.4	19.9
E1	blue flower	98.0	1.3	53.4	54.2	8.7	7.7	-24.2	-23.8
F1	bluish green	94.2	2.5	69.1	69.9	-31.9	-31.3	0.1	-2.2
A1	orange	94.4	4.6	62.6	64.4	35.9	32.2	57.0	55.0
B2	purplish blue	97.0	2.0	39.2	40.0	9.6	8.0	-44.3	-43.4
C2	moderate red	94.8	3.2	50.7	51.6	45.3	43.7	18.3	15.8
D2	purple	98.3	1.1	29.5	30.1	20.4	19.4	-20.2	-20.0
E2	yellow green	96.6	2.6	72.0	72.6	-23.0	-23.3	55.5	52.9
F2	orange yellow	95.5	3.8	71.4	72.7	19.4	16.5	67.1	64.9
A3	blue	96.8	2.2	29.4	30.2	11.6	9.9	-46.9	-45.9
B3	green	96.5	2.3	53.7	54.3	-36.9	-37.1	29.8	27.7
C3	red	95.2	3.4	41.9	43.0	50.5	48.9	27.3	24.4
D3	yellow	96.7	3.2	80.9	81.6	3.8	2.1	78.1	75.5
E3	magenta	98.4	1.4	52.6	53.1	47.1	45.8	-13.0	-13.2
F3	cyan	100.0	0.9	50.7	51.5	-21.5	-21.9	-27.2	-27.4
A4	white	97.6	0.7	95.2	95.2	0.4	0.3	1.7	0.9
B4	neutral 8	97.4	0.9	80.1	80.7	-0.7	-1.0	0.6	-0.1
C4	neutral 6.5	98.4	0.9	65.7	66.4	-0.9	-1.1	-0.5	-1.1
D4	neutral 5	98.2	1.0	49.5	50.1	-0.4	-0.6	0.2	-0.4
E4	neutral 3.5	98.9	0.9	35.3	35.9	-0.5	-0.9	-0.4	-0.9
F4	black	100.0	0.6	20.9	21.4	0.0	-0.4	-0.8	-0.9
A5	paper white	98.8	0.6	98.6	98.4	0.2	0.2	0.7	0.1
B5	Skin highlight L*=88	86.2	3.2	87.4	87.9	11.9	10.7	15.1	12.2
C5	Skin highlight L* =75	90.3	3.4	74.1	74.7	20.2	19.0	21.3	18.2
D5	Skin shadow L*=28	95.5	1.8	25.1	26.1	14.5	13.1	16.9	16.4
E5	Skin shadow L*=13	98.1	1.0	14.2	14.7	15.9	15.1	12.7	13.0
F5	Maximum Black	100.0	0.3	3.2	3.2	-0.4	-0.4	-2.4	-2.1

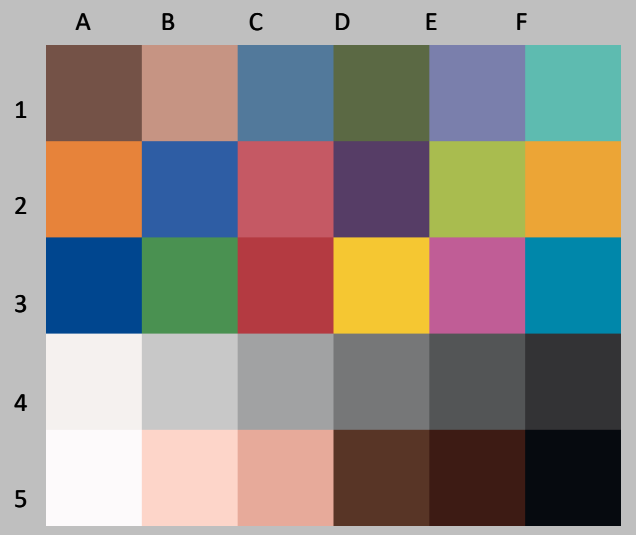
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	96.4	96.5	1.9
Worst 10% (3 lowest scoring patches)	89.3	91.1	4.0

30 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



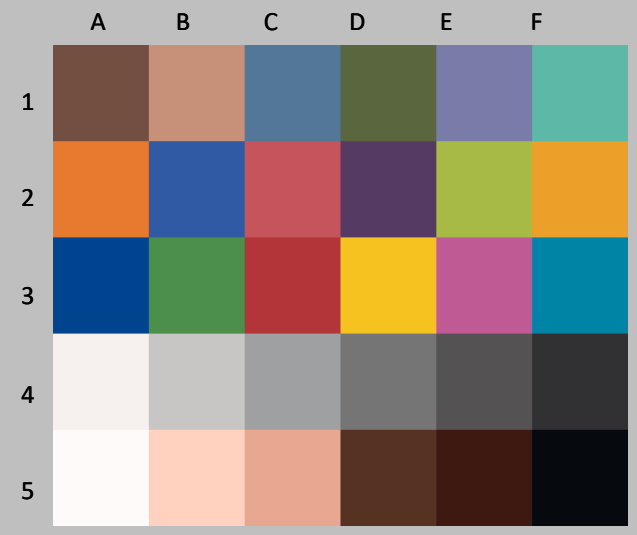
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	91.8	2.4	37.3	38.5	13.1	12.1	14.1	12.3
B1	Light Skin	87.2	4.0	64.7	65.7	17.4	16.4	19.7	15.9
C1	Blue sky	99.3	1.2	48.5	49.4	-4.5	-5.1	-21.9	-21.8
D1	Foliage	93.0	2.4	41.7	42.5	-12.9	-13.4	21.4	19.2
E1	blue flower	97.8	1.4	53.4	54.4	8.7	7.7	-24.2	-23.8
F1	bluish green	90.8	3.6	69.1	70.1	-31.9	-30.9	0.1	-3.2
A1	orange	92.7	5.8	62.6	64.8	35.9	31.5	57.0	53.8
B2	purplish blue	96.5	2.3	39.2	40.2	9.6	7.9	-44.3	-43.2
C2	moderate red	92.9	4.2	50.7	51.9	45.3	43.5	18.3	14.8
D2	purple	98.0	1.3	29.5	30.2	20.4	19.4	-20.2	-19.9
E2	yellow green	94.3	4.0	72.0	72.8	-23.0	-23.3	55.5	51.6
F2	orange yellow	93.7	5.1	71.4	73.1	19.4	15.9	67.1	63.7
A3	blue	96.5	2.4	29.4	30.3	11.6	9.8	-46.9	-45.7
B3	green	94.2	3.4	53.7	54.6	-36.9	-37.1	29.8	26.6
C3	red	93.9	4.2	41.9	43.3	50.5	48.6	27.3	23.8
D3	yellow	95.0	4.5	80.9	81.8	3.8	1.8	78.1	74.2
E3	magenta	98.3	1.5	52.6	53.3	47.1	45.8	-13.0	-13.4
F3	cyan	99.9	1.1	50.7	51.7	-21.5	-21.8	-27.2	-27.6
A4	white	96.6	0.8	95.2	95.3	0.4	0.3	1.7	0.8
B4	neutral 8	94.8	1.2	80.1	80.8	-0.7	-1.0	0.6	-0.4
C4	neutral 6.5	95.9	1.2	65.7	66.6	-0.9	-1.0	-0.5	-1.4
D4	neutral 5	96.2	1.2	49.5	50.3	-0.4	-0.6	0.2	-0.6
E4	neutral 3.5	96.7	1.1	35.3	36.1	-0.5	-0.8	-0.4	-1.2
F4	black	100.0	0.7	20.9	21.5	0.0	-0.4	-0.8	-1.1
A5	paper white	99.7	0.6	98.6	98.4	0.2	0.2	0.7	0.2
B5	Skin highlight L*=88	79.3	4.5	87.4	88.2	11.9	10.7	15.1	10.8
C5	Skin highlight L* =75	84.9	5.0	74.1	75.0	20.2	19.1	21.3	16.5
D5	Skin shadow L*=28	94.0	2.2	25.1	26.3	14.5	12.9	16.9	16.0
E5	Skin shadow L*=13	98.1	1.1	14.2	14.9	15.9	15.1	12.7	13.0
F5	Maximum Black	100.0	0.2	3.2	3.3	-0.4	-0.3	-2.4	-2.3

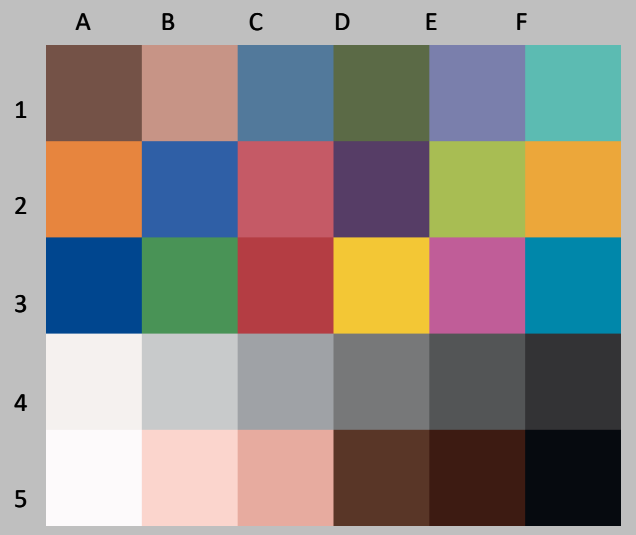
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	94.7	95.8	2.5
Worst 10% (3 lowest scoring patches)	83.8	89.3	5.3

40 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



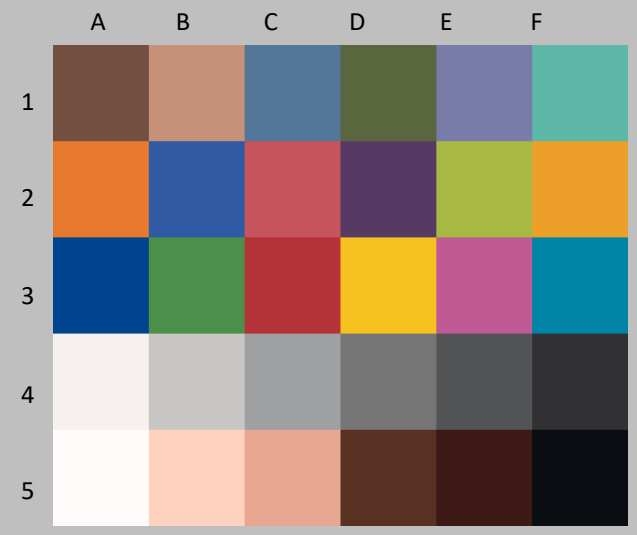
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	89.4	2.9	37.3	38.6	13.1	12.0	14.1	11.8
B1	Light Skin	82.4	5.3	64.7	65.9	17.4	16.4	19.7	14.6
C1	Blue sky	99.6	1.2	48.5	49.5	-4.5	-5.1	-21.9	-22.0
D1	Foliage	90.0	3.2	41.7	42.7	-12.9	-13.4	21.4	18.4
E1	blue flower	97.9	1.5	53.4	54.6	8.7	7.7	-24.2	-23.8
F1	bluish green	86.9	4.8	69.1	70.3	-31.9	-30.5	0.1	-4.4
A1	orange	90.8	7.1	62.6	65.2	35.9	30.9	57.0	52.6
B2	purplish blue	96.4	2.4	39.2	40.3	9.6	7.8	-44.3	-43.2
C2	moderate red	91.0	5.1	50.7	52.2	45.3	43.3	18.3	13.9
D2	purple	97.9	1.3	29.5	30.2	20.4	19.3	-20.2	-19.8
E2	yellow green	92.0	5.4	72.0	73.0	-23.0	-23.3	55.5	50.2
F2	orange yellow	92.1	6.3	71.4	73.4	19.4	15.3	67.1	62.6
A3	blue	96.2	2.5	29.4	30.4	11.6	9.7	-46.9	-45.6
B3	green	91.7	4.6	53.7	54.7	-36.9	-37.1	29.8	25.4
C3	red	92.6	5.0	41.9	43.6	50.5	48.4	27.3	23.0
D3	yellow	93.3	5.8	80.9	82.1	3.8	1.4	78.1	72.9
E3	magenta	98.1	1.7	52.6	53.4	47.1	45.8	-13.0	-13.6
F3	cyan	99.0	1.4	50.7	51.8	-21.5	-21.6	-27.2	-28.0
A4	white	94.8	1.0	95.2	95.3	0.4	0.3	1.7	0.7
B4	neutral 8	91.2	1.6	80.1	81.0	-0.7	-0.9	0.6	-0.8
C4	neutral 6.5	92.7	1.6	65.7	66.7	-0.9	-1.0	-0.5	-1.7
D4	neutral 5	93.9	1.5	49.5	50.5	-0.4	-0.5	0.2	-0.8
E4	neutral 3.5	94.9	1.3	35.3	36.2	-0.5	-0.8	-0.4	-1.4
F4	black	99.8	0.8	20.9	21.5	0.0	-0.4	-0.8	-1.2
A5	paper white	98.9	0.6	98.6	98.5	0.2	0.2	0.7	0.1
B5	Skin highlight L*=88	72.1	5.9	87.4	88.4	11.9	10.7	15.1	9.4
C5	Skin highlight L* =75	79.1	6.7	74.1	75.2	20.2	19.2	21.3	14.8
D5	Skin shadow L*=28	93.0	2.5	25.1	26.5	14.5	12.7	16.9	15.8
E5	Skin shadow L*=13	95.9	1.5	14.2	14.9	15.9	14.9	12.7	13.6
F5	Maximum Black	100.0	0.1	3.2	3.3	-0.4	-0.4	-2.4	-2.4

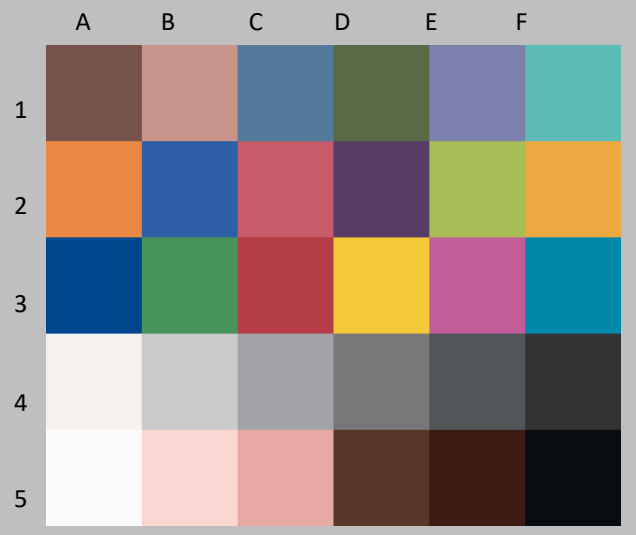
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	92.8	95.1	3.1
Worst 10% (3 lowest scoring patches)	77.9	87.6	6.7

50 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure

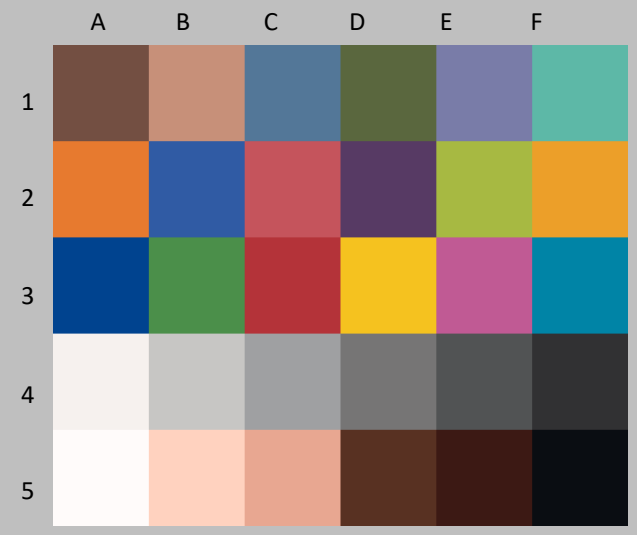


Colors After light exposure

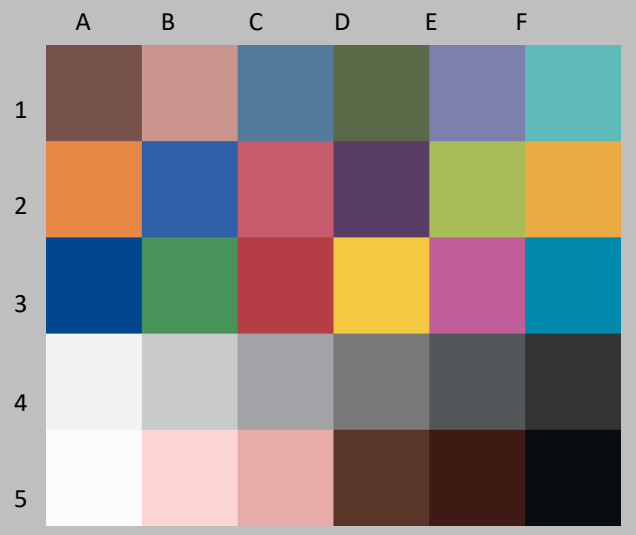
Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	87.1	3.3	37.4	38.9	13.1	11.9	14.0	11.2
B1	Light Skin	76.4	6.9	64.7	66.2	17.4	16.6	19.6	13.0
C1	Blue sky	99.6	1.4	48.5	49.8	-4.3	-4.9	-22.0	-22.2
D1	Foliage	87.0	3.9	41.7	42.9	-12.8	-13.3	21.3	17.6
E1	blue flower	98.2	1.7	53.4	54.8	8.6	7.7	-24.3	-24.1
F1	bluish green	82.6	6.2	69.1	70.7	-31.8	-30.0	0.1	-5.7
A1	orange	88.7	8.6	62.6	65.7	35.9	30.2	56.8	51.0
B2	purplish blue	96.5	2.5	39.1	40.4	9.7	7.9	-44.4	-43.4
C2	moderate red	88.9	6.2	50.6	52.4	45.5	43.4	18.0	12.4
D2	purple	98.1	1.4	29.4	30.4	20.6	19.6	-20.4	-20.1
E2	yellow green	89.7	6.9	71.9	73.3	-23.1	-23.4	55.6	48.9
F2	orange yellow	90.2	7.7	71.3	73.8	19.3	14.8	67.1	61.4
A3	blue	96.2	2.5	29.4	30.4	11.9	9.9	-46.9	-45.8
B3	green	88.9	5.9	53.6	54.9	-37.0	-37.1	30.0	24.2
C3	red	91.3	5.8	41.9	43.8	50.5	48.3	27.4	22.4
D3	yellow	91.3	7.4	80.9	82.3	3.8	1.0	78.3	71.5
E3	magenta	97.9	1.8	52.5	53.5	47.1	46.0	-13.1	-14.0
F3	cyan	98.0	1.8	50.8	52.0	-21.6	-21.4	-27.3	-28.5
A4	white	94.5	1.1	95.1	95.4	0.4	0.3	1.6	0.5
B4	neutral 8	87.9	1.9	80.2	81.2	-0.7	-0.8	0.5	-1.1
C4	neutral 6.5	88.4	2.0	65.7	66.9	-0.9	-0.8	-0.6	-2.2
D4	neutral 5	91.0	1.8	49.5	50.7	-0.3	-0.4	0.1	-1.2
E4	neutral 3.5	93.8	1.5	35.4	36.4	-0.6	-0.9	-0.5	-1.6
F4	black	100.0	0.9	20.9	21.7	0.1	-0.3	-1.1	-1.2
A5	paper white	99.3	0.6	98.6	98.6	0.3	0.2	0.7	0.1
B5	Skin highlight L*=88	64.1	7.5	87.4	88.7	11.9	10.8	15.0	7.7
C5	Skin highlight L* =75	71.7	8.9	74.1	75.5	20.3	19.5	21.3	12.5
D5	Skin shadow L*=28	92.6	2.6	25.0	26.5	14.6	12.7	16.6	15.5
E5	Skin shadow L*=13	91.6	2.3	14.3	15.0	16.1	15.0	11.9	13.8
F5	Maximum Black	99.0	0.6	3.4	3.4	-0.2	-0.4	-2.9	-2.3

Summary Results	I* Color	I* tone	ΔE	
Average Score for all patches	90.7	94.3	3.8	62.6 Megalux hours
Worst 10% (3 lowest scoring patches)	70.7	85.2	8.4	

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



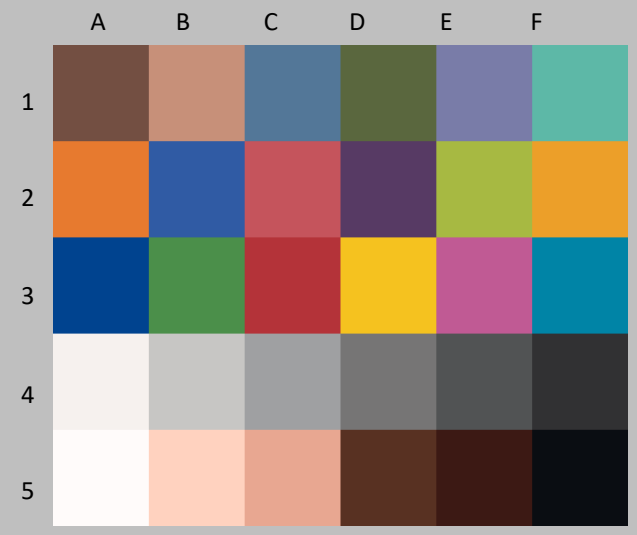
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	84.9	3.8	37.4	39.0	13.1	11.9	14.0	10.7
B1	Light Skin	71.9	8.0	64.7	66.3	17.4	16.7	19.6	11.8
C1	Blue sky	100.0	1.5	48.5	49.8	-4.3	-4.7	-22.0	-22.3
D1	Foliage	84.1	4.7	41.7	42.9	-12.8	-13.3	21.3	17.0
E1	blue flower	98.3	1.8	53.4	54.9	8.6	7.9	-24.3	-24.1
F1	bluish green	79.0	7.4	69.1	70.8	-31.8	-29.5	0.1	-6.7
A1	orange	86.2	10.4	62.6	66.0	35.9	29.8	56.8	49.8
B2	purplish blue	96.2	2.7	39.1	40.5	9.7	7.9	-44.4	-43.2
C2	moderate red	86.3	7.5	50.6	52.5	45.5	43.3	18.0	11.5
D2	purple	98.2	1.5	29.4	30.4	20.6	19.5	-20.4	-20.0
E2	yellow green	87.1	8.4	71.9	73.4	-23.1	-23.2	55.6	47.6
F2	orange yellow	88.1	9.2	71.3	73.9	19.3	14.4	67.1	60.1
A3	blue	95.6	2.9	29.4	30.5	11.9	9.8	-46.9	-45.6
B3	green	86.8	6.9	53.6	55.0	-37.0	-36.8	30.0	23.1
C3	red	89.5	6.8	41.9	44.0	50.5	48.0	27.4	21.5
D3	yellow	90.4	8.0	80.9	82.4	3.8	0.8	78.3	70.1
E3	magenta	97.5	2.0	52.5	53.7	47.1	45.9	-13.1	-14.2
F3	cyan	97.2	2.0	50.8	52.1	-21.6	-21.2	-27.3	-28.7
A4	white	94.4	1.0	95.1	95.3	0.4	0.4	1.6	0.5
B4	neutral 8	86.0	2.1	80.2	81.2	-0.7	-0.7	0.5	-1.4
C4	neutral 6.5	85.1	2.3	65.7	67.0	-0.9	-0.6	-0.6	-2.4
D4	neutral 5	89.5	1.9	49.5	50.7	-0.3	-0.3	0.1	-1.4
E4	neutral 3.5	91.3	1.8	35.4	36.4	-0.6	-0.8	-0.5	-1.8
F4	black	99.0	1.0	20.9	21.7	0.1	-0.2	-1.1	-1.5
A5	paper white	99.5	0.6	98.6	98.5	0.3	0.2	0.7	0.2
B5	Skin highlight L*=88	59.6	8.3	87.4	88.7	11.9	10.8	15.0	6.8
C5	Skin highlight L* =75	67.3	10.3	74.1	75.6	20.3	19.6	21.3	11.1
D5	Skin shadow L*=28	90.2	3.1	25.0	26.6	14.6	12.7	16.6	15.1
E5	Skin shadow L*=13	94.1	1.9	14.3	15.1	16.1	14.8	11.9	13.5
F5	Maximum Black	100.0	0.6	3.4	3.6	-0.2	-0.4	-2.9	-2.4

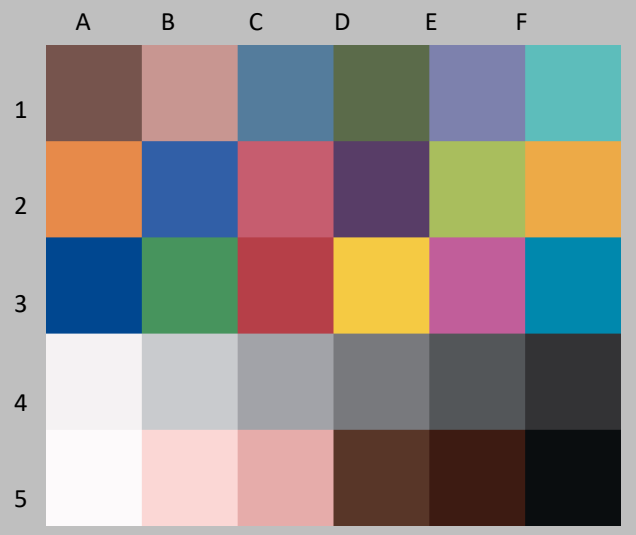
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	89.1	93.9	4.3
Worst 10% (3 lowest scoring patches)	66.2	84.0	9.9

70 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



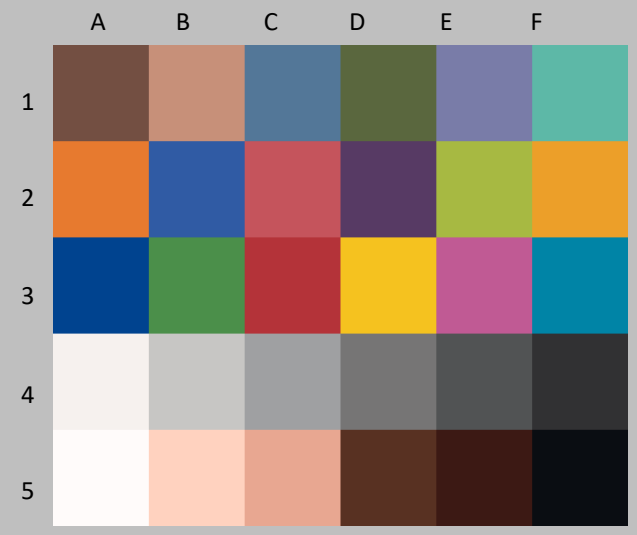
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	82.0	4.3	37.4	39.1	13.1	12.0	14.0	10.2
B1	Light Skin	66.9	9.4	64.7	66.6	17.4	16.9	19.6	10.4
C1	Blue sky	99.4	1.6	48.5	50.0	-4.3	-4.6	-22.0	-22.5
D1	Foliage	81.6	5.3	41.7	43.1	-12.8	-13.3	21.3	16.3
E1	blue flower	99.2	1.9	53.4	55.1	8.6	8.0	-24.3	-24.2
F1	bluish green	75.6	8.5	69.1	71.1	-31.8	-29.1	0.1	-7.7
A1	orange	84.9	11.3	62.6	66.4	35.9	29.4	56.8	48.3
B2	purplish blue	96.4	2.6	39.1	40.7	9.7	7.9	-44.4	-43.3
C2	moderate red	84.9	8.2	50.6	52.8	45.5	43.3	18.0	10.4
D2	purple	98.2	1.5	29.4	30.5	20.6	19.6	-20.4	-20.3
E2	yellow green	85.0	9.7	71.9	73.7	-23.1	-23.1	55.6	46.1
F2	orange yellow	86.5	10.4	71.3	74.4	19.3	14.1	67.1	58.7
A3	blue	96.3	2.6	29.4	30.5	11.9	9.9	-46.9	-45.8
B3	green	84.0	8.3	53.6	55.3	-37.0	-36.7	30.0	21.9
C3	red	88.5	7.5	41.9	44.2	50.5	48.0	27.4	20.7
D3	yellow	87.6	10.4	80.9	82.8	3.8	0.6	78.3	68.6
E3	magenta	97.4	2.3	52.5	53.9	47.1	46.0	-13.1	-14.5
F3	cyan	96.1	2.4	50.8	52.3	-21.6	-21.0	-27.3	-29.1
A4	white	92.6	1.3	95.1	95.6	0.4	0.4	1.6	0.4
B4	neutral 8	82.0	2.6	80.2	81.5	-0.7	-0.5	0.5	-1.7
C4	neutral 6.5	81.3	2.7	65.7	67.2	-0.9	-0.4	-0.6	-2.8
D4	neutral 5	85.6	2.3	49.5	50.8	-0.3	-0.2	0.1	-1.8
E4	neutral 3.5	89.2	1.9	35.4	36.5	-0.6	-0.7	-0.5	-2.0
F4	black	99.9	0.9	20.9	21.6	0.1	-0.3	-1.1	-1.4
A5	paper white	99.2	0.6	98.6	98.6	0.3	0.2	0.7	0.1
B5	Skin highlight L*=88	53.9	9.4	87.4	88.9	11.9	11.0	15.0	5.7
C5	Skin highlight L* =75	61.4	12.0	74.1	75.9	20.3	19.9	21.3	9.4
D5	Skin shadow L*=28	90.9	3.0	25.0	26.7	14.6	12.5	16.6	15.1
E5	Skin shadow L*=13	92.1	2.2	14.3	15.1	16.1	14.9	11.9	13.7
F5	Maximum Black	99.6	0.5	3.4	3.4	-0.2	-0.4	-2.9	-2.4

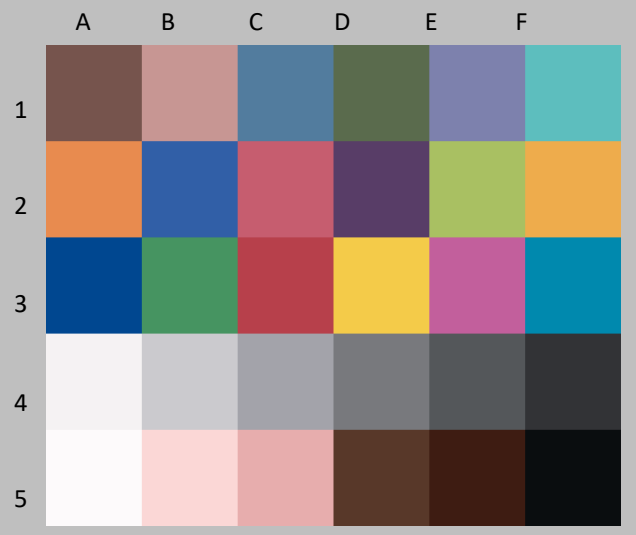
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	87.3	93.2	4.9
Worst 10% (3 lowest scoring patches)	60.7	82.4	11.2

80 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



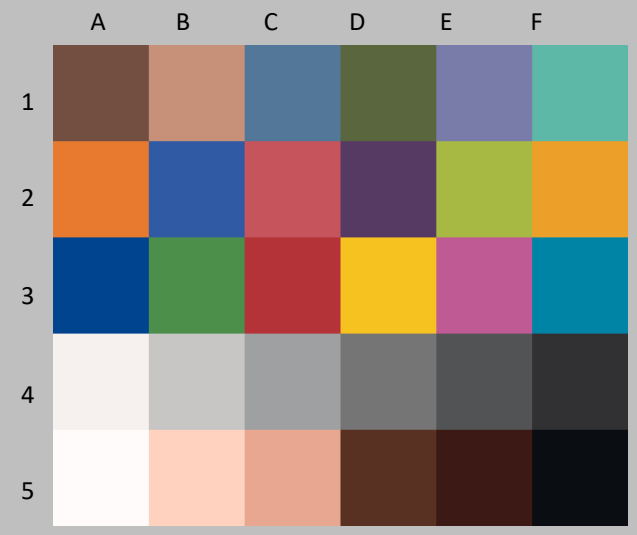
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	79.1	4.9	37.4	39.3	13.1	11.9	14.0	9.6
B1	Light Skin	62.1	10.6	64.7	66.8	17.4	17.0	19.6	9.2
C1	Blue sky	99.5	1.8	48.5	50.2	-4.3	-4.5	-22.0	-22.5
D1	Foliage	78.2	6.1	41.7	43.3	-12.8	-13.2	21.3	15.4
E1	blue flower	99.2	2.0	53.4	55.3	8.6	8.0	-24.3	-24.1
F1	bluish green	72.7	9.4	69.1	71.3	-31.8	-28.6	0.1	-8.5
A1	orange	82.1	13.2	62.6	66.7	35.9	28.9	56.8	46.4
B2	purplish blue	96.3	2.8	39.1	40.8	9.7	7.9	-44.4	-43.2
C2	moderate red	83.2	9.1	50.6	53.1	45.5	43.2	18.0	9.6
D2	purple	98.4	1.6	29.4	30.7	20.6	19.7	-20.4	-20.1
E2	yellow green	82.1	11.5	71.9	74.0	-23.1	-23.0	55.6	44.3
F2	orange yellow	83.9	12.2	71.3	74.7	19.3	13.7	67.1	56.8
A3	blue	95.9	2.8	29.4	30.7	11.9	9.8	-46.9	-45.6
B3	green	81.1	9.7	53.6	55.6	-37.0	-36.6	30.0	20.5
C3	red	87.2	8.3	41.9	44.6	50.5	47.8	27.4	20.0
D3	yellow	85.4	12.2	80.9	83.1	3.8	0.3	78.3	66.8
E3	magenta	97.3	2.4	52.5	54.1	47.1	46.1	-13.1	-14.5
F3	cyan	95.7	2.7	50.8	52.5	-21.6	-20.9	-27.3	-29.2
A4	white	92.6	1.3	95.1	95.6	0.4	0.4	1.6	0.4
B4	neutral 8	80.9	2.8	80.2	81.7	-0.7	-0.5	0.5	-1.8
C4	neutral 6.5	79.5	3.0	65.7	67.4	-0.9	-0.3	-0.6	-2.9
D4	neutral 5	83.4	2.6	49.5	51.1	-0.3	-0.1	0.1	-2.0
E4	neutral 3.5	87.6	2.1	35.4	36.7	-0.6	-0.6	-0.5	-2.2
F4	black	99.3	1.1	20.9	21.7	0.1	-0.3	-1.1	-1.5
A5	paper white	99.7	0.5	98.6	98.6	0.3	0.1	0.7	0.2
B5	Skin highlight L*=88	50.4	10.1	87.4	89.0	11.9	11.0	15.0	5.0
C5	Skin highlight L* =75	56.8	13.4	74.1	76.0	20.3	20.1	21.3	8.0
D5	Skin shadow L*=28	89.4	3.5	25.0	27.0	14.6	12.4	16.6	14.7
E5	Skin shadow L*=13	89.9	2.7	14.3	15.3	16.1	14.7	11.9	14.0
F5	Maximum Black	96.4	0.9	3.4	3.5	-0.2	-0.4	-2.9	-2.1

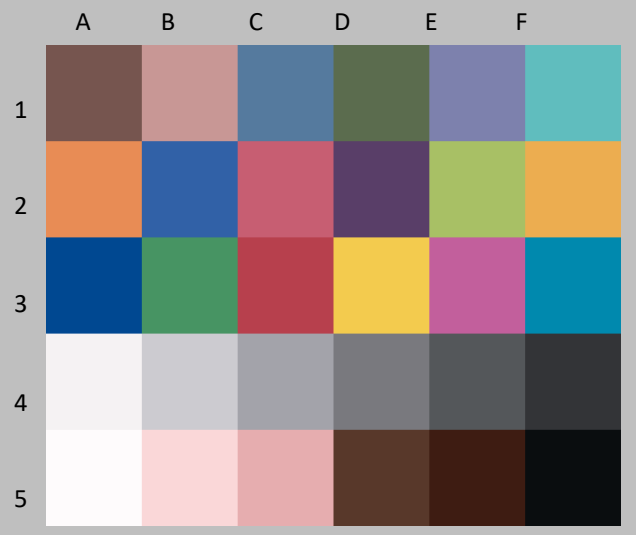
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	85.5	92.5	5.6
Worst 10% (3 lowest scoring patches)	56.4	80.8	12.9

90 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



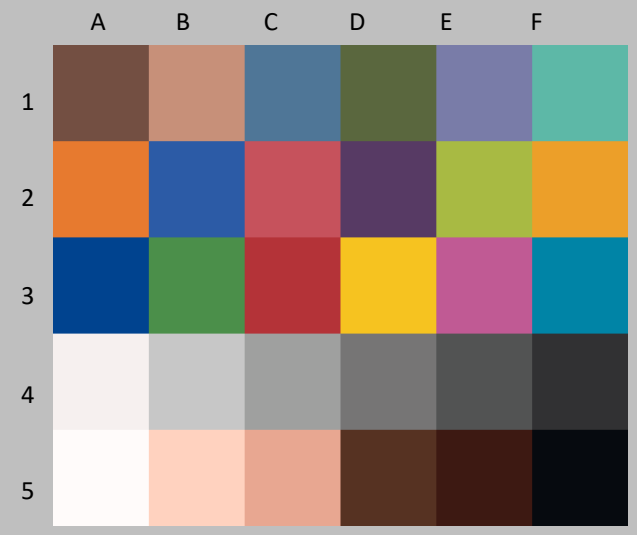
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	76.6	5.4	37.4	39.5	13.1	11.9	14.0	9.1
B1	Light Skin	57.5	11.8	64.7	66.9	17.4	17.2	19.6	8.0
C1	Blue sky	99.4	1.9	48.5	50.3	-4.3	-4.4	-22.0	-22.6
D1	Foliage	74.9	7.0	41.7	43.4	-12.8	-13.0	21.3	14.6
E1	blue flower	99.4	2.1	53.4	55.4	8.6	8.0	-24.3	-24.1
F1	bluish green	69.8	10.4	69.1	71.5	-31.8	-28.2	0.1	-9.3
A1	orange	79.4	15.0	62.6	67.1	35.9	28.5	56.8	44.5
B2	purplish blue	96.1	2.9	39.1	41.0	9.7	7.9	-44.4	-43.1
C2	moderate red	81.2	10.1	50.6	53.3	45.5	43.2	18.0	8.6
D2	purple	98.3	1.7	29.4	30.8	20.6	19.6	-20.4	-20.1
E2	yellow green	79.1	13.3	71.9	74.2	-23.1	-22.8	55.6	42.5
F2	orange yellow	81.3	14.1	71.3	75.0	19.3	13.4	67.1	54.9
A3	blue	95.7	3.0	29.4	30.9	11.9	9.7	-46.9	-45.5
B3	green	78.2	11.1	53.6	55.8	-37.0	-36.3	30.0	19.1
C3	red	85.8	9.1	41.9	44.8	50.5	47.7	27.4	19.2
D3	yellow	82.9	14.1	80.9	83.3	3.8	0.2	78.3	64.9
E3	magenta	97.2	2.6	52.5	54.3	47.1	46.1	-13.1	-14.7
F3	cyan	95.2	2.9	50.8	52.7	-21.6	-20.7	-27.3	-29.3
A4	white	92.7	1.3	95.1	95.7	0.4	0.5	1.6	0.4
B4	neutral 8	79.7	2.9	80.2	81.8	-0.7	-0.4	0.5	-1.9
C4	neutral 6.5	76.8	3.3	65.7	67.6	-0.9	-0.2	-0.6	-3.2
D4	neutral 5	80.9	2.9	49.5	51.2	-0.3	0.0	0.1	-2.2
E4	neutral 3.5	85.9	2.3	35.4	36.8	-0.6	-0.5	-0.5	-2.4
F4	black	99.0	1.2	20.9	21.9	0.1	-0.2	-1.1	-1.6
A5	paper white	100.0	0.5	98.6	98.6	0.3	0.2	0.7	0.2
B5	Skin highlight L*=88	47.2	10.7	87.4	89.2	11.9	11.0	15.0	4.4
C5	Skin highlight L* =75	52.1	14.8	74.1	76.2	20.3	20.3	21.3	6.7
D5	Skin shadow L*=28	87.7	3.8	25.0	27.1	14.6	12.3	16.6	14.3
E5	Skin shadow L*=13	89.4	2.9	14.3	15.4	16.1	14.6	11.9	14.1
F5	Maximum Black	94.0	1.1	3.4	3.7	-0.2	-0.4	-2.9	-1.8

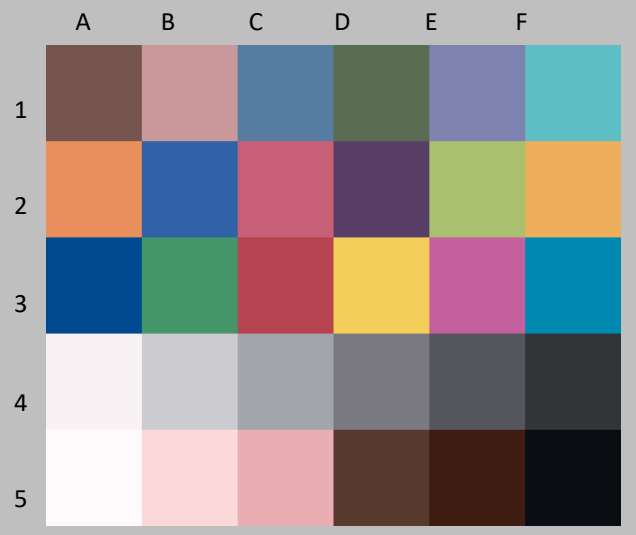
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	83.8	92.0	6.2
Worst 10% (3 lowest scoring patches)	52.3	79.3	14.6

100 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



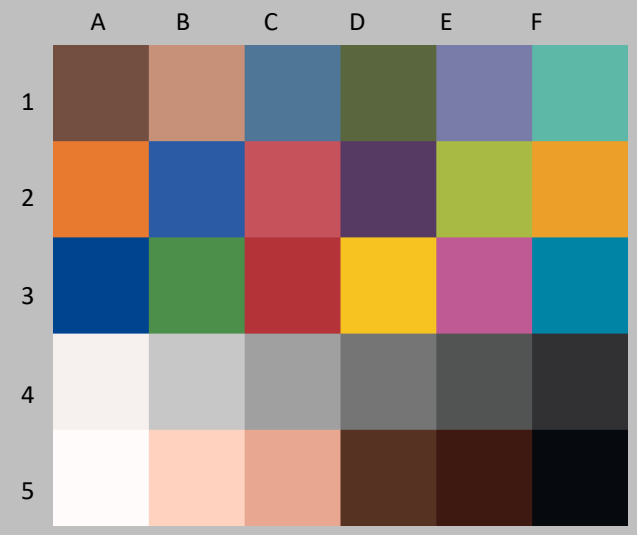
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	71.2	6.5	37.2	39.7	13.1	12.0	13.9	8.0
B1	Light Skin	49.6	13.9	64.7	67.3	17.3	17.4	19.6	5.9
C1	Blue sky	99.4	2.3	48.4	50.6	-4.6	-4.5	-22.0	-22.7
D1	Foliage	67.8	8.8	41.6	43.6	-12.9	-12.8	21.4	12.9
E1	blue flower	99.4	2.4	53.4	55.7	8.8	8.2	-24.3	-24.1
F1	bluish green	65.2	11.9	69.2	71.8	-32.0	-27.6	0.1	-10.7
A1	orange	73.6	19.1	62.7	67.8	36.1	27.7	57.3	40.9
B2	purplish blue	95.7	3.2	39.1	41.2	9.6	7.7	-44.7	-43.1
C2	moderate red	77.1	12.1	50.6	53.6	45.6	43.0	18.3	6.8
D2	purple	98.5	1.8	29.3	30.9	20.5	19.6	-20.4	-20.2
E2	yellow green	73.6	16.7	72.0	74.6	-23.1	-22.5	55.9	39.4
F2	orange yellow	76.1	17.8	71.5	75.6	19.4	12.8	67.4	51.4
A3	blue	94.9	3.4	29.4	31.1	12.0	9.6	-47.1	-45.4
B3	green	72.6	13.7	53.7	56.1	-37.1	-35.9	29.9	16.4
C3	red	82.2	11.3	41.9	45.2	50.6	47.3	27.5	17.3
D3	yellow	79.3	16.7	81.1	83.7	3.7	-0.1	77.5	61.4
E3	magenta	96.7	2.9	52.6	54.6	47.2	46.2	-13.0	-14.9
F3	cyan	94.0	3.4	50.8	52.9	-21.7	-20.5	-27.3	-29.7
A4	white	92.9	1.3	95.4	96.0	0.6	0.6	1.5	0.3
B4	neutral 8	78.3	3.1	80.2	82.0	-0.6	-0.3	0.4	-2.1
C4	neutral 6.5	71.8	3.8	65.7	67.8	-0.9	0.0	-0.5	-3.5
D4	neutral 5	75.6	3.4	49.5	51.4	-0.3	0.2	0.1	-2.7
E4	neutral 3.5	79.4	2.9	35.3	36.9	-0.6	-0.4	-0.5	-2.9
F4	black	92.2	1.7	20.9	22.1	0.0	0.0	-0.9	-2.2
A5	paper white	99.7	0.5	98.8	98.7	0.2	0.1	0.7	0.2
B5	Skin highlight L*=88	44.2	11.3	87.5	89.3	12.0	10.9	15.0	3.8
C5	Skin highlight L* =75	45.9	16.6	74.0	76.5	20.4	20.6	21.3	4.8
D5	Skin shadow L*=28	82.5	5.0	25.0	27.4	14.5	12.2	17.1	13.3
E5	Skin shadow L*=13	92.7	2.4	14.2	15.5	16.2	14.6	12.5	13.7
F5	Maximum Black	100.0	0.8	3.0	3.8	-0.5	-0.4	-2.6	-2.5

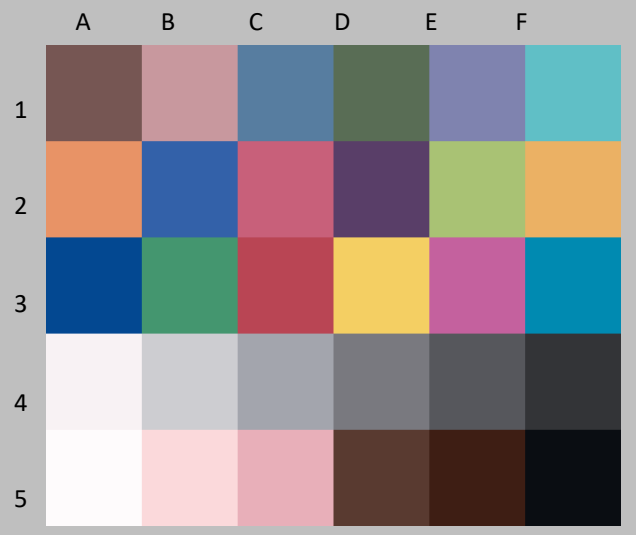
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	80.7	91.0	7.4
Worst 10% (3 lowest scoring patches)	46.6	76.6	17.9

120 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



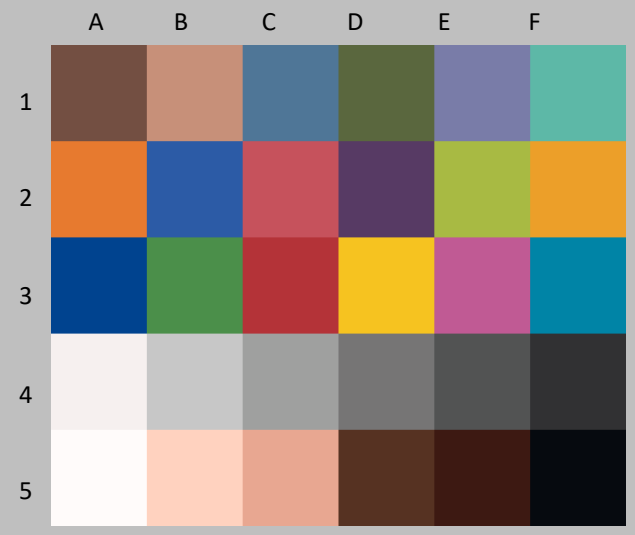
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	66.0	7.5	37.2	40.0	13.1	12.0	13.9	7.0
B1	Light Skin	42.9	15.7	64.7	67.6	17.3	17.6	19.6	4.2
C1	Blue sky	98.9	2.6	48.4	50.8	-4.6	-4.3	-22.0	-22.7
D1	Foliage	60.5	10.6	41.6	43.8	-12.9	-12.5	21.4	11.0
E1	blue flower	99.3	2.7	53.4	56.0	8.8	8.3	-24.3	-23.9
F1	bluish green	60.3	13.5	69.2	72.0	-32.0	-26.8	0.1	-12.0
A1	orange	67.6	23.2	62.7	68.6	36.1	26.7	57.3	36.9
B2	purplish blue	95.1	3.6	39.1	41.4	9.6	7.7	-44.7	-42.8
C2	moderate red	73.6	13.9	50.6	54.1	45.6	42.8	18.3	5.1
D2	purple	98.5	2.0	29.3	31.1	20.5	19.7	-20.4	-20.0
E2	yellow green	67.1	20.6	72.0	74.9	-23.1	-21.9	55.9	35.5
F2	orange yellow	70.0	22.0	71.5	76.2	19.4	12.2	67.4	47.1
A3	blue	94.6	3.6	29.4	31.2	12.0	9.6	-47.1	-45.1
B3	green	66.2	16.8	53.7	56.4	-37.1	-35.2	29.9	13.4
C3	red	79.3	13.0	41.9	45.8	50.6	46.8	27.5	15.7
D3	yellow	73.6	21.2	81.1	84.1	3.7	-0.4	77.5	56.9
E3	magenta	96.9	3.1	52.6	54.9	47.2	46.1	-13.0	-14.8
F3	cyan	93.0	3.7	50.8	53.1	-21.7	-20.2	-27.3	-29.9
A4	white	92.2	1.4	95.4	96.0	0.6	0.6	1.5	0.2
B4	neutral 8	76.3	3.4	80.2	82.2	-0.6	-0.1	0.4	-2.3
C4	neutral 6.5	68.0	4.2	65.7	68.0	-0.9	0.3	-0.5	-3.8
D4	neutral 5	71.3	3.8	49.5	51.5	-0.3	0.5	0.1	-3.1
E4	neutral 3.5	75.5	3.4	35.3	37.1	-0.6	-0.2	-0.5	-3.3
F4	black	91.1	1.8	20.9	22.0	0.0	0.0	-0.9	-2.3
A5	paper white	99.7	0.5	98.8	98.7	0.2	0.1	0.7	0.2
B5	Skin highlight L*=88	40.2	12.1	87.5	89.5	12.0	10.8	15.0	3.1
C5	Skin highlight L* =75	40.4	18.3	74.0	76.8	20.4	20.8	21.3	3.2
D5	Skin shadow L*=28	78.6	5.9	25.0	27.7	14.5	11.9	17.1	12.4
E5	Skin shadow L*=13	92.3	2.5	14.2	15.6	16.2	14.3	12.5	13.4
F5	Maximum Black	100.0	0.7	3.0	3.8	-0.5	-0.3	-2.6	-2.6

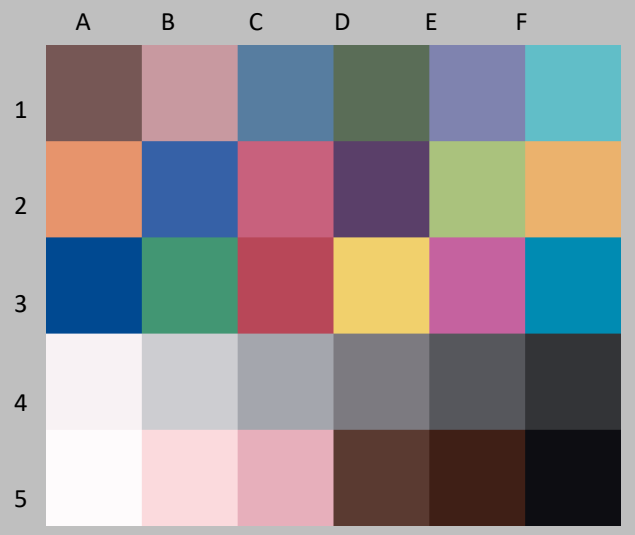
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	77.6	89.7	8.6
Worst 10% (3 lowest scoring patches)	41.2	72.8	22.2

140 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



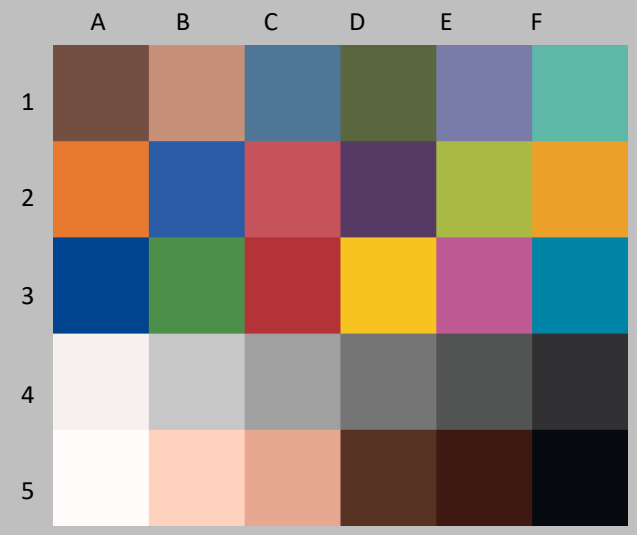
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	62.0	8.3	37.2	40.3	13.1	12.0	13.9	6.2
B1	Light Skin	39.0	16.8	64.7	67.9	17.3	17.7	19.6	3.1
C1	Blue sky	99.1	2.7	48.4	51.0	-4.6	-4.2	-22.0	-22.7
D1	Foliage	55.2	12.0	41.6	44.0	-12.9	-12.2	21.4	9.7
E1	blue flower	98.6	3.0	53.4	56.2	8.8	8.2	-24.3	-23.6
F1	bluish green	58.2	14.2	69.2	72.2	-32.0	-26.3	0.1	-12.5
A1	orange	62.6	26.7	62.7	69.2	36.1	25.8	57.3	33.6
B2	purplish blue	94.4	3.9	39.1	41.5	9.6	7.6	-44.7	-42.4
C2	moderate red	71.1	15.2	50.6	54.4	45.6	42.5	18.3	3.9
D2	purple	98.1	2.1	29.3	31.2	20.5	19.6	-20.4	-19.9
E2	yellow green	61.5	23.9	72.0	75.1	-23.1	-21.4	55.9	32.2
F2	orange yellow	64.9	25.6	71.5	76.6	19.4	11.6	67.4	43.5
A3	blue	93.7	4.0	29.4	31.4	12.0	9.4	-47.1	-44.8
B3	green	61.0	19.3	53.7	56.5	-37.1	-34.5	29.9	11.0
C3	red	76.9	14.5	41.9	46.3	50.6	46.3	27.5	14.4
D3	yellow	69.1	24.7	81.1	84.5	3.7	-0.6	77.5	53.4
E3	magenta	97.1	3.2	52.6	55.2	47.2	46.1	-13.0	-14.6
F3	cyan	92.6	4.0	50.8	53.3	-21.7	-20.0	-27.3	-29.9
A4	white	92.7	1.3	95.4	96.1	0.6	0.6	1.5	0.3
B4	neutral 8	75.7	3.5	80.2	82.4	-0.6	0.0	0.4	-2.3
C4	neutral 6.5	66.8	4.4	65.7	68.2	-0.9	0.4	-0.5	-3.9
D4	neutral 5	68.7	4.1	49.5	51.7	-0.3	0.6	0.1	-3.3
E4	neutral 3.5	72.7	3.6	35.3	37.2	-0.6	-0.1	-0.5	-3.5
F4	black	89.3	2.0	20.9	22.2	0.0	0.1	-0.9	-2.5
A5	paper white	99.8	0.5	98.8	98.7	0.2	0.1	0.7	0.2
B5	Skin highlight L*=88	38.5	12.5	87.5	89.7	12.0	10.7	15.0	2.7
C5	Skin highlight L* =75	37.6	19.1	74.0	77.0	20.4	20.8	21.3	2.4
D5	Skin shadow L*=28	75.1	6.8	25.0	28.1	14.5	11.7	17.1	11.7
E5	Skin shadow L*=13	90.5	3.1	14.2	16.0	16.2	13.9	12.5	13.4
F5	Maximum Black	100.0	1.1	3.0	4.1	-0.5	-0.4	-2.6	-2.5

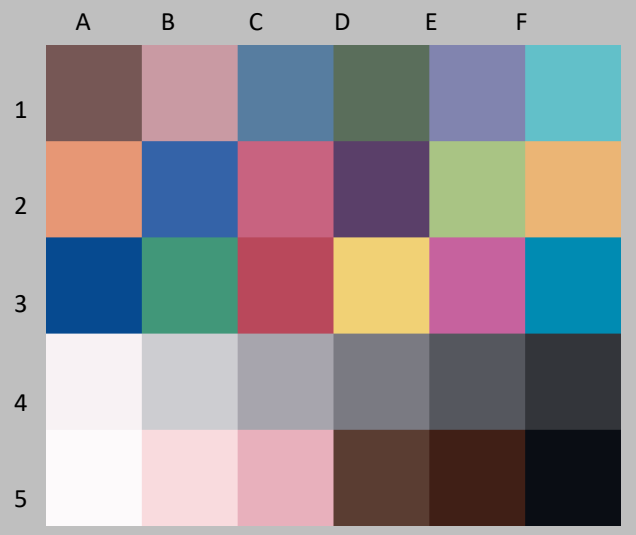
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	75.4	88.5	9.5
Worst 10% (3 lowest scoring patches)	38.3	69.9	25.7

160 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



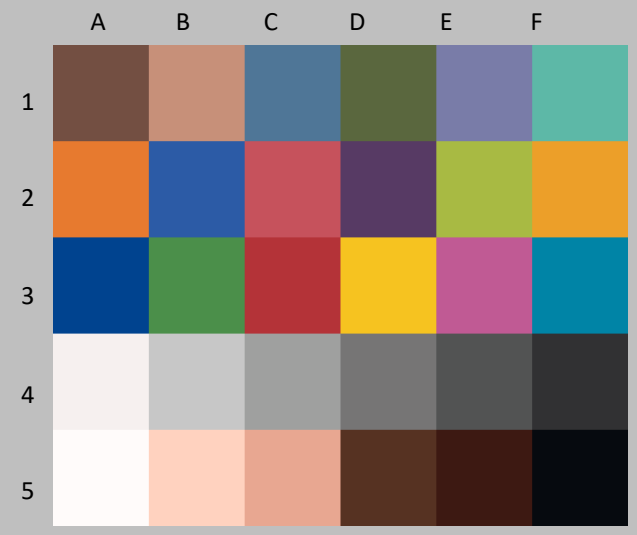
Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	58.3	9.1	37.2	40.6	13.1	12.0	13.9	5.5
B1	Light Skin	35.7	17.7	64.7	68.1	17.3	17.8	19.6	2.3
C1	Blue sky	99.2	2.9	48.4	51.2	-4.6	-4.1	-22.0	-22.5
D1	Foliage	48.9	13.5	41.6	44.1	-12.9	-11.9	21.4	8.2
E1	blue flower	97.5	3.2	53.4	56.4	8.8	8.2	-24.3	-23.3
F1	bluish green	56.1	14.9	69.2	72.4	-32.0	-25.7	0.1	-13.0
A1	orange	57.5	30.2	62.7	69.9	36.1	24.8	57.3	30.3
B2	purplish blue	93.6	4.4	39.1	41.8	9.6	7.4	-44.7	-42.0
C2	moderate red	68.6	16.5	50.6	54.9	45.6	42.2	18.3	2.7
D2	purple	97.9	2.4	29.3	31.5	20.5	19.6	-20.4	-19.8
E2	yellow green	56.1	27.3	72.0	75.5	-23.1	-20.8	55.9	28.9
F2	orange yellow	59.6	29.4	71.5	77.3	19.4	11.0	67.4	39.7
A3	blue	93.2	4.4	29.4	31.6	12.0	9.3	-47.1	-44.5
B3	green	55.7	21.8	53.7	56.8	-37.1	-33.8	29.9	8.5
C3	red	74.2	16.1	41.9	46.8	50.6	45.7	27.5	12.9
D3	yellow	63.9	28.8	81.1	84.7	3.7	-0.7	77.5	49.3
E3	magenta	97.3	3.4	52.6	55.4	47.2	45.9	-13.0	-14.4
F3	cyan	92.3	4.2	50.8	53.4	-21.7	-19.8	-27.3	-29.9
A4	white	92.5	1.3	95.4	96.0	0.6	0.5	1.5	0.3
B4	neutral 8	75.5	3.6	80.2	82.5	-0.6	0.1	0.4	-2.3
C4	neutral 6.5	65.4	4.6	65.7	68.4	-0.9	0.6	-0.5	-4.0
D4	neutral 5	65.9	4.4	49.5	51.8	-0.3	0.8	0.1	-3.5
E4	neutral 3.5	69.7	3.9	35.3	37.3	-0.6	0.1	-0.5	-3.8
F4	black	87.8	2.2	20.9	22.3	0.0	0.2	-0.9	-2.6
A5	paper white	99.3	0.6	98.8	98.5	0.2	0.1	0.7	0.1
B5	Skin highlight L*=88	36.7	12.8	87.5	89.8	12.0	10.4	15.0	2.4
C5	Skin highlight L* =75	35.2	19.9	74.0	77.2	20.4	20.8	21.3	1.7
D5	Skin shadow L*=28	70.9	7.8	25.0	28.5	14.5	11.4	17.1	10.8
E5	Skin shadow L*=13	89.5	3.4	14.2	16.3	16.2	13.6	12.5	12.8
F5	Maximum Black	100.0	1.4	3.0	4.4	-0.5	-0.3	-2.6	-2.5

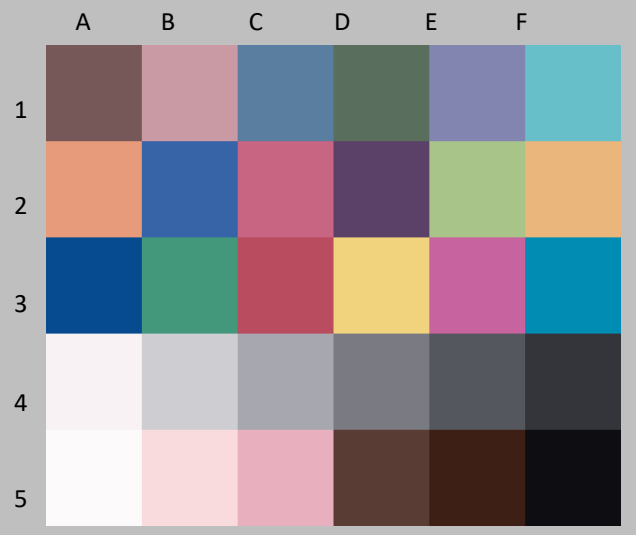
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	73.1	86.9	10.5
Worst 10% (3 lowest scoring patches)	35.9	65.4	29.5

180 Megalux hours

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



Colors After light exposure

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	55.9	9.7	37.2	40.9	13.1	11.9	13.9	5.1
B1	Light Skin	34.0	18.2	64.7	68.4	17.3	17.9	19.6	1.8
C1	Blue sky	100.0	3.2	48.4	51.5	-4.6	-4.1	-22.0	-22.2
D1	Foliage	44.7	14.6	41.6	44.3	-12.9	-11.6	21.4	7.2
E1	blue flower	95.6	3.8	53.4	56.7	8.8	8.1	-24.3	-22.8
F1	bluish green	55.3	15.2	69.2	72.7	-32.0	-25.3	0.1	-13.1
A1	orange	53.5	33.0	62.7	70.7	36.1	23.8	57.3	27.8
B2	purplish blue	92.1	5.1	39.1	42.1	9.6	7.2	-44.7	-41.4
C2	moderate red	66.9	17.4	50.6	55.2	45.6	41.8	18.3	2.0
D2	purple	96.8	2.7	29.3	31.7	20.5	19.5	-20.4	-19.4
E2	yellow green	51.7	29.9	72.0	75.6	-23.1	-20.1	55.9	26.3
F2	orange yellow	55.4	32.4	71.5	77.6	19.4	10.6	67.4	36.8
A3	blue	91.8	5.0	29.4	31.7	12.0	8.9	-47.1	-43.9
B3	green	51.5	23.8	53.7	56.9	-37.1	-33.0	29.9	6.6
C3	red	71.7	17.6	41.9	47.3	50.6	45.0	27.5	11.7
D3	yellow	59.7	32.0	81.1	84.9	3.7	-0.6	77.5	46.0
E3	magenta	97.6	3.5	52.6	55.7	47.2	45.7	-13.0	-13.9
F3	cyan	92.9	4.1	50.8	53.6	-21.7	-19.8	-27.3	-29.6
A4	white	94.1	1.2	95.4	96.0	0.6	0.5	1.5	0.4
B4	neutral 8	77.7	3.5	80.2	82.6	-0.6	0.1	0.4	-2.1
C4	neutral 6.5	66.7	4.6	65.7	68.5	-0.9	0.7	-0.5	-3.8
D4	neutral 5	65.4	4.5	49.5	51.9	-0.3	0.9	0.1	-3.5
E4	neutral 3.5	68.4	4.1	35.3	37.4	-0.6	0.1	-0.5	-3.9
F4	black	87.5	2.3	20.9	22.4	0.0	0.2	-0.9	-2.6
A5	paper white	100.0	0.5	98.8	98.5	0.2	0.1	0.7	0.3
B5	Skin highlight L*=88	36.8	12.8	87.5	89.9	12.0	10.2	15.0	2.5
C5	Skin highlight L* =75	34.3	20.1	74.0	77.4	20.4	20.7	21.3	1.4
D5	Skin shadow L*=28	69.3	8.2	25.0	28.5	14.5	11.3	17.1	10.4
E5	Skin shadow L*=13	88.4	3.5	14.2	16.2	16.2	13.4	12.5	13.1
F5	Maximum Black	100.0	1.2	3.0	4.1	-0.5	-0.5	-2.6	-2.1

Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	71.9	85.8	11.3
Worst 10% (3 lowest scoring patches)	35.0	62.1	32.5

200 Megalux hours

Section III: Light Induced Low-intensity Staining Test Results

This section presents test results for samples that are retired from the light fade testing unit to dark storage (0 lux,~21˚C, 50% RH) at five discreet exposure intervals (0 luxhrs, i.e., the dark storage control sample, 20 Mluxhrs, 50 Mluxhrs, 100 Mluxhrs, and 200 Mluxhrs). All of the sample image targets were printed at the same time on the same sheet of media to ensure maximum uniformity of the sample set. Also, reference measurements were initially made for each individual target to account for any minor printer output variations withn the complete sample set. The retired targets undergo a series of remeasurements at specified intervals (6 months, 1year, 2 years, etc.) from the time each sample was retired to dark storage. I* color and tonal accuracy scores and Conservation Display ratings decrease while Δb* values increase if the media shows ongoing light-induced post-exposure yellowing. The dark storage control sample (see section IV) reveals if any humidity-induced colorant shifts, thermal aging, and/or gas contaimination is also contributing to color appearance changes over time.

AaI 30 Patch Color Target

I* Color (Average) Summary

Light Exposure (Mluxhrs)	Years of Dark Storage Time after exposure						
	0	0.5	1	2	3	4	5
0	100.0	99.9	99.9	100.0	100.0	99.9	
20	97.8	97.7	98.0	98.0	98.0	98.0	
50	92.8	93.3	93.0	93.1	93.3		
100	83.8	84.0	84.8	85.1	85.1		

values in red exceed Conservation Display Rating *Upper* limit

I* Color (Worst 10%) Summary

Light Exposure (Mluxhrs)	Years of Dark Storage Time after exposure						
	0	0.5	1	2	3	4	5
0	100.0	98.7	99.3	99.9	99.9	99.4	
20	93.8	93.8	95.2	95.1	95.5	95.6	
50	77.9	78.9	78.3	78.7	79.0		
100	52.3	52.7	54.5	54.8	55.0		

values in red exceed Conservation Display Rating *Lower* limit

I* Tone (Average) Summary

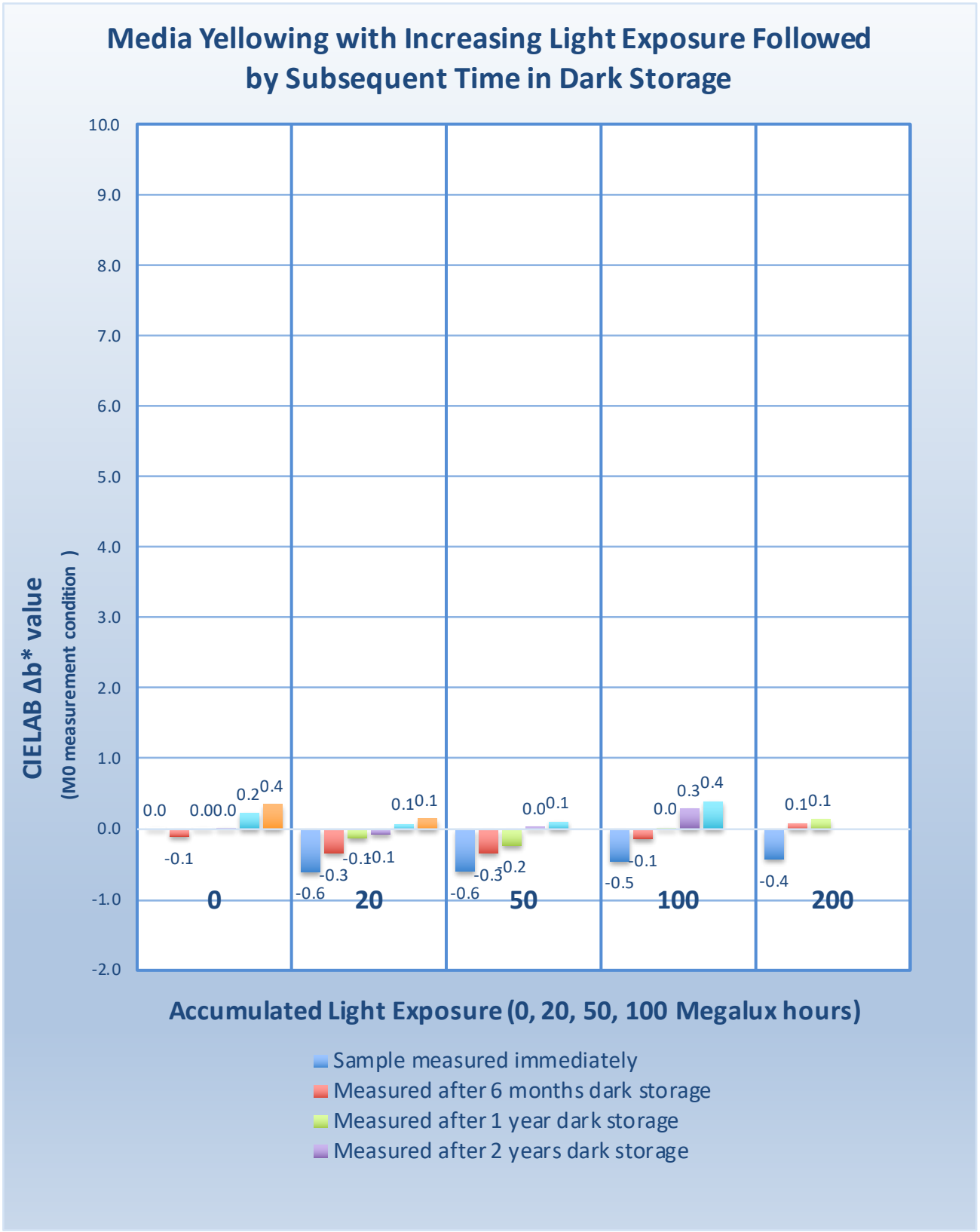
Light Exposure (Mluxhrs)	Years of Dark Storage Time after exposure						
	0	0.5	1	2	3	4	5
0	100.0	98.7	97.1	99.2	99.3	99.4	
20	97.2	97.0	97.1	97.2	97.1	97.2	
50	95.1	95.1	94.9	95.0	95.0		
100	92.0	92.0	92.1	92.0	92.2		

values in red exceed Conservation Display Rating Upper limit

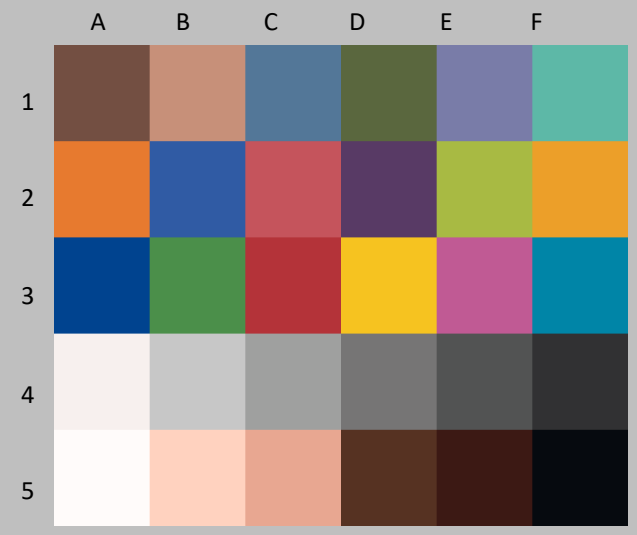
I* Tone (Worst 10%) Summary

Light Exposure (Mluxhrs)	Years of Dark Storage Time after exposure						
	0	0.5	1	2	3	4	5
0	100.0	97.4	92.5	98.3	98.5	99.0	
20	92.6	92.7	92.3	92.6	92.4	92.6	
50	87.6	87.5	87.3	87.1	87.6		
100	79.3	79.3	79.7	79.2	79.5		

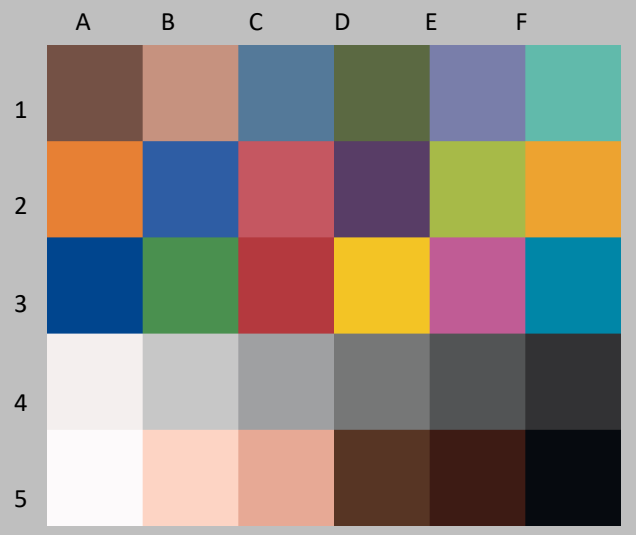
values in red exceed Conservation Display Rating *Lower* limit


Media Yellowing with Increasing Light Exposure Followed by Subsequent Time in Dark Storage
CIELAB Δb* value
(M0 measurement condition)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
0.0
-0.1
0.0
0.0
0.2
0.4
-0.6
-0.3
-0.1
0.1
0.1
0
20
-0.6
-0.3
0.2
0.0
0.1
50
-0.5
-0.1
0.0
0.3
0.4
100
-0.4
0.1
0.1
200
Accumulated Light Exposure (0, 20, 50, 100 Megalux hours)
Sample measured immediately
Measured after 6 months dark storage
Measured after 1 year dark storage
Measured after 2 years dark storage

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



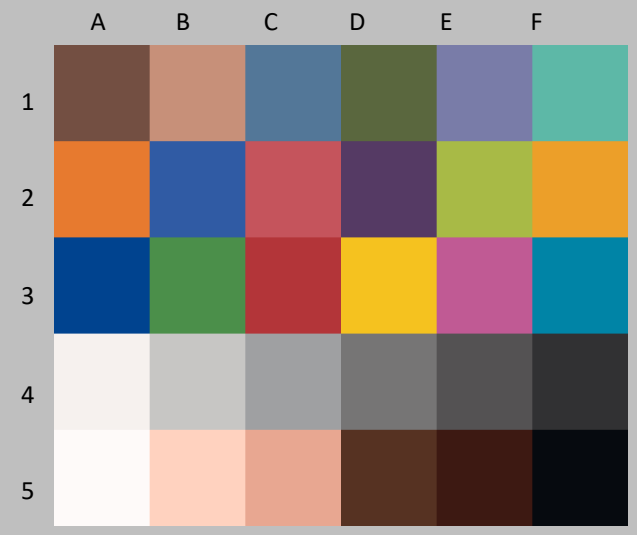
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	95.6	1.6	37.3	38.2	13.1	12.1	14.1	13.1
B1	Light Skin	94.7	2.0	64.7	65.2	17.4	16.5	19.7	18.1
C1	Blue sky	99.3	0.9	48.6	49.2	-4.4	-5.0	-21.7	-21.5
D1	Foliage	97.4	1.3	41.7	42.3	-12.8	-13.1	21.3	20.3
E1	blue flower	98.0	1.2	53.5	54.1	8.7	7.8	-24.2	-23.7
F1	bluish green	97.5	1.4	69.2	69.7	-31.9	-31.5	0.0	-1.3
A1	orange	95.7	3.6	62.7	64.0	35.9	32.7	56.9	55.7
B2	purplish blue	97.3	1.8	39.3	39.9	9.6	8.2	-44.3	-43.3
C2	moderate red	96.4	2.3	50.8	51.5	45.4	44.0	18.0	16.3
D2	purple	98.5	1.0	29.6	30.1	20.7	19.8	-20.1	-19.7
E2	yellow green	98.1	1.7	72.1	72.4	-22.9	-23.1	55.6	53.9
F2	orange yellow	96.9	2.8	71.5	72.4	19.3	16.8	66.8	65.6
A3	blue	97.0	2.1	29.4	29.9	12.1	10.4	-47.1	-46.1
B3	green	98.0	1.5	53.8	54.2	-36.8	-36.9	29.9	28.5
C3	red	96.1	2.9	42.0	42.8	50.6	49.1	27.4	25.1
D3	yellow	98.0	2.0	81.0	81.3	3.8	2.4	78.1	76.5
E3	magenta	98.6	1.2	52.6	52.8	47.0	45.8	-12.9	-13.0
F3	cyan	100.0	0.6	50.9	51.4	-21.5	-21.8	-27.2	-27.1
A4	white	100.0	0.5	95.4	95.1	0.6	0.3	1.6	1.2
B4	neutral 8	99.7	0.6	80.2	80.4	-0.6	-0.9	0.5	0.1
C4	neutral 6.5	100.0	0.5	65.8	66.1	-0.9	-1.1	-0.5	-0.8
D4	neutral 5	100.0	0.7	49.6	50.0	-0.3	-0.6	0.2	-0.2
E4	neutral 3.5	100.0	0.7	35.3	35.8	-0.6	-0.9	-0.5	-0.7
F4	black	99.3	0.8	20.9	21.4	0.4	-0.2	-1.0	-1.0
A5	paper white	100.0	0.5	98.8	98.4	0.3	0.2	0.7	0.4
B5	Skin highlight L*=88	92.6	1.9	87.5	87.7	11.9	10.9	14.8	13.2
C5	Skin highlight L* =75	94.1	2.2	74.2	74.5	20.2	19.2	21.4	19.4
D5	Skin shadow L*=28	96.0	1.6	25.0	25.8	14.5	13.1	16.7	16.5
E5	Skin shadow L*=13	96.6	1.3	14.3	14.9	16.1	15.2	12.3	13.1
F5	Maximum Black	98.8	0.6	3.2	3.3	-0.3	-0.5	-2.7	-2.2

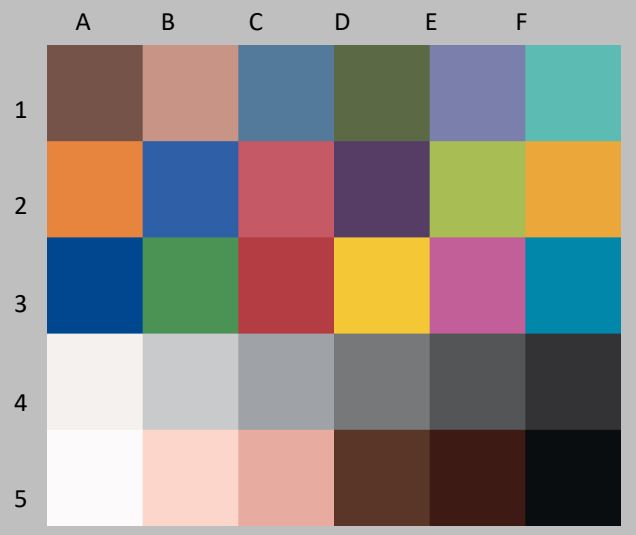
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	97.7	97.0	1.5
Worst 10% (3 lowest scoring patches)	93.8	92.7	3.1

20 Mluxhrs + 6 months

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



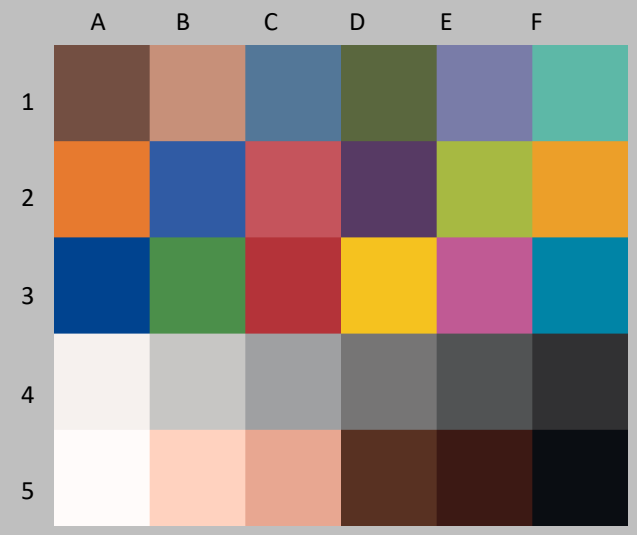
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	89.5	2.9	37.3	38.7	13.1	11.9	14.1	11.8
B1	Light Skin	82.7	5.2	64.7	65.9	17.4	16.4	19.7	14.7
C1	Blue sky	99.5	1.3	48.5	49.6	-4.5	-5.1	-21.9	-21.8
D1	Foliage	90.4	3.1	41.7	42.7	-12.9	-13.4	21.4	18.5
E1	blue flower	97.6	1.6	53.4	54.6	8.7	7.7	-24.2	-23.7
F1	bluish green	87.5	4.7	69.1	70.3	-31.9	-30.5	0.1	-4.2
A1	orange	90.9	7.1	62.6	65.2	35.9	30.9	57.0	52.7
B2	purplish blue	96.3	2.5	39.2	40.4	9.6	7.8	-44.3	-43.0
C2	moderate red	91.1	5.1	50.7	52.2	45.3	43.3	18.3	13.9
D2	purple	97.6	1.5	29.5	30.4	20.4	19.3	-20.2	-19.7
E2	yellow green	92.4	5.2	72.0	73.1	-23.0	-23.3	55.5	50.4
F2	orange yellow	92.2	6.3	71.4	73.5	19.4	15.4	67.1	62.7
A3	blue	96.2	2.5	29.4	30.4	11.6	9.7	-46.9	-45.6
B3	green	92.0	4.4	53.7	54.8	-36.9	-37.0	29.8	25.6
C3	red	92.6	5.0	41.9	43.6	50.5	48.4	27.3	23.0
D3	yellow	93.5	5.7	80.9	82.1	3.8	1.5	78.1	73.0
E3	magenta	98.3	1.7	52.6	53.5	47.1	45.8	-13.0	-13.4
F3	cyan	99.4	1.4	50.7	51.9	-21.5	-21.6	-27.2	-27.9
A4	white	97.7	0.8	95.2	95.4	0.4	0.2	1.7	1.0
B4	neutral 8	93.7	1.4	80.1	81.0	-0.7	-1.0	0.6	-0.5
C4	neutral 6.5	94.4	1.5	65.7	66.8	-0.9	-1.0	-0.5	-1.5
D4	neutral 5	95.1	1.4	49.5	50.5	-0.4	-0.5	0.2	-0.7
E4	neutral 3.5	96.0	1.3	35.3	36.2	-0.5	-0.8	-0.4	-1.3
F4	black	100.0	0.8	20.9	21.6	0.0	-0.3	-0.8	-1.1
A5	paper white	100.0	0.4	98.6	98.5	0.2	0.1	0.7	0.4
B5	Skin highlight L*=88	74.0	5.6	87.4	88.4	11.9	10.6	15.1	9.7
C5	Skin highlight L* =75	80.0	6.5	74.1	75.2	20.2	19.2	21.3	15.0
D5	Skin shadow L*=28	92.7	2.5	25.1	26.5	14.5	12.6	16.9	15.8
E5	Skin shadow L*=13	96.0	1.5	14.2	15.0	15.9	14.8	12.7	13.4
F5	Maximum Black	100.0	0.3	3.2	3.5	-0.4	-0.4	-2.4	-2.3

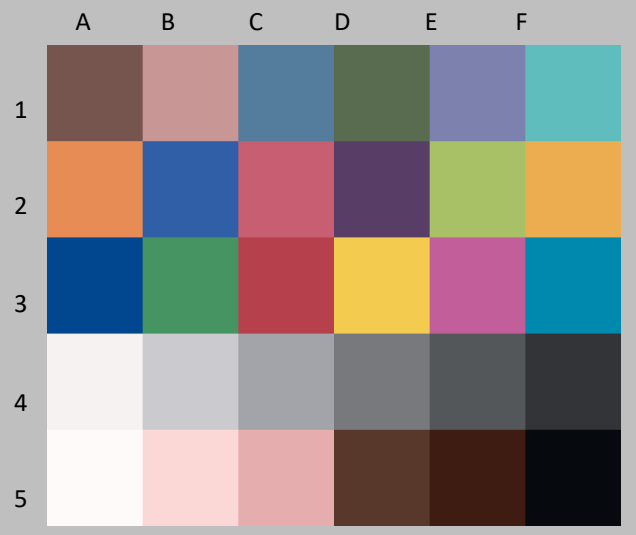
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	93.3	95.1	3.0
Worst 10% (3 lowest scoring patches)	78.9	87.5	6.6

50 Mluxhrs + 6 months

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



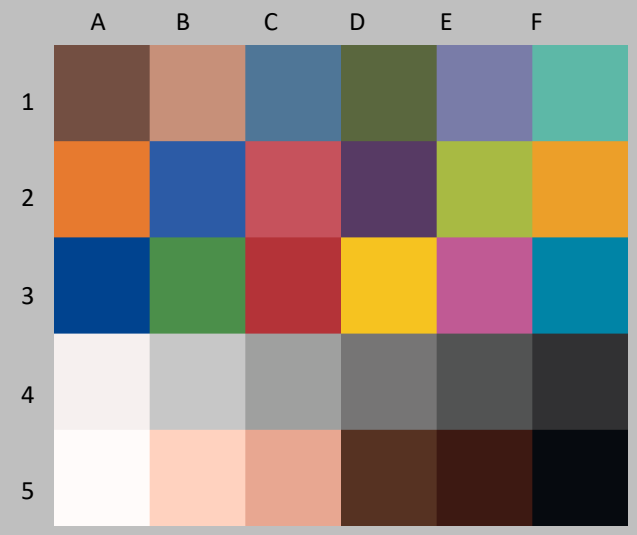
Colors after both light exposure + dark storage

				L*		a*		b*	
Patch #	Description	I* Color	ΔE	Before	After	Before	After	Before	After
A1	Dark Skin	76.1	5.5	37.4	39.4	13.1	11.9	14.0	9.0
B1	Light Skin	57.9	11.7	64.7	66.9	17.4	17.2	19.6	8.1
C1	Blue sky	99.7	1.8	48.5	50.2	-4.3	-4.5	-22.0	-22.5
D1	Foliage	74.4	7.1	41.7	43.3	-12.8	-12.9	21.3	14.4
E1	blue flower	98.9	2.1	53.4	55.3	8.6	8.0	-24.3	-23.9
F1	bluish green	69.4	10.5	69.1	71.4	-31.8	-28.1	0.1	-9.4
A1	orange	79.3	15.1	62.6	67.0	35.9	28.6	56.8	44.4
B2	purplish blue	95.9	3.0	39.1	40.9	9.7	7.9	-44.4	-42.9
C2	moderate red	81.2	10.0	50.6	53.2	45.5	43.2	18.0	8.6
D2	purple	98.5	1.6	29.4	30.7	20.6	19.7	-20.4	-20.1
E2	yellow green	78.9	13.4	71.9	74.1	-23.1	-22.8	55.6	42.4
F2	orange yellow	81.1	14.2	71.3	74.9	19.3	13.5	67.1	54.7
A3	blue	95.6	2.9	29.4	30.7	11.9	9.7	-46.9	-45.5
B3	green	77.8	11.3	53.6	55.6	-37.0	-36.2	30.0	18.9
C3	red	85.6	9.2	41.9	44.7	50.5	47.6	27.4	19.1
D3	yellow	82.7	14.2	80.9	83.2	3.8	0.3	78.3	64.7
E3	magenta	97.5	2.4	52.5	54.2	47.1	46.1	-13.1	-14.4
F3	cyan	95.2	2.8	50.8	52.6	-21.6	-20.7	-27.3	-29.3
A4	white	95.7	1.0	95.1	95.6	0.4	0.4	1.6	0.7
B4	neutral 8	80.7	2.8	80.2	81.7	-0.7	-0.4	0.5	-1.8
C4	neutral 6.5	77.0	3.2	65.7	67.5	-0.9	-0.2	-0.6	-3.1
D4	neutral 5	80.7	2.8	49.5	51.1	-0.3	0.0	0.1	-2.2
E4	neutral 3.5	85.7	2.3	35.4	36.7	-0.6	-0.5	-0.5	-2.4
F4	black	98.5	1.1	20.9	21.8	0.1	-0.2	-1.1	-1.6
A5	paper white	100.0	0.2	98.6	98.6	0.3	0.1	0.7	0.5
B5	Skin highlight L*=88	47.9	10.6	87.4	89.1	11.9	11.1	15.0	4.6
C5	Skin highlight L* =75	52.3	14.7	74.1	76.1	20.3	20.3	21.3	6.7
D5	Skin shadow L*=28	87.5	3.8	25.0	27.0	14.6	12.4	16.6	14.2
E5	Skin shadow L*=13	90.6	2.6	14.3	15.2	16.1	14.7	11.9	13.9
F5	Maximum Black	97.3	0.8	3.4	3.3	-0.2	-0.5	-2.9	-2.2

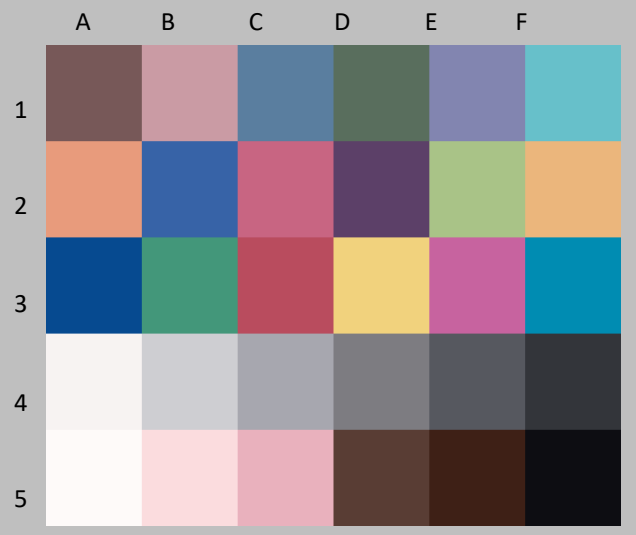
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	84.0	92.0	6.2
Worst 10% (3 lowest scoring patches)	52.7	79.3	14.7

100 Mluxhrs + 6 months

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



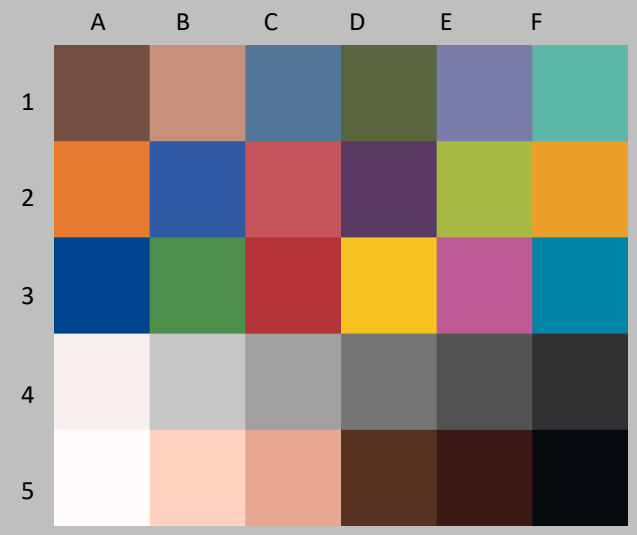
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	56.9	9.5	37.2	40.9	13.1	11.9	13.9	5.3
B1	Light Skin	35.4	17.8	64.7	68.5	17.3	17.8	19.6	2.2
C1	Blue sky	100.0	3.2	48.4	51.6	-4.6	-4.2	-22.0	-22.0
D1	Foliage	45.2	14.5	41.6	44.4	-12.9	-11.7	21.4	7.3
E1	blue flower	94.7	3.9	53.4	56.8	8.8	8.1	-24.3	-22.6
F1	bluish green	56.1	15.0	69.2	72.8	-32.0	-25.4	0.1	-12.8
A1	orange	54.0	32.7	62.7	70.8	36.1	23.8	57.3	28.1
B2	purplish blue	91.9	5.2	39.1	42.1	9.6	7.1	-44.7	-41.3
C2	moderate red	67.5	17.1	50.6	55.4	45.6	41.9	18.3	2.3
D2	purple	96.7	2.8	29.3	31.7	20.5	19.6	-20.4	-19.3
E2	yellow green	52.3	29.6	72.0	75.8	-23.1	-20.1	55.9	26.7
F2	orange yellow	55.9	32.0	71.5	77.8	19.4	10.7	67.4	37.2
A3	blue	91.9	5.0	29.4	31.8	12.0	9.0	-47.1	-43.9
B3	green	52.0	23.6	53.7	57.0	-37.1	-33.1	29.9	6.8
C3	red	72.2	17.4	41.9	47.4	50.6	45.1	27.5	11.9
D3	yellow	60.1	31.7	81.1	85.1	3.7	-0.6	77.5	46.4
E3	magenta	98.2	3.5	52.6	55.8	47.2	45.9	-13.0	-13.7
F3	cyan	93.4	4.1	50.8	53.7	-21.7	-19.8	-27.3	-29.4
A4	white	98.8	0.9	95.4	96.2	0.6	0.4	1.5	0.9
B4	neutral 8	81.5	3.4	80.2	82.8	-0.6	0.1	0.4	-1.7
C4	neutral 6.5	69.0	4.6	65.7	68.7	-0.9	0.7	-0.5	-3.5
D4	neutral 5	67.6	4.4	49.5	52.1	-0.3	0.9	0.1	-3.3
E4	neutral 3.5	70.2	4.0	35.3	37.5	-0.6	0.1	-0.5	-3.7
F4	black	88.3	2.2	20.9	22.3	0.0	0.2	-0.9	-2.5
A5	paper white	100.0	0.3	98.8	98.6	0.2	0.0	0.7	0.8
B5	Skin highlight L*=88	39.2	12.4	87.5	90.1	12.0	10.1	15.0	3.0
C5	Skin highlight L* =75	35.5	19.8	74.0	77.5	20.4	20.8	21.3	1.7
D5	Skin shadow L*=28	69.3	8.2	25.0	28.6	14.5	11.3	17.1	10.5
E5	Skin shadow L*=13	88.7	3.5	14.2	16.3	16.2	13.5	12.5	13.0
F5	Maximum Black	100.0	1.5	3.0	4.5	-0.5	-0.3	-2.6	-2.3

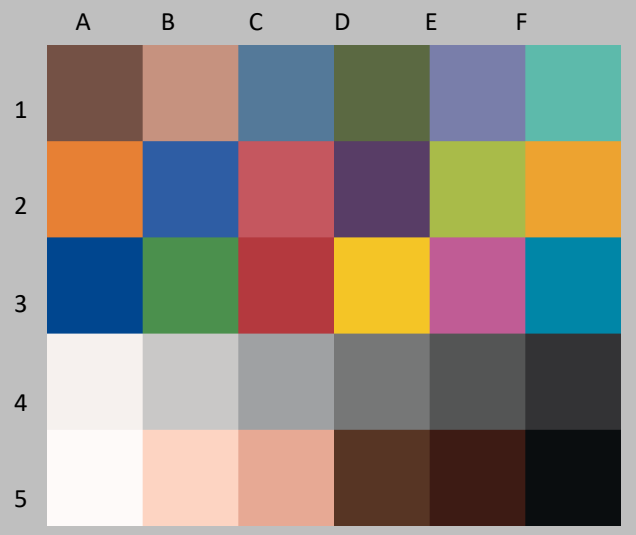
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	72.8	85.7	11.1
Worst 10% (3 lowest scoring patches)	36.7	61.7	32.2

200 Mluxhrs + 6 months

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



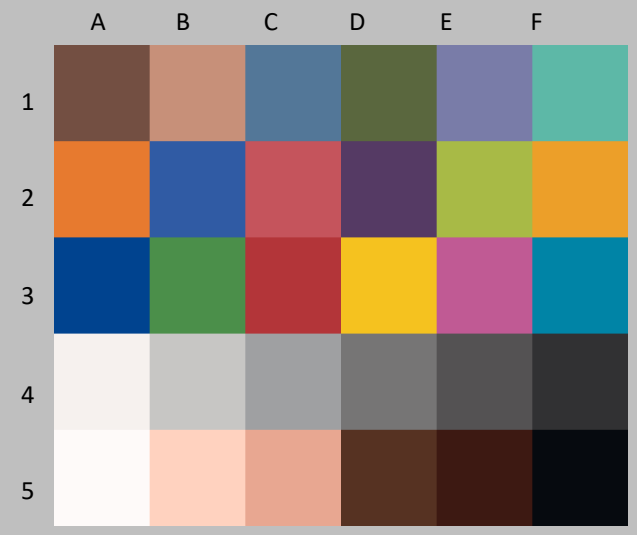
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	96.6	1.4	37.3	38.1	13.1	12.1	14.1	13.4
B1	Light Skin	95.6	1.8	64.7	65.2	17.4	16.4	19.7	18.4
C1	Blue sky	98.6	1.0	48.6	49.2	-4.4	-5.0	-21.7	-21.3
D1	Foliage	98.0	1.2	41.7	42.3	-12.8	-13.1	21.3	20.4
E1	blue flower	97.4	1.3	53.5	54.1	8.7	7.7	-24.2	-23.5
F1	bluish green	98.7	1.0	69.2	69.7	-31.9	-31.6	0.0	-0.9
A1	orange	95.8	3.6	62.7	64.1	35.9	32.7	56.9	55.9
B2	purplish blue	96.9	2.0	39.3	40.0	9.6	8.1	-44.3	-43.1
C2	moderate red	96.7	2.2	50.8	51.5	45.4	43.9	18.0	16.6
D2	purple	98.0	1.2	29.6	30.1	20.7	19.8	-20.1	-19.5
E2	yellow green	98.2	1.6	72.1	72.5	-22.9	-23.1	55.6	54.0
F2	orange yellow	97.0	2.8	71.5	72.6	19.3	16.9	66.8	65.9
A3	blue	96.6	2.2	29.4	30.0	12.1	10.3	-47.1	-45.9
B3	green	98.6	1.3	53.8	54.3	-36.8	-36.9	29.9	28.7
C3	red	96.7	2.6	42.0	42.9	50.6	49.2	27.4	25.4
D3	yellow	98.3	1.9	81.0	81.5	3.8	2.4	78.1	76.8
E3	magenta	98.7	1.2	52.6	53.1	47.0	45.9	-12.9	-12.7
F3	cyan	99.8	0.9	50.9	51.5	-21.5	-21.9	-27.2	-26.9
A4	white	100.0	0.3	95.4	95.4	0.6	0.3	1.6	1.5
B4	neutral 8	100.0	0.6	80.2	80.6	-0.6	-1.0	0.5	0.5
C4	neutral 6.5	100.0	0.6	65.8	66.3	-0.9	-1.2	-0.5	-0.5
D4	neutral 5	100.0	0.7	49.6	50.2	-0.3	-0.7	0.2	0.1
E4	neutral 3.5	100.0	0.7	35.3	35.9	-0.6	-1.0	-0.5	-0.4
F4	black	99.7	0.8	20.9	21.4	0.4	-0.1	-1.0	-0.8
A5	paper white	100.0	0.3	98.8	98.6	0.3	0.1	0.7	0.6
B5	Skin highlight L*=88	94.5	1.6	87.5	87.8	11.9	10.8	14.8	13.8
C5	Skin highlight L* =75	95.4	1.9	74.2	74.6	20.2	19.1	21.4	19.9
D5	Skin shadow L*=28	96.3	1.6	25.0	25.8	14.5	13.2	16.7	16.6
E5	Skin shadow L*=13	96.5	1.4	14.3	15.0	16.1	15.1	12.3	12.9
F5	Maximum Black	100.0	0.7	3.2	3.7	-0.3	-0.3	-2.7	-2.2

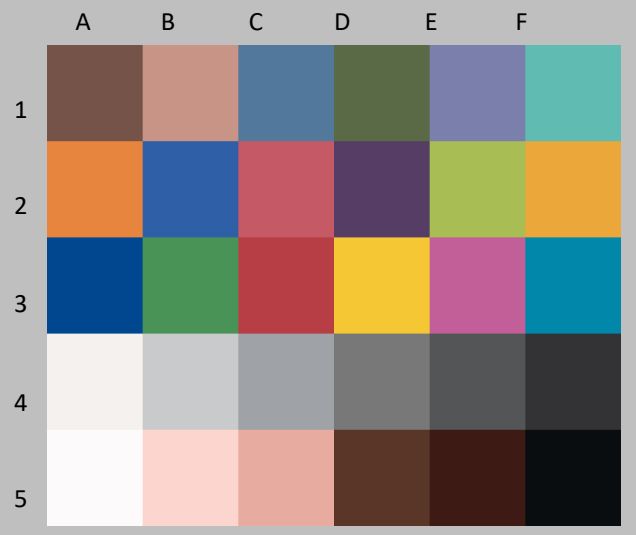
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	98.0	97.1	1.4
Worst 10% (3 lowest scoring patches)	95.2	92.3	3.0

20 Mluxhrs + 1 year

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



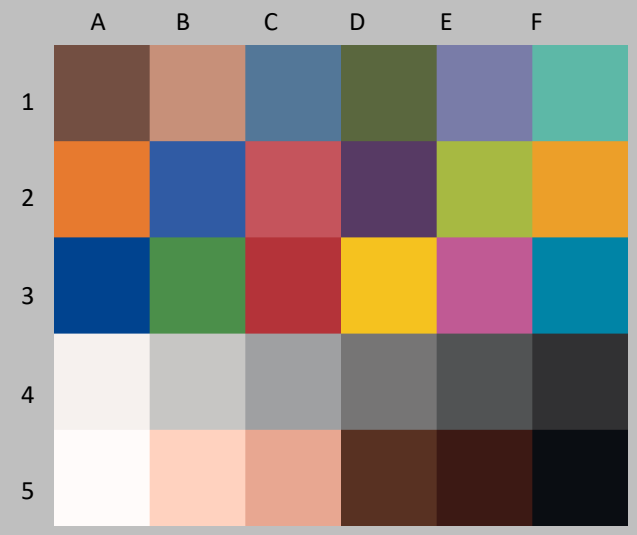
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	88.9	3.0	37.3	38.8	13.1	11.9	14.1	11.7
B1	Light Skin	82.5	5.2	64.7	66.0	17.4	16.5	19.7	14.6
C1	Blue sky	99.7	1.3	48.5	49.6	-4.5	-5.0	-21.9	-21.8
D1	Foliage	89.7	3.2	41.7	42.7	-12.9	-13.3	21.4	18.3
E1	blue flower	97.4	1.7	53.4	54.6	8.7	7.7	-24.2	-23.6
F1	bluish green	86.5	5.0	69.1	70.3	-31.9	-30.4	0.1	-4.5
A1	orange	90.8	7.2	62.6	65.2	35.9	30.9	57.0	52.6
B2	purplish blue	96.1	2.5	39.2	40.4	9.6	7.8	-44.3	-42.9
C2	moderate red	91.2	5.1	50.7	52.3	45.3	43.2	18.3	14.0
D2	purple	97.6	1.5	29.5	30.4	20.4	19.3	-20.2	-19.7
E2	yellow green	91.9	5.5	72.0	73.1	-23.0	-23.2	55.5	50.1
F2	orange yellow	92.1	6.3	71.4	73.5	19.4	15.4	67.1	62.6
A3	blue	96.0	2.7	29.4	30.4	11.6	9.7	-46.9	-45.4
B3	green	91.4	4.7	53.7	54.8	-36.9	-36.9	29.8	25.3
C3	red	92.1	5.3	41.9	43.7	50.5	48.1	27.3	22.9
D3	yellow	93.2	5.9	80.9	82.1	3.8	1.6	78.1	72.7
E3	magenta	98.2	1.7	52.6	53.6	47.1	45.7	-13.0	-13.3
F3	cyan	99.2	1.4	50.7	51.9	-21.5	-21.5	-27.2	-27.9
A4	white	98.1	0.7	95.2	95.5	0.4	0.2	1.7	1.0
B4	neutral 8	92.7	1.5	80.1	81.0	-0.7	-0.9	0.6	-0.6
C4	neutral 6.5	93.5	1.5	65.7	66.8	-0.9	-0.9	-0.5	-1.6
D4	neutral 5	94.6	1.5	49.5	50.5	-0.4	-0.5	0.2	-0.8
E4	neutral 3.5	95.0	1.4	35.3	36.2	-0.5	-0.8	-0.4	-1.4
F4	black	100.0	0.9	20.9	21.6	0.0	-0.4	-0.8	-1.2
A5	paper white	100.0	0.3	98.6	98.6	0.2	0.1	0.7	0.5
B5	Skin highlight L*=88	72.9	5.8	87.4	88.5	11.9	10.8	15.1	9.5
C5	Skin highlight L* =75	79.6	6.6	74.1	75.3	20.2	19.3	21.3	14.9
D5	Skin shadow L*=28	92.3	2.7	25.1	26.6	14.5	12.6	16.9	15.7
E5	Skin shadow L*=13	96.1	1.6	14.2	15.1	15.9	14.9	12.7	13.4
F5	Maximum Black	100.0	0.3	3.2	3.5	-0.4	-0.4	-2.4	-2.4

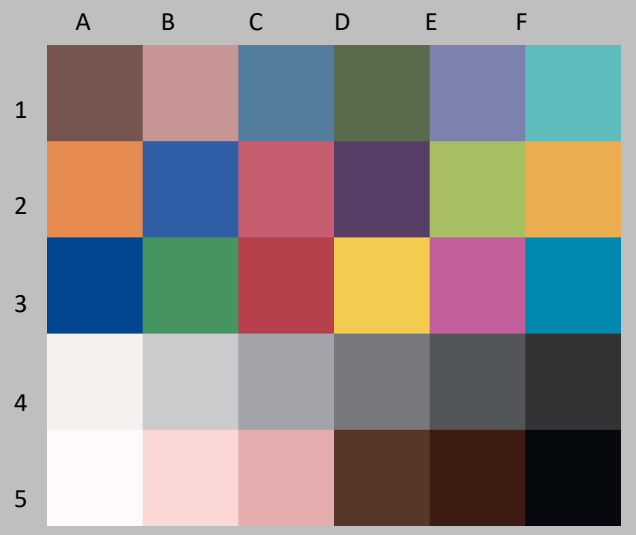
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	93.0	94.9	3.1
Worst 10% (3 lowest scoring patches)	78.3	87.3	6.7

50 Mluxhrs + 1 year

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



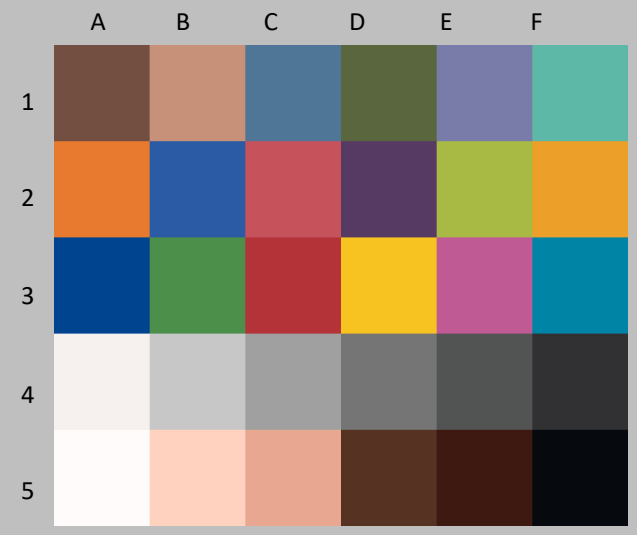
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	77.9	5.1	37.4	39.2	13.1	11.9	14.0	9.4
B1	Light Skin	59.4	11.3	64.7	66.7	17.4	17.1	19.6	8.5
C1	Blue sky	100.0	1.6	48.5	50.1	-4.3	-4.6	-22.0	-22.2
D1	Foliage	75.9	6.7	41.7	43.2	-12.8	-13.0	21.3	14.8
E1	blue flower	97.9	2.1	53.4	55.1	8.6	7.9	-24.3	-23.6
F1	bluish green	71.4	9.8	69.1	71.2	-31.8	-28.3	0.1	-8.8
A1	orange	79.7	14.8	62.6	66.8	35.9	28.5	56.8	44.7
B2	purplish blue	95.1	3.1	39.1	40.7	9.7	7.7	-44.4	-42.6
C2	moderate red	81.8	9.7	50.6	53.0	45.5	43.0	18.0	8.9
D2	purple	97.5	1.7	29.4	30.5	20.6	19.5	-20.4	-19.9
E2	yellow green	79.4	13.1	71.9	73.9	-23.1	-22.7	55.6	42.7
F2	orange yellow	81.4	13.9	71.3	74.7	19.3	13.4	67.1	55.0
A3	blue	95.1	3.1	29.4	30.6	11.9	9.6	-46.9	-45.2
B3	green	78.3	11.0	53.6	55.5	-37.0	-36.2	30.0	19.2
C3	red	86.0	8.9	41.9	44.6	50.5	47.6	27.4	19.4
D3	yellow	82.9	14.0	80.9	83.0	3.8	0.2	78.3	64.9
E3	magenta	97.7	2.2	52.5	54.0	47.1	46.0	-13.1	-14.2
F3	cyan	96.1	2.5	50.8	52.4	-21.6	-20.8	-27.3	-29.0
A4	white	97.5	0.8	95.1	95.4	0.4	0.3	1.6	0.8
B4	neutral 8	84.4	2.4	80.2	81.5	-0.7	-0.5	0.5	-1.5
C4	neutral 6.5	80.6	2.8	65.7	67.3	-0.9	-0.3	-0.6	-2.8
D4	neutral 5	83.7	2.5	49.5	50.9	-0.3	-0.1	0.1	-1.9
E4	neutral 3.5	87.9	2.0	35.4	36.6	-0.6	-0.6	-0.5	-2.2
F4	black	100.0	0.9	20.9	21.6	0.1	-0.3	-1.1	-1.4
A5	paper white	100.0	0.4	98.6	98.3	0.3	0.0	0.7	0.7
B5	Skin highlight L*=88	50.2	10.1	87.4	88.9	11.9	10.8	15.0	5.0
C5	Skin highlight L* =75	53.7	14.2	74.1	76.0	20.3	20.1	21.3	7.1
D5	Skin shadow L*=28	88.5	3.6	25.0	26.8	14.6	12.3	16.6	14.5
E5	Skin shadow L*=13	89.2	2.8	14.3	15.1	16.1	14.7	11.9	14.2
F5	Maximum Black	95.5	0.9	3.4	3.2	-0.2	-0.4	-2.9	-2.0

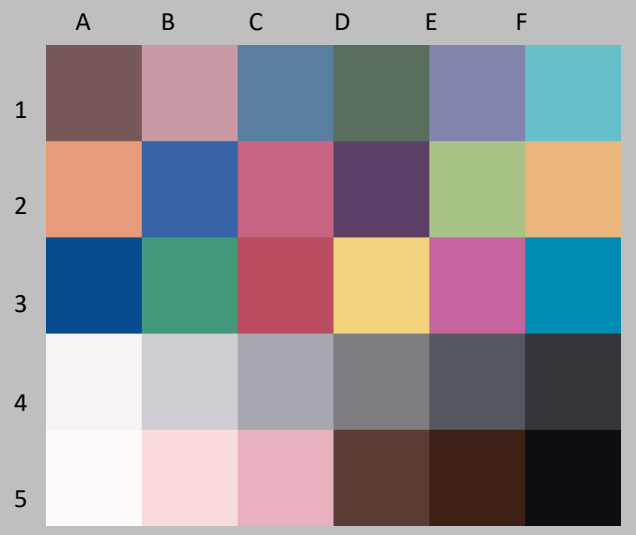
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	84.8	92.1	5.9
Worst 10% (3 lowest scoring patches)	54.5	79.7	14.4

100 Mluxhrs + 1 year

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



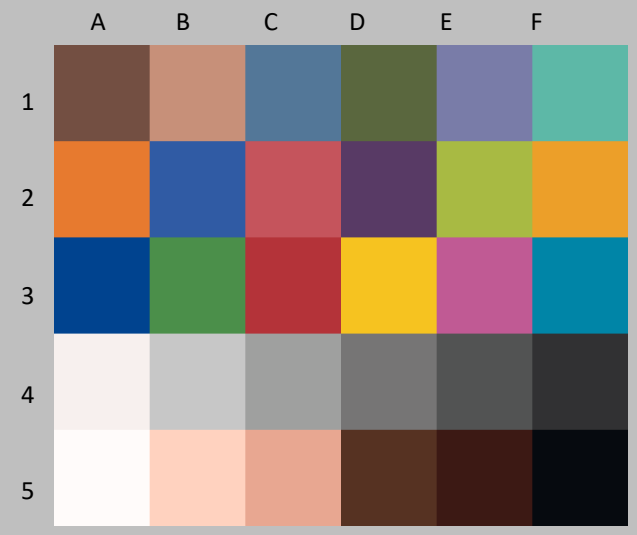
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	56.4	9.6	37.2	40.9	13.1	11.9	13.9	5.2
B1	Light Skin	35.3	17.8	64.7	68.4	17.3	17.8	19.6	2.2
C1	Blue sky	100.0	3.2	48.4	51.5	-4.6	-4.2	-22.0	-21.9
D1	Foliage	44.8	14.6	41.6	44.4	-12.9	-11.6	21.4	7.2
E1	blue flower	94.4	3.9	53.4	56.8	8.8	8.1	-24.3	-22.5
F1	bluish green	56.0	15.0	69.2	72.7	-32.0	-25.4	0.1	-12.8
A1	orange	53.9	32.8	62.7	70.8	36.1	23.9	57.3	28.0
B2	purplish blue	91.7	5.3	39.1	42.1	9.6	7.1	-44.7	-41.2
C2	moderate red	67.5	17.1	50.6	55.3	45.6	41.8	18.3	2.2
D2	purple	96.6	2.8	29.3	31.7	20.5	19.5	-20.4	-19.3
E2	yellow green	52.1	29.7	72.0	75.8	-23.1	-20.1	55.9	26.5
F2	orange yellow	55.7	32.2	71.5	77.7	19.4	10.7	67.4	37.0
A3	blue	91.6	5.1	29.4	31.8	12.0	8.9	-47.1	-43.8
B3	green	51.8	23.7	53.7	57.0	-37.1	-33.0	29.9	6.8
C3	red	72.1	17.4	41.9	47.3	50.6	45.1	27.5	11.9
D3	yellow	59.9	31.9	81.1	85.0	3.7	-0.5	77.5	46.2
E3	magenta	98.0	3.5	52.6	55.8	47.2	45.8	-13.0	-13.6
F3	cyan	93.6	4.0	50.8	53.7	-21.7	-19.9	-27.3	-29.4
A4	white	99.4	0.8	95.4	96.0	0.6	0.4	1.5	0.9
B4	neutral 8	81.7	3.3	80.2	82.7	-0.6	0.1	0.4	-1.7
C4	neutral 6.5	69.1	4.5	65.7	68.6	-0.9	0.7	-0.5	-3.5
D4	neutral 5	67.2	4.4	49.5	52.0	-0.3	0.9	0.1	-3.3
E4	neutral 3.5	69.6	4.0	35.3	37.5	-0.6	0.2	-0.5	-3.7
F4	black	87.4	2.3	20.9	22.4	0.0	0.2	-0.9	-2.6
A5	paper white	100.0	0.4	98.8	98.5	0.2	0.0	0.7	0.8
B5	Skin highlight L*=88	39.3	12.4	87.5	90.0	12.0	10.2	15.0	3.0
C5	Skin highlight L* =75	35.6	19.8	74.0	77.5	20.4	20.7	21.3	1.8
D5	Skin shadow L*=28	68.8	8.3	25.0	28.6	14.5	11.3	17.1	10.3
E5	Skin shadow L*=13	88.3	3.7	14.2	16.5	16.2	13.3	12.5	12.4
F5	Maximum Black	100.0	1.4	3.0	4.4	-0.5	-0.2	-2.6	-2.4

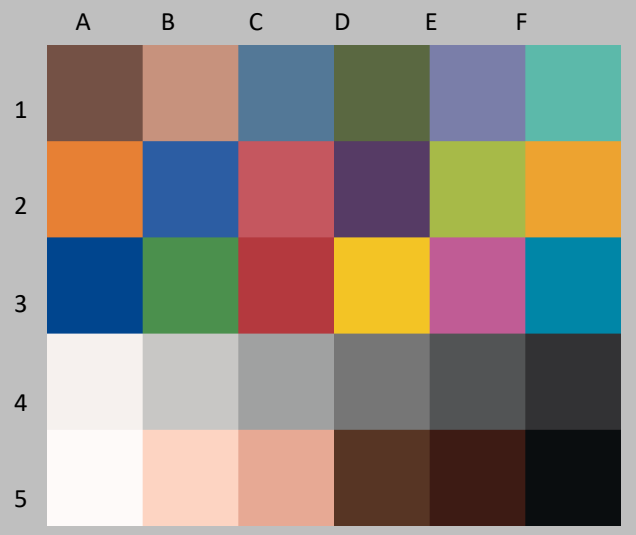
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	72.6	85.7	11.2
Worst 10% (3 lowest scoring patches)	36.7	61.7	32.3

200 Mluxhrs + 1 year

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



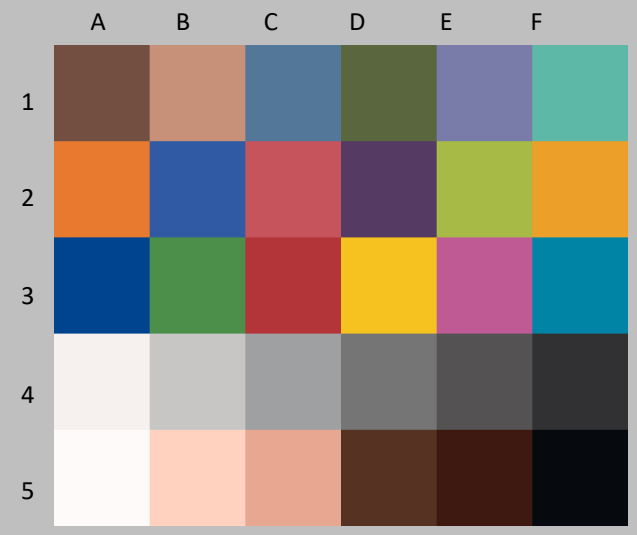
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	96.5	1.3	37.3	38.0	13.1	12.2	14.1	13.4
B1	Light Skin	95.9	1.7	64.7	65.2	17.4	16.4	19.7	18.5
C1	Blue sky	98.5	1.0	48.6	49.0	-4.4	-5.1	-21.7	-21.3
D1	Foliage	98.3	1.0	41.7	42.1	-12.8	-13.2	21.3	20.5
E1	blue flower	97.0	1.3	53.5	54.0	8.7	7.7	-24.2	-23.4
F1	bluish green	98.9	0.9	69.2	69.5	-31.9	-31.6	0.0	-0.8
A1	orange	95.7	3.6	62.7	63.9	35.9	32.6	56.9	55.9
B2	purplish blue	96.7	2.1	39.3	39.8	9.6	8.1	-44.3	-43.0
C2	moderate red	96.9	2.1	50.8	51.4	45.4	43.9	18.0	16.7
D2	purple	98.2	1.1	29.6	29.9	20.7	19.8	-20.1	-19.6
E2	yellow green	98.2	1.6	72.1	72.3	-22.9	-23.1	55.6	54.0
F2	orange yellow	97.0	2.8	71.5	72.4	19.3	16.8	66.8	65.8
A3	blue	96.8	2.1	29.4	29.8	12.1	10.4	-47.1	-46.0
B3	green	98.5	1.3	53.8	54.2	-36.8	-36.9	29.9	28.7
C3	red	96.5	2.7	42.0	42.8	50.6	49.1	27.4	25.4
D3	yellow	98.0	2.1	81.0	81.3	3.8	2.4	78.1	76.5
E3	magenta	98.5	1.3	52.6	52.9	47.0	45.8	-12.9	-12.6
F3	cyan	99.9	0.7	50.9	51.4	-21.5	-21.9	-27.2	-26.9
A4	white	100.0	0.4	95.4	95.2	0.6	0.2	1.6	1.6
B4	neutral 8	99.9	0.6	80.2	80.4	-0.6	-1.1	0.5	0.6
C4	neutral 6.5	100.0	0.5	65.8	66.1	-0.9	-1.2	-0.5	-0.5
D4	neutral 5	100.0	0.6	49.6	50.0	-0.3	-0.7	0.2	0.0
E4	neutral 3.5	100.0	0.6	35.3	35.7	-0.6	-1.0	-0.5	-0.5
F4	black	100.0	0.5	20.9	21.2	0.4	0.0	-1.0	-1.0
A5	paper white	100.0	0.4	98.8	98.4	0.3	0.1	0.7	0.6
B5	Skin highlight L*=88	94.2	1.6	87.5	87.7	11.9	10.7	14.8	13.8
C5	Skin highlight L* =75	95.4	1.9	74.2	74.5	20.2	19.1	21.4	19.9
D5	Skin shadow L*=28	96.3	1.5	25.0	25.8	14.5	13.2	16.7	16.5
E5	Skin shadow L*=13	97.2	1.2	14.3	14.8	16.1	15.2	12.3	12.9
F5	Maximum Black	100.0	0.4	3.2	3.5	-0.3	-0.3	-2.7	-2.5

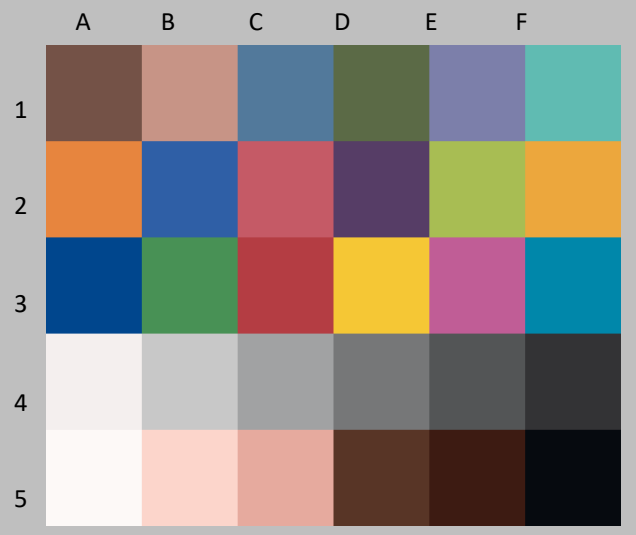
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	98.0	97.2	1.4
Worst 10% (3 lowest scoring patches)	95.1	92.6	3.0

20 Mluxhrs + 2 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



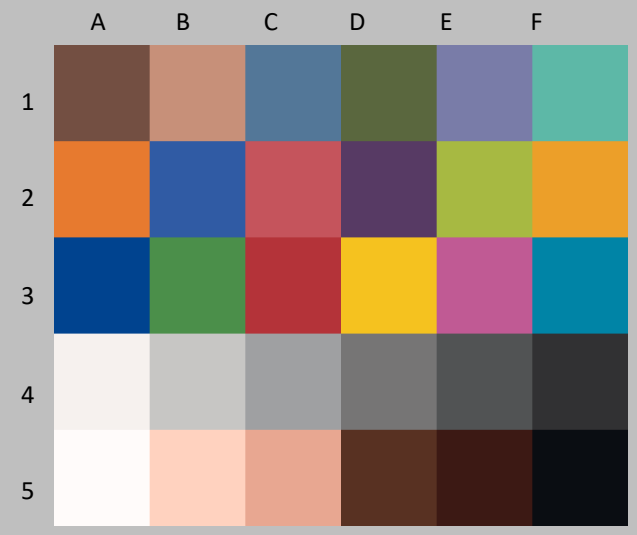
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	88.8	3.0	37.3	38.6	13.1	11.8	14.1	11.7
B1	Light Skin	82.6	5.2	64.7	65.8	17.4	16.4	19.7	14.7
C1	Blue sky	99.1	1.3	48.5	49.5	-4.5	-5.1	-21.9	-21.6
D1	Foliage	89.7	3.2	41.7	42.6	-12.9	-13.2	21.4	18.3
E1	blue flower	96.6	1.7	53.4	54.5	8.7	7.5	-24.2	-23.4
F1	bluish green	86.8	4.8	69.1	70.2	-31.9	-30.4	0.1	-4.4
A1	orange	90.6	7.2	62.6	65.1	35.9	30.8	57.0	52.6
B2	purplish blue	95.6	2.7	39.2	40.3	9.6	7.7	-44.3	-42.7
C2	moderate red	91.1	5.0	50.7	52.1	45.3	43.2	18.3	14.0
D2	purple	97.1	1.5	29.5	30.3	20.4	19.2	-20.2	-19.6
E2	yellow green	91.9	5.4	72.0	72.8	-23.0	-23.2	55.5	50.1
F2	orange yellow	92.0	6.4	71.4	73.3	19.4	15.3	67.1	62.5
A3	blue	95.5	2.8	29.4	30.3	11.6	9.7	-46.9	-45.1
B3	green	91.4	4.7	53.7	54.6	-36.9	-36.8	29.8	25.2
C3	red	92.5	5.1	41.9	43.6	50.5	48.1	27.3	23.1
D3	yellow	93.1	6.0	80.9	81.9	3.8	1.5	78.1	72.6
E3	magenta	97.8	1.8	52.6	53.4	47.1	45.5	-13.0	-13.1
F3	cyan	99.8	1.1	50.7	51.7	-21.5	-21.5	-27.2	-27.7
A4	white	99.9	0.5	95.2	95.1	0.4	0.2	1.7	1.2
B4	neutral 8	94.2	1.2	80.1	80.7	-0.7	-0.9	0.6	-0.5
C4	neutral 6.5	95.0	1.2	65.7	66.5	-0.9	-0.9	-0.5	-1.5
D4	neutral 5	95.7	1.2	49.5	50.3	-0.4	-0.5	0.2	-0.7
E4	neutral 3.5	96.0	1.2	35.3	36.0	-0.5	-0.8	-0.4	-1.3
F4	black	100.0	0.7	20.9	21.5	0.0	-0.3	-0.8	-1.0
A5	paper white	100.0	0.5	98.6	98.1	0.2	0.0	0.7	0.8
B5	Skin highlight L*=88	73.8	5.6	87.4	88.1	11.9	10.7	15.1	9.7
C5	Skin highlight L* =75	79.7	6.5	74.1	75.0	20.2	19.2	21.3	14.9
D5	Skin shadow L*=28	92.6	2.5	25.1	26.4	14.5	12.6	16.9	15.9
E5	Skin shadow L*=13	94.8	1.7	14.2	14.9	15.9	14.7	12.7	13.7
F5	Maximum Black	100.0	0.3	3.2	3.3	-0.4	-0.5	-2.4	-2.1

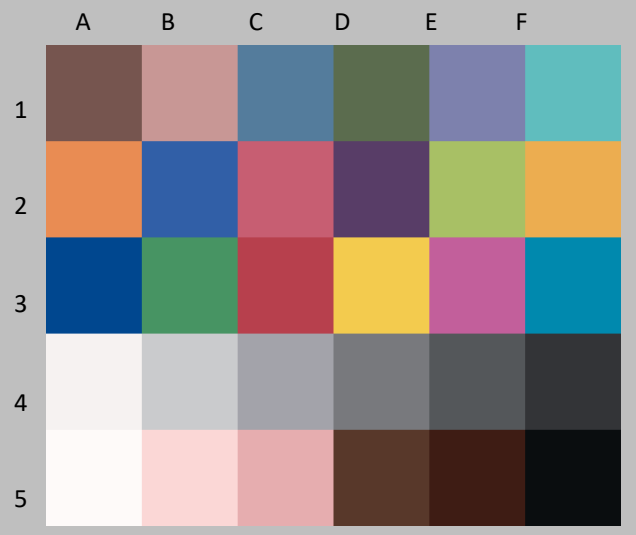
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	93.1	95.0	3.1
Worst 10% (3 lowest scoring patches)	78.7	87.1	6.7

50 Mluxhrs + 2 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



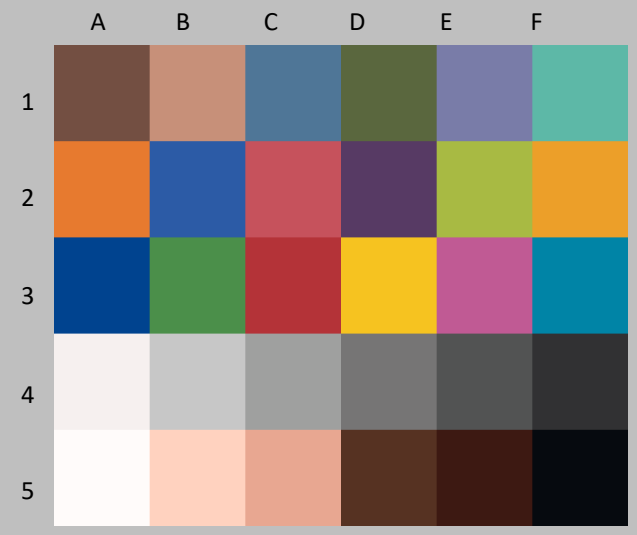
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	77.6	5.2	37.4	39.4	13.1	12.0	14.0	9.3
B1	Light Skin	59.2	11.4	64.7	66.9	17.4	17.1	19.6	8.4
C1	Blue sky	100.0	1.9	48.5	50.3	-4.3	-4.5	-22.0	-22.1
D1	Foliage	75.3	6.9	41.7	43.4	-12.8	-13.1	21.3	14.7
E1	blue flower	98.2	2.2	53.4	55.4	8.6	8.0	-24.3	-23.6
F1	bluish green	71.2	9.9	69.1	71.4	-31.8	-28.3	0.1	-8.9
A1	orange	79.8	14.8	62.6	67.1	35.9	28.6	56.8	44.7
B2	purplish blue	95.1	3.3	39.1	41.0	9.7	7.7	-44.4	-42.6
C2	moderate red	81.8	9.7	50.6	53.2	45.5	43.1	18.0	8.9
D2	purple	97.7	1.7	29.4	30.7	20.6	19.6	-20.4	-19.9
E2	yellow green	79.5	13.1	71.9	74.1	-23.1	-22.7	55.6	42.7
F2	orange yellow	81.6	13.8	71.3	75.0	19.3	13.5	67.1	55.1
A3	blue	95.2	3.1	29.4	30.7	11.9	9.7	-46.9	-45.2
B3	green	78.2	11.1	53.6	55.7	-37.0	-36.2	30.0	19.1
C3	red	86.1	8.9	41.9	44.8	50.5	47.6	27.4	19.4
D3	yellow	83.0	14.0	80.9	83.3	3.8	0.3	78.3	64.9
E3	magenta	98.0	2.3	52.5	54.3	47.1	46.0	-13.1	-14.1
F3	cyan	96.1	2.6	50.8	52.6	-21.6	-20.8	-27.3	-29.0
A4	white	99.7	0.7	95.1	95.6	0.4	0.3	1.6	1.0
B4	neutral 8	85.7	2.5	80.2	81.8	-0.7	-0.5	0.5	-1.3
C4	neutral 6.5	81.4	2.9	65.7	67.6	-0.9	-0.3	-0.6	-2.7
D4	neutral 5	83.3	2.6	49.5	51.1	-0.3	0.0	0.1	-2.0
E4	neutral 3.5	88.0	2.1	35.4	36.7	-0.6	-0.6	-0.5	-2.2
F4	black	97.2	1.2	20.9	21.8	0.1	-0.1	-1.1	-1.8
A5	paper white	100.0	0.4	98.6	98.6	0.3	0.0	0.7	1.0
B5	Skin highlight L*=88	51.1	10.0	87.4	89.1	11.9	10.9	15.0	5.2
C5	Skin highlight L* =75	54.2	14.1	74.1	76.2	20.3	20.2	21.3	7.3
D5	Skin shadow L*=28	87.0	3.9	25.0	27.0	14.6	12.4	16.6	14.0
E5	Skin shadow L*=13	91.9	2.4	14.3	15.3	16.1	14.5	11.9	13.4
F5	Maximum Black	98.9	0.7	3.4	3.7	-0.2	-0.4	-2.9	-2.3

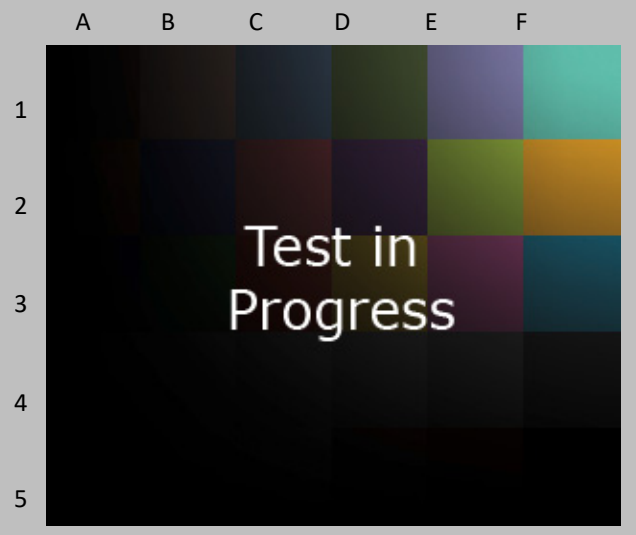
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	85.1	92.0	6.0
Worst 10% (3 lowest scoring patches)	54.8	79.2	14.3

100 Mluxhrs + 2 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



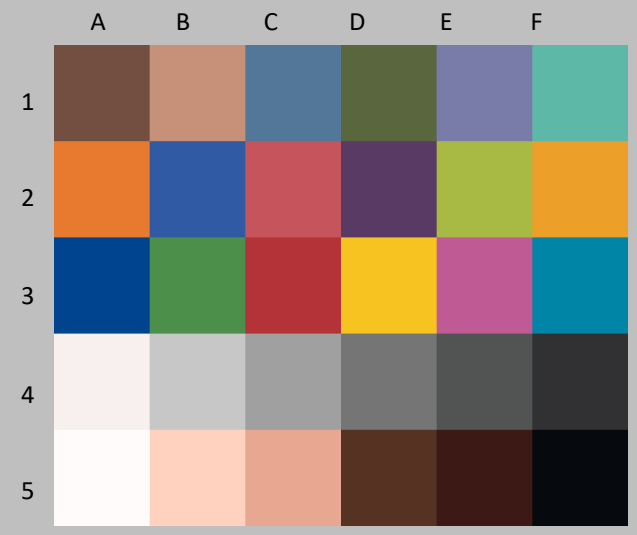
Original Print Colors before light exposure



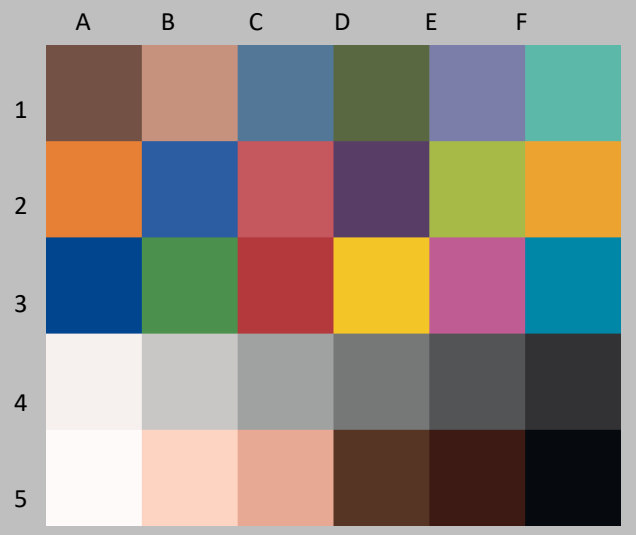
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin			37.2	34.9	13.1		13.9	
B1	Light Skin			64.7	63.1	17.3		19.6	
C1	Blue sky			48.4	46.8	-4.6		-22.0	
D1	Foliage			41.6	40.2	-12.9		21.4	
E1	blue flower			53.4	52.3	8.8		-24.3	
F1	bluish green			69.2	65.9	-32.0		0.1	
A1	orange			62.7	58.6	36.1		57.3	
B2	purplish blue			39.1	37.0	9.6		-44.7	
C2	moderate red			50.6	46.6	45.6		18.3	
D2	purple			29.3	26.2	20.5		-20.4	
E2	yellow green			72.0	66.9	-23.1		55.9	
F2	orange yellow			71.5	67.1	19.4		67.4	
A3	blue			29.4	25.6	12.0		-47.1	
B3	green			53.7	49.3	-37.1		29.9	
C3	red			41.9	37.8	50.6		27.5	
D3	yellow			81.1	76.5	3.7		77.5	
E3	magenta			52.6	48.1	47.2		-13.0	
F3	cyan			50.8	48.3	-21.7		-27.3	
A4	white			95.4	92.2	0.6		1.5	
B4	neutral 8			80.2	76.0	-0.6		0.4	
C4	neutral 6.5			65.7	65.3	-0.9		-0.5	
D4	neutral 5			49.5	48.4	-0.3		0.1	
E4	neutral 3.5			35.3	34.2	-0.6		-0.5	
F4	black			20.9	17.5	0.0		-0.9	
A5	paper white			98.8	95.1	0.2		0.7	
B5	Skin highlight L*=88			87.5	84.2	12.0		15.0	
C5	Skin highlight L* =75			74.0	72.1	20.4		21.3	
D5	Skin shadow L*=28			25.0	23.2	14.5		17.1	
E5	Skin shadow L*=13			14.2	11.6	16.2		12.5	
F5	Maximum Black			3.0	4.2	-0.5		-2.6	
Summary Results		I* Color	I* tone	ΔE	200 Mluxhrs + 2 years				
Average Score for all patches									
Worst 10% (3 lowest scoring patches)									

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



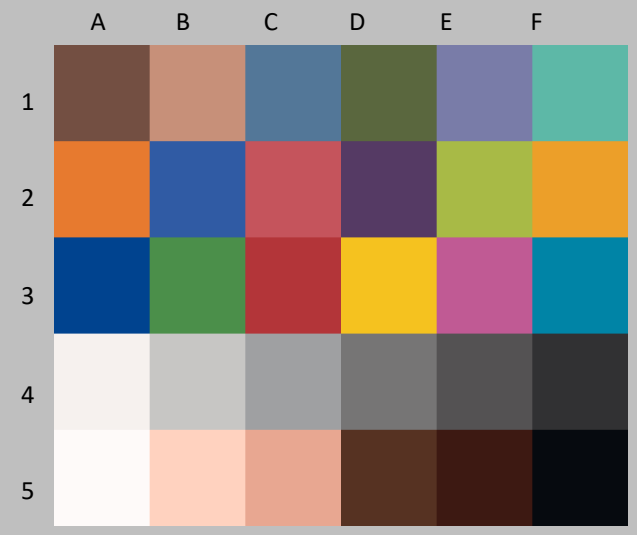
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	96.7	1.3	37.3	38.0	13.1	12.2	14.1	13.4
B1	Light Skin	96.1	1.6	64.7	65.2	17.4	16.4	19.7	18.6
C1	Blue sky	98.3	1.0	48.6	49.1	-4.4	-5.1	-21.7	-21.2
D1	Foliage	98.2	1.1	41.7	42.2	-12.8	-13.2	21.3	20.5
E1	blue flower	97.1	1.3	53.5	54.0	8.7	7.7	-24.2	-23.4
F1	bluish green	99.0	0.9	69.2	69.6	-31.9	-31.6	0.0	-0.8
A1	orange	95.8	3.6	62.7	64.0	35.9	32.7	56.9	55.9
B2	purplish blue	96.8	2.0	39.3	39.8	9.6	8.1	-44.3	-43.0
C2	moderate red	97.0	2.1	50.8	51.5	45.4	43.9	18.0	16.8
D2	purple	97.9	1.2	29.6	30.0	20.7	19.7	-20.1	-19.5
E2	yellow green	98.2	1.6	72.1	72.3	-22.9	-23.1	55.6	54.0
F2	orange yellow	97.0	2.7	71.5	72.5	19.3	16.9	66.8	65.9
A3	blue	96.4	2.3	29.4	29.9	12.1	10.3	-47.1	-45.8
B3	green	98.4	1.3	53.8	54.2	-36.8	-36.9	29.9	28.7
C3	red	96.8	2.5	42.0	42.9	50.6	49.1	27.4	25.5
D3	yellow	98.1	2.0	81.0	81.5	3.8	2.5	78.1	76.6
E3	magenta	98.5	1.3	52.6	53.0	47.0	45.9	-12.9	-12.5
F3	cyan	99.8	0.8	50.9	51.4	-21.5	-22.0	-27.2	-26.9
A4	white	100.0	0.4	95.4	95.3	0.6	0.2	1.6	1.8
B4	neutral 8	99.7	0.6	80.2	80.5	-0.6	-1.1	0.5	0.7
C4	neutral 6.5	100.0	0.6	65.8	66.2	-0.9	-1.2	-0.5	-0.4
D4	neutral 5	100.0	0.6	49.6	50.0	-0.3	-0.7	0.2	0.1
E4	neutral 3.5	100.0	0.6	35.3	35.7	-0.6	-1.0	-0.5	-0.5
F4	black	100.0	0.5	20.9	21.1	0.4	-0.1	-1.0	-0.9
A5	paper white	100.0	0.4	98.8	98.5	0.3	0.1	0.7	0.8
B5	Skin highlight L*=88	94.9	1.5	87.5	87.8	11.9	10.7	14.8	14.0
C5	Skin highlight L* =75	95.8	1.8	74.2	74.6	20.2	19.1	21.4	20.0
D5	Skin shadow L*=28	96.2	1.6	25.0	25.8	14.5	13.2	16.7	16.7
E5	Skin shadow L*=13	96.7	1.2	14.3	14.7	16.1	15.2	12.3	13.0
F5	Maximum Black	100.0	0.4	3.2	3.3	-0.3	-0.4	-2.7	-2.3

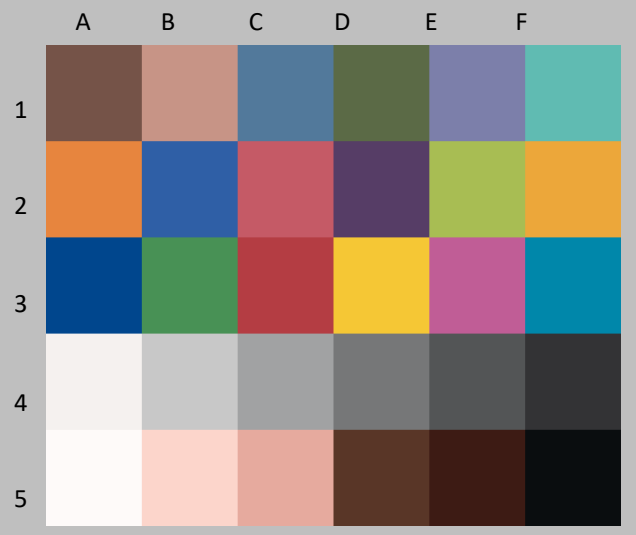
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	98.0	97.1	1.4
Worst 10% (3 lowest scoring patches)	95.5	92.4	2.9

20 Mluxhrs + 3 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



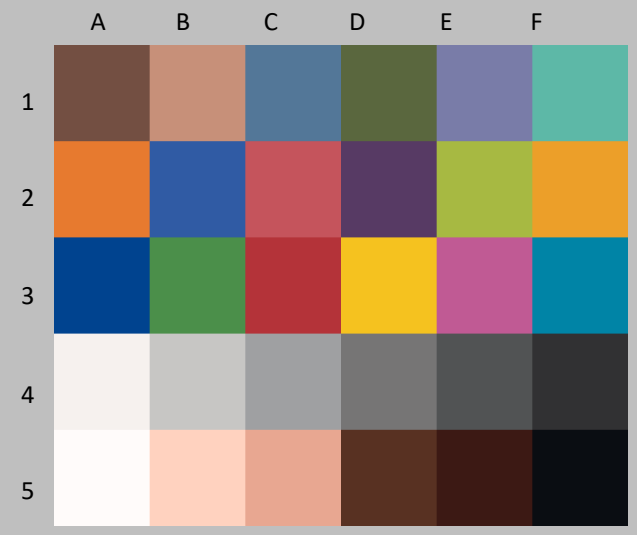
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	89.5	2.9	37.3	38.7	13.1	11.9	14.1	11.8
B1	Light Skin	82.9	5.1	64.7	65.8	17.4	16.4	19.7	14.8
C1	Blue sky	99.2	1.2	48.5	49.5	-4.5	-5.1	-21.9	-21.6
D1	Foliage	90.3	3.1	41.7	42.6	-12.9	-13.4	21.4	18.5
E1	blue flower	96.5	1.8	53.4	54.5	8.7	7.6	-24.2	-23.3
F1	bluish green	86.8	4.8	69.1	70.1	-31.9	-30.3	0.1	-4.3
A1	orange	90.6	7.2	62.6	65.1	35.9	30.8	57.0	52.5
B2	purplish blue	95.7	2.6	39.2	40.2	9.6	7.8	-44.3	-42.7
C2	moderate red	91.3	4.9	50.7	52.1	45.3	43.2	18.3	14.1
D2	purple	97.2	1.5	29.5	30.3	20.4	19.2	-20.2	-19.6
E2	yellow green	91.9	5.4	72.0	72.8	-23.0	-23.2	55.5	50.1
F2	orange yellow	92.1	6.3	71.4	73.3	19.4	15.4	67.1	62.6
A3	blue	95.2	3.0	29.4	30.4	11.6	9.5	-46.9	-45.1
B3	green	91.5	4.6	53.7	54.6	-36.9	-36.8	29.8	25.3
C3	red	92.3	5.2	41.9	43.6	50.5	48.1	27.3	23.0
D3	yellow	93.2	5.9	80.9	81.9	3.8	1.5	78.1	72.7
E3	magenta	98.1	1.7	52.6	53.4	47.1	45.6	-13.0	-13.1
F3	cyan	99.6	1.2	50.7	51.7	-21.5	-21.5	-27.2	-27.8
A4	white	100.0	0.5	95.2	95.2	0.4	0.2	1.7	1.2
B4	neutral 8	94.6	1.2	80.1	80.8	-0.7	-0.9	0.6	-0.4
C4	neutral 6.5	95.2	1.3	65.7	66.6	-0.9	-0.9	-0.5	-1.5
D4	neutral 5	95.6	1.3	49.5	50.3	-0.4	-0.5	0.2	-0.7
E4	neutral 3.5	96.0	1.2	35.3	36.1	-0.5	-0.8	-0.4	-1.3
F4	black	99.8	0.8	20.9	21.6	0.0	-0.3	-0.8	-1.2
A5	paper white	100.0	0.4	98.6	98.3	0.2	0.0	0.7	0.8
B5	Skin highlight L*=88	74.0	5.5	87.4	88.2	11.9	10.7	15.1	9.7
C5	Skin highlight L* =75	80.1	6.4	74.1	75.1	20.2	19.2	21.3	15.1
D5	Skin shadow L*=28	92.3	2.6	25.1	26.5	14.5	12.7	16.9	15.6
E5	Skin shadow L*=13	96.3	1.5	14.2	15.1	15.9	14.8	12.7	13.2
F5	Maximum Black	100.0	0.3	3.2	3.4	-0.4	-0.4	-2.4	-2.4

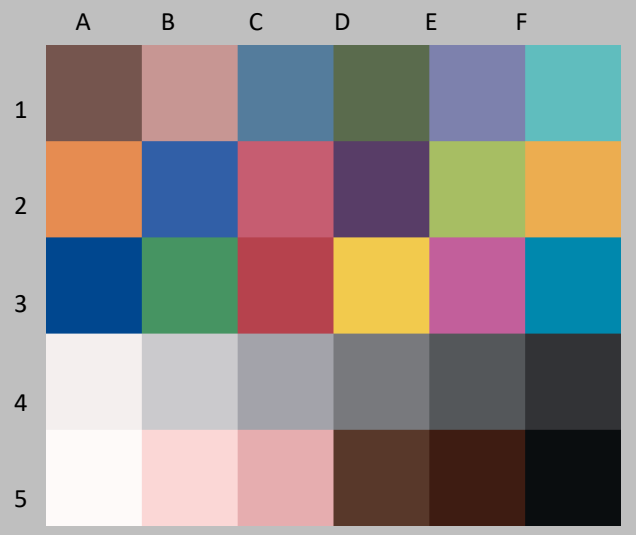
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	93.3	95.0	3.0
Worst 10% (3 lowest scoring patches)	79.0	87.6	6.6

50 Mluxhrs + 3 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



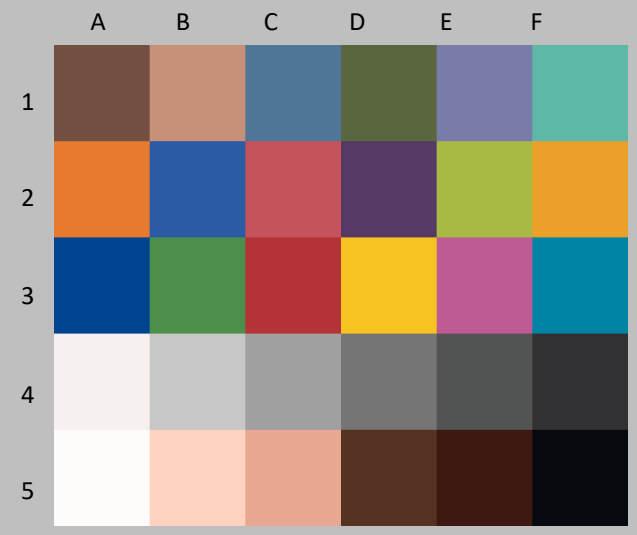
Colors after both light exposure + dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	77.4	5.2	37.4	39.4	13.1	11.9	14.0	9.3
B1	Light Skin	59.5	11.3	64.7	66.8	17.4	17.1	19.6	8.5
C1	Blue sky	100.0	1.7	48.5	50.1	-4.3	-4.6	-22.0	-22.1
D1	Foliage	75.4	6.8	41.7	43.3	-12.8	-12.9	21.3	14.7
E1	blue flower	97.6	2.2	53.4	55.2	8.6	7.9	-24.3	-23.5
F1	bluish green	71.1	9.9	69.1	71.2	-31.8	-28.1	0.1	-8.9
A1	orange	79.4	14.9	62.6	66.8	35.9	28.5	56.8	44.5
B2	purplish blue	95.0	3.2	39.1	40.8	9.7	7.7	-44.4	-42.5
C2	moderate red	81.9	9.7	50.6	53.1	45.5	43.1	18.0	9.0
D2	purple	97.8	1.7	29.4	30.6	20.6	19.6	-20.4	-19.8
E2	yellow green	79.1	13.2	71.9	73.9	-23.1	-22.7	55.6	42.5
F2	orange yellow	81.2	14.1	71.3	74.8	19.3	13.4	67.1	54.8
A3	blue	94.4	3.5	29.4	30.8	11.9	9.5	-46.9	-44.8
B3	green	78.1	11.1	53.6	55.4	-37.0	-36.1	30.0	19.1
C3	red	86.0	9.0	41.9	44.6	50.5	47.4	27.4	19.4
D3	yellow	82.8	14.2	80.9	82.9	3.8	0.3	78.3	64.7
E3	magenta	97.8	2.1	52.5	54.0	47.1	45.8	-13.1	-14.0
F3	cyan	96.5	2.3	50.8	52.3	-21.6	-20.7	-27.3	-28.8
A4	white	100.0	0.5	95.1	95.1	0.4	0.3	1.6	1.1
B4	neutral 8	85.9	2.3	80.2	81.5	-0.7	-0.5	0.5	-1.3
C4	neutral 6.5	81.5	2.8	65.7	67.4	-0.9	-0.3	-0.6	-2.7
D4	neutral 5	84.3	2.6	49.5	51.1	-0.3	0.0	0.1	-1.9
E4	neutral 3.5	87.0	2.1	35.4	36.7	-0.6	-0.5	-0.5	-2.3
F4	black	98.4	1.1	20.9	21.7	0.1	-0.2	-1.1	-1.7
A5	paper white	100.0	0.6	98.6	98.3	0.3	0.0	0.7	1.1
B5	Skin highlight L*=88	51.1	9.9	87.4	88.9	11.9	10.9	15.0	5.2
C5	Skin highlight L* =75	54.3	14.1	74.1	76.1	20.3	20.2	21.3	7.3
D5	Skin shadow L*=28	87.6	3.8	25.0	27.0	14.6	12.4	16.6	14.2
E5	Skin shadow L*=13	91.0	2.6	14.3	15.4	16.1	14.6	11.9	13.7
F5	Maximum Black	99.4	0.6	3.4	3.5	-0.2	-0.3	-2.9	-2.3

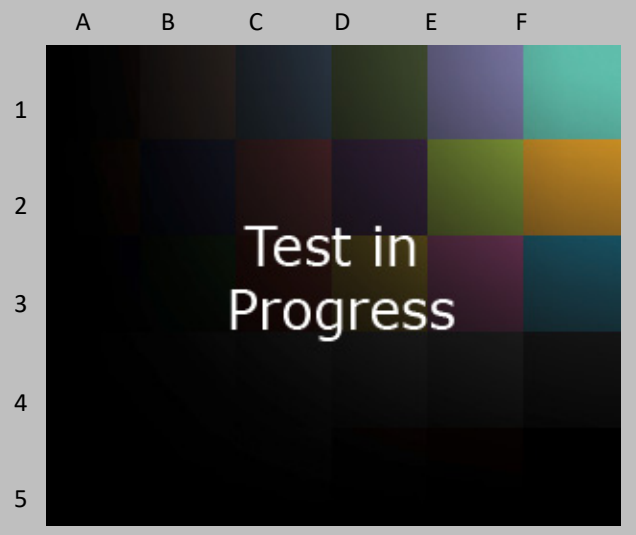
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	85.1	92.2	6.0
Worst 10% (3 lowest scoring patches)	55.0	79.5	14.4

100 Mluxhrs + 3 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure

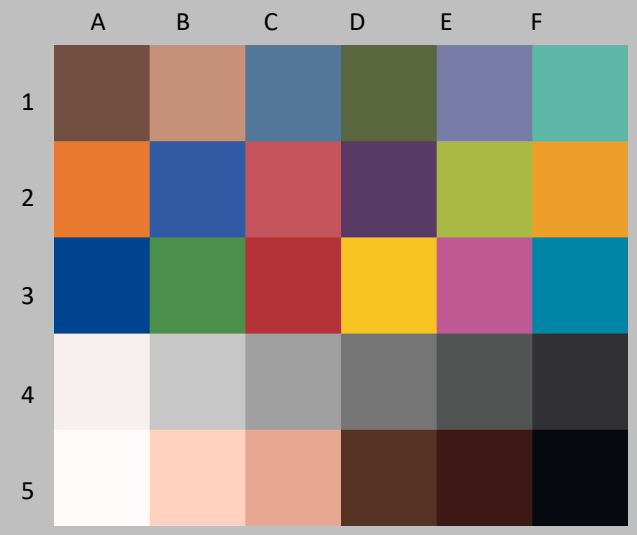


Colors after both light exposure + dark storage

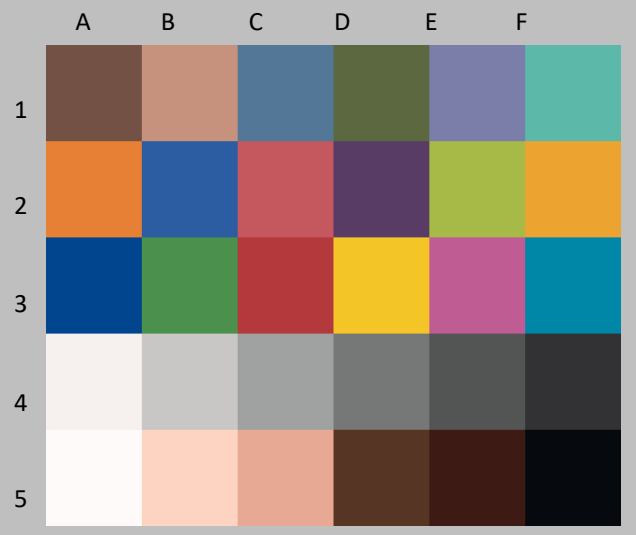
Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin			37.2		13.1		13.9	
B1	Light Skin			64.7		17.3		19.6	
C1	Blue sky			48.4		-4.6		-22.0	
D1	Foliage			41.6		-12.9		21.4	
E1	blue flower			53.4		8.8		-24.3	
F1	bluish green			69.2		-32.0		0.1	
A1	orange			62.7		36.1		57.3	
B2	purplish blue			39.1		9.6		-44.7	
C2	moderate red			50.6		45.6		18.3	
D2	purple			29.3		20.5		-20.4	
E2	yellow green			72.0		-23.1		55.9	
F2	orange yellow			71.5		19.4		67.4	
A3	blue			29.4		12.0		-47.1	
B3	green			53.7		-37.1		29.9	
C3	red			41.9		50.6		27.5	
D3	yellow			81.1		3.7		77.5	
E3	magenta			52.6		47.2		-13.0	
F3	cyan			50.8		-21.7		-27.3	
A4	white			95.4		0.6		1.5	
B4	neutral 8			80.2		-0.6		0.4	
C4	neutral 6.5			65.7		-0.9		-0.5	
D4	neutral 5			49.5		-0.3		0.1	
E4	neutral 3.5			35.3		-0.6		-0.5	
F4	black			20.9		0.0		-0.9	
A5	paper white			98.8		0.2		0.7	
B5	Skin highlight L*=88			87.5		12.0		15.0	
C5	Skin highlight L* =75			74.0		20.4		21.3	
D5	Skin shadow L*=28			25.0		14.5		17.1	
E5	Skin shadow L*=13			14.2		16.2		12.5	
F5	Maximum Black			3.0		-0.5		-2.6	
Summary Results		I* Color	I* tone	ΔE					
Average Score for all patches									
Worst 10% (3 lowest scoring patches)									

200 Mluxhrs + 3 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



Colors after both light exposure + dark storage

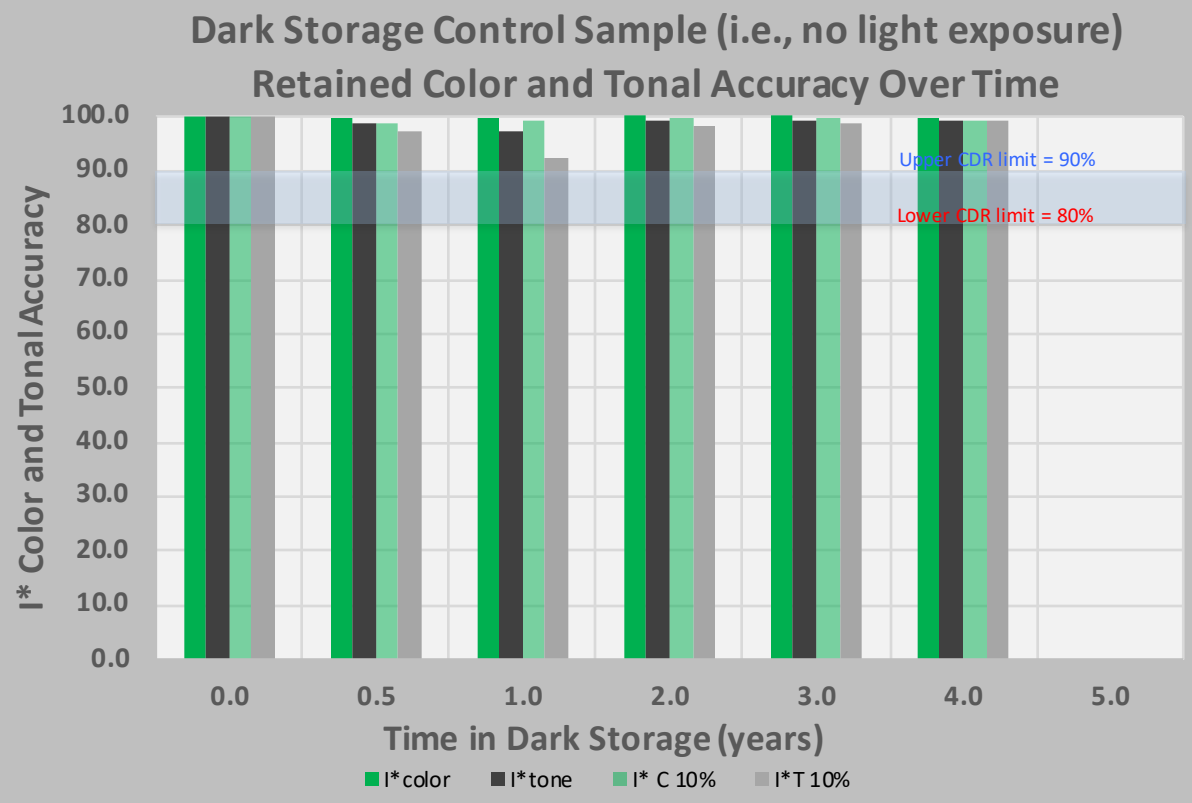
Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	97.0	1.2	37.3	37.9	13.1	12.2	14.1	13.5
B1	Light Skin	96.1	1.6	64.7	65.2	17.4	16.4	19.7	18.6
C1	Blue sky	98.0	1.1	48.6	49.0	-4.4	-5.1	-21.7	-21.2
D1	Foliage	98.5	1.0	41.7	42.1	-12.8	-13.2	21.3	20.6
E1	blue flower	96.8	1.4	53.5	54.0	8.7	7.7	-24.2	-23.3
F1	bluish green	99.1	0.9	69.2	69.6	-31.9	-31.6	0.0	-0.8
A1	orange	95.8	3.6	62.7	64.0	35.9	32.7	56.9	55.9
B2	purplish blue	96.5	2.1	39.3	39.8	9.6	8.0	-44.3	-42.9
C2	moderate red	97.0	2.1	50.8	51.4	45.4	43.9	18.0	16.8
D2	purple	97.7	1.2	29.6	30.0	20.7	19.7	-20.1	-19.5
E2	yellow green	98.2	1.6	72.1	72.3	-22.9	-23.1	55.6	54.0
F2	orange yellow	97.1	2.7	71.5	72.5	19.3	16.9	66.8	65.9
A3	blue	96.2	2.4	29.4	29.9	12.1	10.2	-47.1	-45.7
B3	green	98.5	1.3	53.8	54.2	-36.8	-36.9	29.9	28.7
C3	red	96.8	2.5	42.0	42.9	50.6	49.1	27.4	25.6
D3	yellow	98.1	2.0	81.0	81.4	3.8	2.5	78.1	76.6
E3	magenta	98.4	1.3	52.6	53.0	47.0	45.9	-12.9	-12.4
F3	cyan	99.7	0.8	50.9	51.4	-21.5	-22.0	-27.2	-26.9
A4	white	100.0	0.4	95.4	95.3	0.6	0.2	1.6	1.8
B4	neutral 8	99.4	0.6	80.2	80.6	-0.6	-1.1	0.5	0.7
C4	neutral 6.5	100.0	0.6	65.8	66.2	-0.9	-1.2	-0.5	-0.4
D4	neutral 5	100.0	0.6	49.6	50.0	-0.3	-0.7	0.2	0.2
E4	neutral 3.5	100.0	0.7	35.3	35.8	-0.6	-1.0	-0.5	-0.5
F4	black	100.0	0.5	20.9	21.2	0.4	0.0	-1.0	-0.9
A5	paper white	100.0	0.3	98.8	98.6	0.3	0.1	0.7	0.9
B5	Skin highlight L*=88	95.2	1.5	87.5	87.8	11.9	10.8	14.8	14.0
C5	Skin highlight L* =75	95.9	1.8	74.2	74.6	20.2	19.2	21.4	20.0
D5	Skin shadow L*=28	96.3	1.6	25.0	25.8	14.5	13.2	16.7	16.6
E5	Skin shadow L*=13	96.8	1.2	14.3	14.8	16.1	15.2	12.3	13.0
F5	Maximum Black	99.9	0.5	3.2	3.3	-0.3	-0.4	-2.7	-2.2

Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	98.0	97.2	1.4
Worst 10% (3 lowest scoring patches)	95.6	92.6	2.9

20 Mluxhrs + 4 years

Section IV: Ongoing Dark Storage Test Results

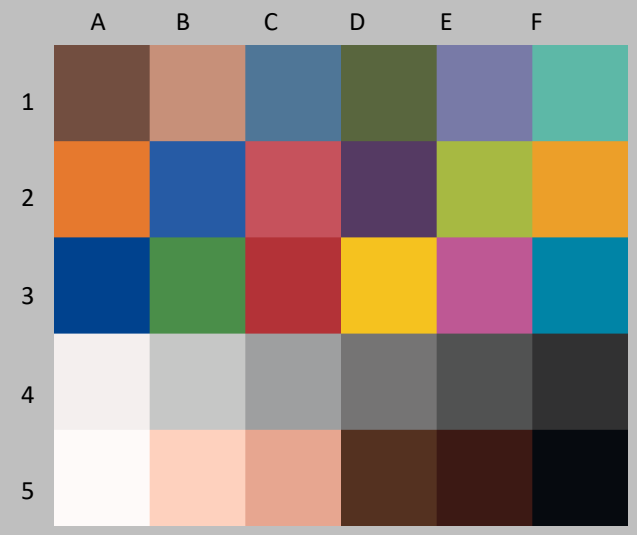
This section of the report tracks a sample of this print process (i.e., printer/ink/media) that remains in an amibient room temperature/moderate RH dark storage environment and has not been subjected to light exposure tests like the other samples. It is essentially a "control" sample that will remain in natural aging conditions (e.g., photo album storage) while the other light fastness tests are ongoing, and then in the Aardenburg Archives under simliar conditions indefinitely along with the retired light fade samples. The chart below will be rescaled to longer time intervals once total acumulated storage time exceeds 5 years.



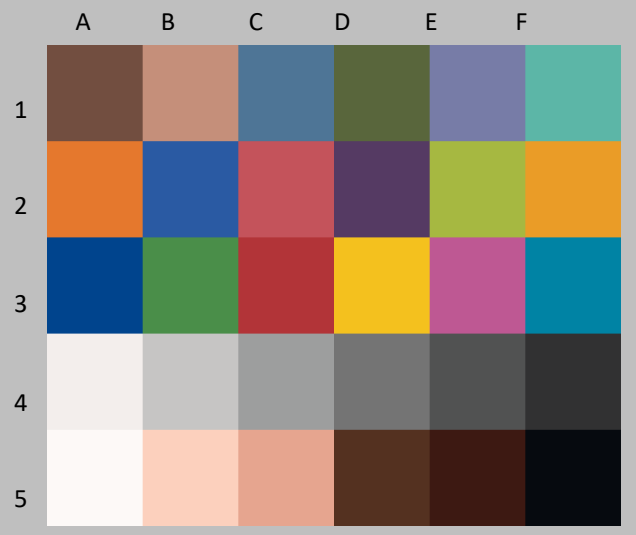
Time in Storage Summary for Dark Storage Control Sample

Years	*I*color (worst 10%)*	*I* Tone (10%)*	I* Color	I* tone	ΔE avg.	ΔE (worst 10%)
0.0	100.0	*100.0*	100.0	100.0	0.0	0.0
0.5	98.7	*97.4*	99.9	98.7	0.4	0.8
1.0	99.3	*92.5*	99.9	97.1	0.6	1.3
2.0	99.9	*98.3*	100.0	99.2	0.2	0.5
3.0	99.9	*98.5*	100.0	99.3	0.3	0.6
4.0	99.4	*99.0*	99.9	99.4	0.4	0.6
5.0						

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



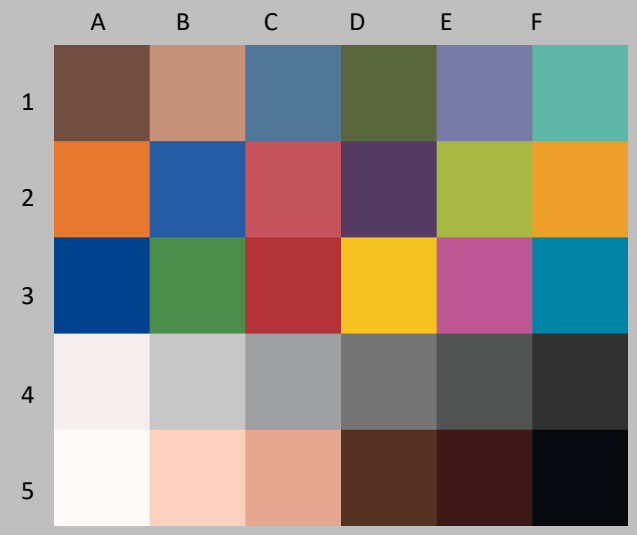
Colors after additional time in dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	100.0	0.3	37.0	36.7	13.0	13.0	13.9	13.9
B1	Light Skin	100.0	0.4	64.5	64.2	17.4	17.3	19.5	19.5
C1	Blue sky	100.0	0.4	48.1	47.9	-4.7	-4.9	-22.1	-21.9
D1	Foliage	100.0	0.3	41.3	41.2	-12.9	-13.0	21.3	21.5
E1	blue flower	100.0	0.3	53.1	52.9	8.6	8.4	-24.4	-24.3
F1	bluish green	100.0	0.4	68.9	68.7	-32.1	-32.2	0.2	0.5
A1	orange	100.0	0.5	62.5	62.0	36.2	36.0	57.2	57.1
B2	purplish blue	100.0	0.3	39.0	38.8	9.4	9.2	-44.5	-44.3
C2	moderate red	100.0	0.5	50.4	50.0	45.6	45.4	18.2	18.0
D2	purple	100.0	0.3	29.1	28.9	20.4	20.2	-20.3	-20.3
E2	yellow green	100.0	0.3	71.8	71.4	-23.1	-23.0	56.0	56.0
F2	orange yellow	100.0	0.4	71.2	70.8	19.5	19.3	67.1	67.0
A3	blue	99.2	1.0	29.2	29.5	12.0	11.5	-46.9	-46.2
B3	green	100.0	0.4	53.5	53.3	-37.3	-37.2	29.8	30.1
C3	red	100.0	0.5	41.7	41.4	50.5	50.3	27.5	27.3
D3	yellow	100.0	0.4	80.7	80.3	3.8	3.8	78.4	78.3
E3	magenta	100.0	0.4	52.3	52.0	47.1	46.9	-13.0	-13.2
F3	cyan	100.0	0.4	50.4	50.3	-21.9	-22.1	-27.4	-27.1
A4	white	100.0	0.4	95.0	94.6	0.5	0.4	1.5	1.6
B4	neutral 8	100.0	0.4	79.9	79.6	-0.6	-0.7	0.4	0.6
C4	neutral 6.5	100.0	0.3	65.5	65.2	-0.9	-1.0	-0.6	-0.5
D4	neutral 5	100.0	0.3	49.2	49.0	-0.4	-0.5	0.0	0.1
E4	neutral 3.5	100.0	0.2	34.9	34.8	-0.7	-0.8	-0.5	-0.4
F4	black	100.0	0.4	20.5	20.5	0.1	-0.1	-1.1	-0.7
A5	paper white	100.0	0.4	98.4	98.1	0.2	0.2	0.6	0.5
B5	Skin highlight L*=88	100.0	0.4	87.2	86.8	11.8	11.7	14.9	15.0
C5	Skin highlight L* =75	100.0	0.4	73.8	73.5	20.4	20.3	21.1	21.1
D5	Skin shadow L*=28	100.0	0.2	24.5	24.4	14.5	14.4	16.6	16.8
E5	Skin shadow L*=13	99.4	0.6	13.9	13.9	15.9	15.7	12.2	12.8
F5	Maximum Black	97.4	0.8	3.2	3.1	-0.3	-0.7	-2.7	-2.0

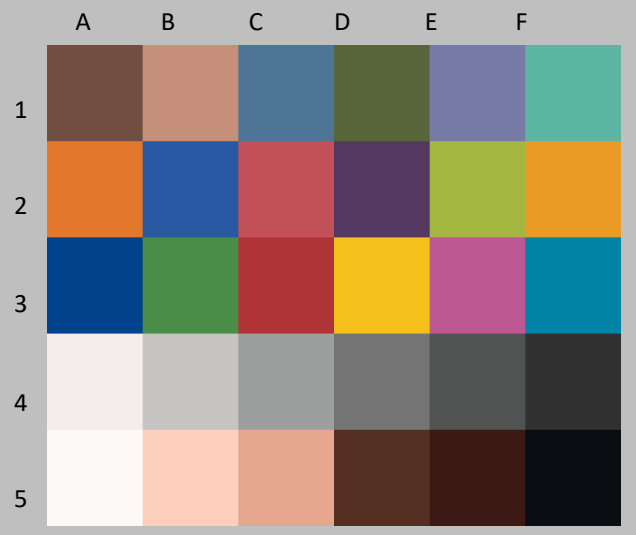
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	99.9	98.7	0.4
Worst 10% (3 lowest scoring patches)	98.7	97.4	0.8

DS Control at 6 months

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



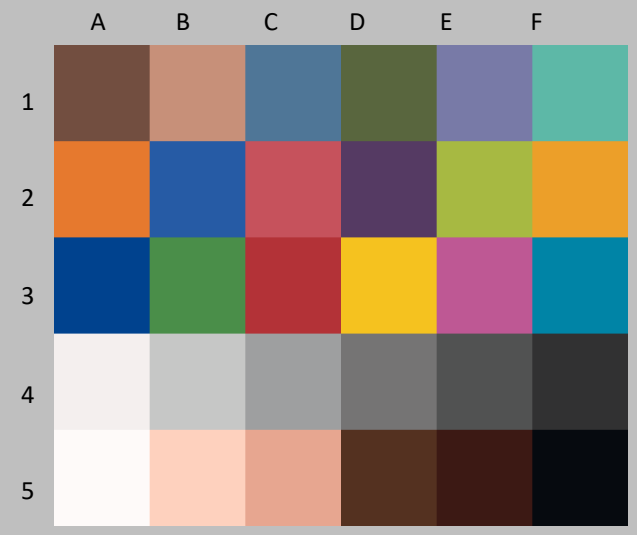
Colors after additional time in dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	100.0	0.2	37.0	36.7	13.0	13.0	13.9	13.9
B1	Light Skin	100.0	0.3	64.5	64.3	17.4	17.3	19.5	19.6
C1	Blue sky	100.0	0.4	48.1	47.9	-4.7	-4.9	-22.1	-21.9
D1	Foliage	100.0	0.4	41.3	41.1	-12.9	-12.9	21.3	21.6
E1	blue flower	100.0	0.5	53.1	52.8	8.6	8.4	-24.4	-24.1
F1	bluish green	100.0	0.7	68.9	68.4	-32.1	-32.0	0.2	0.6
A1	orange	99.7	1.2	62.5	61.5	36.2	35.8	57.2	56.6
B2	purplish blue	99.6	0.9	39.0	38.4	9.4	9.1	-44.5	-43.9
C2	moderate red	99.6	1.1	50.4	49.5	45.6	45.0	18.2	17.8
D2	purple	100.0	0.8	29.1	28.5	20.4	20.0	-20.3	-20.0
E2	yellow green	99.9	1.3	71.8	70.6	-23.1	-22.7	56.0	55.6
F2	orange yellow	99.7	1.3	71.2	70.0	19.5	19.2	67.1	66.5
A3	blue	98.6	1.2	29.2	29.2	12.0	11.4	-46.9	-45.9
B3	green	100.0	0.7	53.5	52.9	-37.3	-36.9	29.8	29.9
C3	red	100.0	0.7	41.7	41.2	50.5	50.2	27.5	27.2
D3	yellow	100.0	0.6	80.7	80.1	3.8	3.8	78.4	78.3
E3	magenta	100.0	0.4	52.3	51.9	47.1	46.9	-13.0	-13.1
F3	cyan	100.0	0.4	50.4	50.3	-21.9	-22.1	-27.4	-27.1
A4	white	100.0	0.5	95.0	94.6	0.5	0.4	1.5	1.6
B4	neutral 8	100.0	0.5	79.9	79.6	-0.6	-0.7	0.4	0.7
C4	neutral 6.5	100.0	0.3	65.5	65.2	-0.9	-1.0	-0.6	-0.4
D4	neutral 5	100.0	0.3	49.2	49.0	-0.4	-0.4	0.0	0.2
E4	neutral 3.5	100.0	0.1	34.9	34.8	-0.7	-0.7	-0.5	-0.5
F4	black	100.0	0.2	20.5	20.6	0.1	0.0	-1.1	-0.9
A5	paper white	100.0	0.3	98.4	98.1	0.2	0.2	0.6	0.6
B5	Skin highlight L*=88	100.0	0.4	87.2	86.8	11.8	11.7	14.9	15.0
C5	Skin highlight L* =75	100.0	0.3	73.8	73.6	20.4	20.2	21.1	21.3
D5	Skin shadow L*=28	100.0	0.2	24.5	24.4	14.5	14.5	16.6	16.5
E5	Skin shadow L*=13	100.0	0.5	13.9	14.1	15.9	15.8	12.2	11.7
F5	Maximum Black	100.0	0.3	3.2	3.4	-0.3	-0.3	-2.7	-2.8

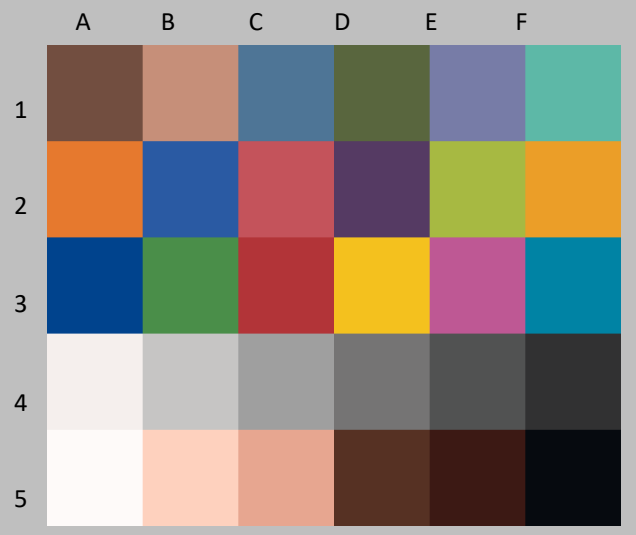
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	99.9	97.1	0.6
Worst 10% (3 lowest scoring patches)	99.3	92.5	1.3

DS Control at 1 year

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



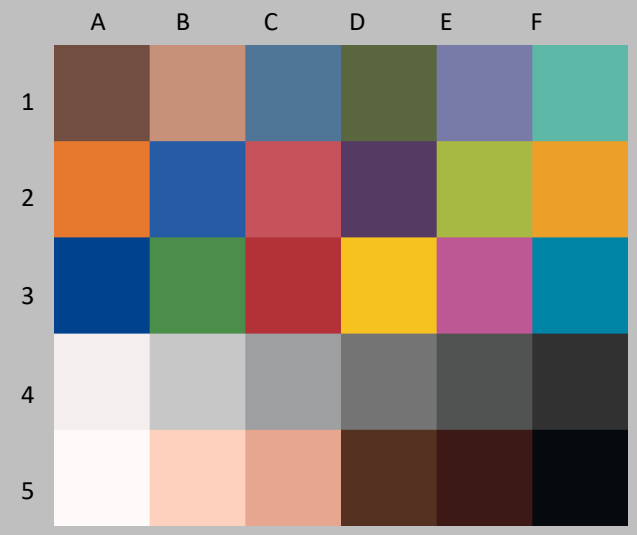
Colors after additional time in dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	100.0	0.1	37.0	36.8	13.0	13.0	13.9	13.9
B1	Light Skin	100.0	0.2	64.5	64.3	17.4	17.3	19.5	19.6
C1	Blue sky	100.0	0.3	48.1	48.0	-4.7	-4.8	-22.1	-21.8
D1	Foliage	100.0	0.1	41.3	41.3	-12.9	-12.9	21.3	21.3
E1	blue flower	100.0	0.3	53.1	53.0	8.6	8.4	-24.4	-24.2
F1	bluish green	100.0	0.3	68.9	68.8	-32.1	-32.1	0.2	0.4
A1	orange	100.0	0.3	62.5	62.2	36.2	36.1	57.2	57.1
B2	purplish blue	100.0	0.2	39.0	38.9	9.4	9.3	-44.5	-44.3
C2	moderate red	100.0	0.2	50.4	50.2	45.6	45.5	18.2	18.1
D2	purple	100.0	0.1	29.1	29.0	20.4	20.3	-20.3	-20.3
E2	yellow green	100.0	0.2	71.8	71.6	-23.1	-23.0	56.0	56.0
F2	orange yellow	100.0	0.2	71.2	71.0	19.5	19.3	67.1	67.1
A3	blue	99.7	0.7	29.2	29.5	12.0	11.6	-46.9	-46.3
B3	green	100.0	0.2	53.5	53.4	-37.3	-37.2	29.8	29.9
C3	red	100.0	0.3	41.7	41.5	50.5	50.4	27.5	27.2
D3	yellow	100.0	0.2	80.7	80.5	3.8	3.8	78.4	78.5
E3	magenta	100.0	0.2	52.3	52.1	47.1	47.0	-13.0	-13.0
F3	cyan	100.0	0.3	50.4	50.4	-21.9	-22.0	-27.4	-27.2
A4	white	100.0	0.3	95.0	94.8	0.5	0.3	1.5	1.7
B4	neutral 8	100.0	0.3	79.9	79.8	-0.6	-0.8	0.4	0.7
C4	neutral 6.5	100.0	0.2	65.5	65.4	-0.9	-1.0	-0.6	-0.4
D4	neutral 5	100.0	0.2	49.2	49.1	-0.4	-0.4	0.0	0.2
E4	neutral 3.5	100.0	0.1	34.9	34.9	-0.7	-0.8	-0.5	-0.4
F4	black	100.0	0.3	20.5	20.6	0.1	0.0	-1.1	-0.8
A5	paper white	100.0	0.2	98.4	98.3	0.2	0.1	0.6	0.6
B5	Skin highlight L*=88	100.0	0.2	87.2	87.0	11.8	11.7	14.9	15.0
C5	Skin highlight L* =75	100.0	0.2	73.8	73.7	20.4	20.3	21.1	21.2
D5	Skin shadow L*=28	100.0	0.2	24.5	24.6	14.5	14.5	16.6	16.4
E5	Skin shadow L*=13	100.0	0.3	13.9	14.1	15.9	15.9	12.2	11.9
F5	Maximum Black	100.0	0.2	3.2	3.3	-0.3	-0.4	-2.7	-2.5

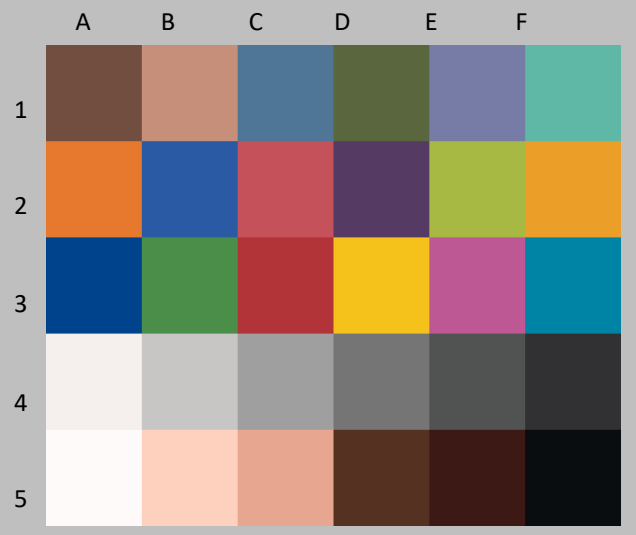
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	100.0	99.2	0.2
Worst 10% (3 lowest scoring patches)	99.9	98.3	0.5

DS Control at 2 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



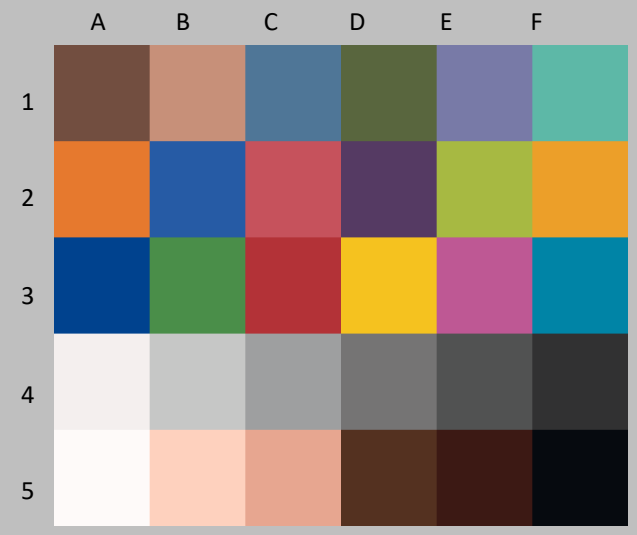
Colors after additional time in dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	100.0	0.2	37.0	36.9	13.0	13.0	13.9	14.1
B1	Light Skin	100.0	0.3	64.5	64.4	17.4	17.3	19.5	19.7
C1	Blue sky	100.0	0.5	48.1	48.1	-4.7	-4.9	-22.1	-21.7
D1	Foliage	100.0	0.2	41.3	41.4	-12.9	-12.9	21.3	21.5
E1	blue flower	100.0	0.5	53.1	53.1	8.6	8.3	-24.4	-24.0
F1	bluish green	100.0	0.4	68.9	68.9	-32.1	-32.2	0.2	0.5
A1	orange	100.0	0.1	62.5	62.3	36.2	36.1	57.2	57.3
B2	purplish blue	100.0	0.3	39.0	38.9	9.4	9.2	-44.5	-44.2
C2	moderate red	100.0	0.2	50.4	50.3	45.6	45.5	18.2	18.3
D2	purple	100.0	0.2	29.1	29.1	20.4	20.2	-20.3	-20.1
E2	yellow green	100.0	0.1	71.8	71.7	-23.1	-23.1	56.0	56.1
F2	orange yellow	100.0	0.2	71.2	71.1	19.5	19.4	67.1	67.3
A3	blue	99.7	0.7	29.2	29.5	12.0	11.6	-46.9	-46.4
B3	green	100.0	0.3	53.5	53.5	-37.3	-37.2	29.8	30.1
C3	red	100.0	0.1	41.7	41.7	50.5	50.4	27.5	27.4
D3	yellow	100.0	0.2	80.7	80.7	3.8	3.8	78.4	78.6
E3	magenta	100.0	0.2	52.3	52.2	47.1	47.0	-13.0	-12.8
F3	cyan	100.0	0.5	50.4	50.5	-21.9	-22.1	-27.4	-27.0
A4	white	100.0	0.5	95.0	94.9	0.5	0.3	1.5	1.9
B4	neutral 8	100.0	0.5	79.9	79.9	-0.6	-0.8	0.4	0.9
C4	neutral 6.5	100.0	0.3	65.5	65.4	-0.9	-1.1	-0.6	-0.3
D4	neutral 5	100.0	0.3	49.2	49.2	-0.4	-0.5	0.0	0.3
E4	neutral 3.5	100.0	0.2	34.9	34.9	-0.7	-0.7	-0.5	-0.4
F4	black	100.0	0.4	20.5	20.7	0.1	0.0	-1.1	-0.8
A5	paper white	100.0	0.3	98.4	98.4	0.2	0.1	0.6	0.8
B5	Skin highlight L*=88	100.0	0.4	87.2	87.1	11.8	11.7	14.9	15.3
C5	Skin highlight L* =75	100.0	0.3	73.8	73.7	20.4	20.3	21.1	21.3
D5	Skin shadow L*=28	100.0	0.1	24.5	24.5	14.5	14.4	16.6	16.7
E5	Skin shadow L*=13	100.0	0.2	13.9	14.1	15.9	15.8	12.2	12.3
F5	Maximum Black	100.0	0.3	3.2	3.4	-0.3	-0.4	-2.7	-2.5

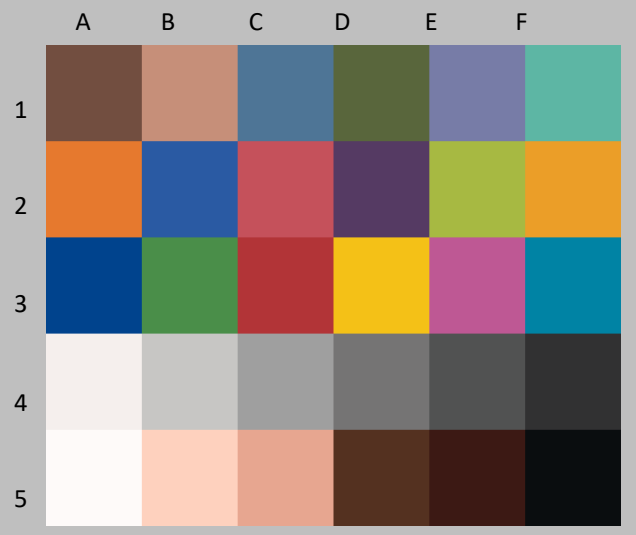
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	100.0	99.3	0.3
Worst 10% (3 lowest scoring patches)	99.9	98.5	0.6

DS Control at 3 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



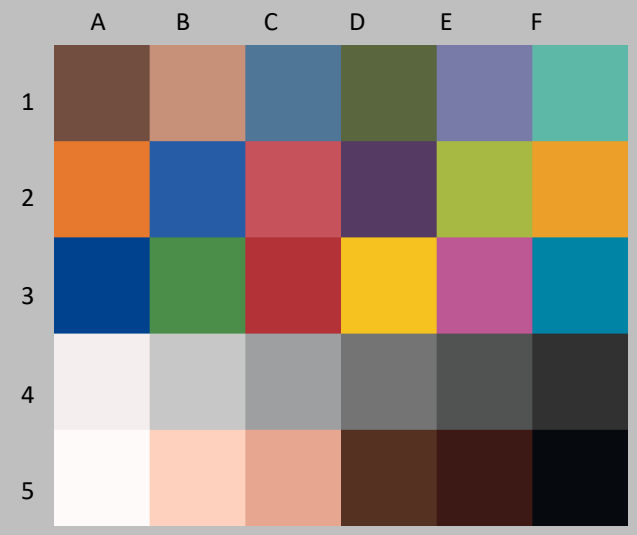
Colors after additional time in dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin	100.0	0.4	37.0	36.8	13.0	13.0	13.9	14.2
B1	Light Skin	100.0	0.4	64.5	64.3	17.4	17.3	19.5	19.7
C1	Blue sky	99.9	0.5	48.1	48.0	-4.7	-4.9	-22.1	-21.7
D1	Foliage	100.0	0.3	41.3	41.2	-12.9	-12.9	21.3	21.5
E1	blue flower	100.0	0.5	53.1	53.0	8.6	8.4	-24.4	-23.9
F1	bluish green	100.0	0.5	68.9	68.8	-32.1	-32.2	0.2	0.6
A1	orange	100.0	0.3	62.5	62.2	36.2	36.1	57.2	57.4
B2	purplish blue	100.0	0.5	39.0	38.9	9.4	9.2	-44.5	-44.1
C2	moderate red	100.0	0.3	50.4	50.3	45.6	45.5	18.2	18.4
D2	purple	100.0	0.4	29.1	29.0	20.4	20.2	-20.3	-19.9
E2	yellow green	100.0	0.2	71.8	71.6	-23.1	-23.0	56.0	56.1
F2	orange yellow	100.0	0.2	71.2	71.0	19.5	19.4	67.1	67.3
A3	blue	99.7	0.6	29.2	29.2	12.0	11.7	-46.9	-46.4
B3	green	100.0	0.4	53.5	53.4	-37.3	-37.3	29.8	30.2
C3	red	100.0	0.3	41.7	41.6	50.5	50.4	27.5	27.7
D3	yellow	100.0	0.3	80.7	80.6	3.8	3.8	78.4	78.7
E3	magenta	100.0	0.4	52.3	52.2	47.1	47.0	-13.0	-12.7
F3	cyan	99.9	0.5	50.4	50.4	-21.9	-22.2	-27.4	-27.0
A4	white	99.1	0.6	95.0	94.8	0.5	0.3	1.5	2.0
B4	neutral 8	99.3	0.6	79.9	79.8	-0.6	-0.8	0.4	1.0
C4	neutral 6.5	100.0	0.4	65.5	65.4	-0.9	-1.0	-0.6	-0.2
D4	neutral 5	100.0	0.4	49.2	49.2	-0.4	-0.5	0.0	0.4
E4	neutral 3.5	100.0	0.3	34.9	34.9	-0.7	-0.7	-0.5	-0.2
F4	black	100.0	0.3	20.5	20.5	0.1	0.0	-1.1	-0.8
A5	paper white	100.0	0.4	98.4	98.2	0.2	0.1	0.6	1.0
B5	Skin highlight L*=88	100.0	0.5	87.2	87.0	11.8	11.7	14.9	15.3
C5	Skin highlight L* =75	100.0	0.3	73.8	73.6	20.4	20.3	21.1	21.4
D5	Skin shadow L*=28	100.0	0.2	24.5	24.4	14.5	14.5	16.6	16.8
E5	Skin shadow L*=13	100.0	0.2	13.9	14.1	15.9	15.7	12.2	12.2
F5	Maximum Black	100.0	0.4	3.2	3.4	-0.3	-0.4	-2.7	-2.4

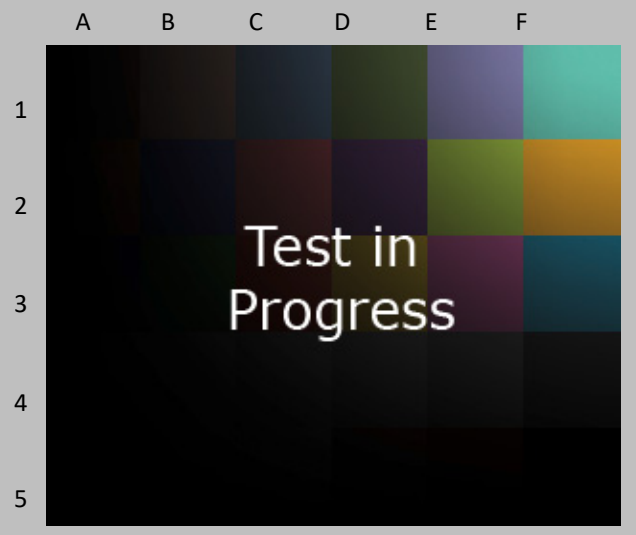
Summary Results	I* Color	I* tone	ΔE
Average Score for all patches	99.9	99.4	0.4
Worst 10% (3 lowest scoring patches)	99.4	99.0	0.6

DS Control at 4 years

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag



Original Print Colors before light exposure



Colors after additional time in dark storage

Patch #	Description	I* Color	ΔE	L* Before	L* After	a* Before	a* After	b* Before	b* After
A1	Dark Skin			37.0		13.0		13.9	
B1	Light Skin			64.5		17.4		19.5	
C1	Blue sky			48.1		-4.7		-22.1	
D1	Foliage			41.3		-12.9		21.3	
E1	blue flower			53.1		8.6		-24.4	
F1	bluish green			68.9		-32.1		0.2	
A1	orange			62.5		36.2		57.2	
B2	purplish blue			39.0		9.4		-44.5	
C2	moderate red			50.4		45.6		18.2	
D2	purple			29.1		20.4		-20.3	
E2	yellow green			71.8		-23.1		56.0	
F2	orange yellow			71.2		19.5		67.1	
A3	blue			29.2		12.0		-46.9	
B3	green			53.5		-37.3		29.8	
C3	red			41.7		50.5		27.5	
D3	yellow			80.7		3.8		78.4	
E3	magenta			52.3		47.1		-13.0	
F3	cyan			50.4		-21.9		-27.4	
A4	white			95.0		0.5		1.5	
B4	neutral 8			79.9		-0.6		0.4	
C4	neutral 6.5			65.5		-0.9		-0.6	
D4	neutral 5			49.2		-0.4		0.0	
E4	neutral 3.5			34.9		-0.7		-0.5	
F4	black			20.5		0.1		-1.1	
A5	paper white			98.4		0.2		0.6	
B5	Skin highlight L*=88			87.2		11.8		14.9	
C5	Skin highlight L* =75			73.8		20.4		21.1	
D5	Skin shadow L*=28			24.5		14.5		16.6	
E5	Skin shadow L*=13			13.9		15.9		12.2	
F5	Maximum Black			3.2		-0.3		-2.7	

Summary Results	I* Color	I* tone	ΔE
Average Score for all patches			
Worst 10% (3 lowest scoring patches)			

DS Control at 5 years

Section V: Comments and Conclusions

ID# 331

Print Quality:

The Prosumer Canon Pixma Pro-1 printer appears to have been discontinued in 2018 which is understandable given that it was the highest price model in the Pixma Pro 1, 10, and 100 model lineup, and its price tag was close to the larger format and more pro-oriented Canon ImageProGraph Pro-1000 model. The larger more economical ink carts in the Pro-1000 tip the cost-value proposition in favor of the Pro-1000. That said, the Pixma Pro-1 was unique in the market place as the only printer model to offer an OEM ink set with four rather than two or three levels of gray (i.e., light gray, gray, dark gray, and MK/PK black). The four levels provide slightly finer dot structure and smoother grayscale tonality/neutrality when making black&white prints. The benefit can be demonstrated even in full color mode printing by comparing this sample's gray scale neutrality plot (see page 5) to ID# 333 which tested the same paper with the Canon Pro-11 three-level gray ink set used in the iPF Pro-1000. Note the extra smoothness in the curve from media white through mid tones and all the way into the deep shadow values achieved by a custom profile on the Pro-1 compared to the Pro-1000 results shown in the ID #333 report using a similarly made custom profile. To be clear, both printers produce excellent results, but the Pro-1 gray scale neutrality results were nevertheless slightly better. Black and white printing even in full color mode on the Pro-1 can achieve a technical degree of excellence that rivals true B&W print processes. Canon claims only that the chroma optimizer helps to enhance color saturation, but use of the chroma optimizer in full coverage mode resulted in a finished print with no detectable bronzing or differential gloss. Red River Palo Duro Soft Gloss is a good choice for those looking for a luster surface non RC "traditional fiber" paper exhibiting stable and best-in-class neutral whitepoint color without any added optical brighteners.

Print Longevity:

Red River Palo Duro Soft Gloss Rag contains no optical brighteners nor does it use TiO2 as a whitening pigment. Hence, no further fading or yellowing is occurring in the dark storage and combined lightfade/dark storage tests (see sections III and IV). However, the 47-66 Megalux hour Conservation Display rating is lower than can be achieved with the Canon OEM PGI-29 ink set on various other fine art matte media (e.g., Moab Entrada Natural 300gsm). Glossy and luster inkjet coatings typically incorporate nanoporous alumina and silica particles which are small enough not to scatter light thus allowing higher gloss levels. The pH of the coatings tend to by higher (more alkaline), and coatings with nanoporous particles are more brittle and prone to microcracking. Glossy coatings also tend to keep the ink pigments closer to the surface of the coating during drydown. These factors in turn leave the pigment particles somewhat more prone to photo oxidation. All that said, because the measured color values remain stable in dark storage after light exposure, Red River Palo Duro Soft Gloss is a better choice for archival printmaking than choosing resin coated (RC) media which commonly suffer from noticeable media yellowing issues in less than 20 Megalux hours of light exposure.

Mark H. McCormick-Goodhart

Printer: Canon Pixma Pro-1 **Ink:** Canon Lucia (PGI-29) **Media:** Red River Palo Duro Soft Gloss Rag

Table to Convert Megalux-hours of Light Exposure to estimated "Years on Display" Light Fastness Ratings.

Indoor Light Levels for Print Display		Multiply Mlux-hrs by	Megalux-hours in test									
Light Exposure	**Description**		**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
≤ 10 Lux 24 hours per day	Interior rooms, storage areas, or hallways without windows, illuminated sparingly by artificial lighting	**11.42**	**114**	**228**	**342**	**457**	**571**	**685**	**799**	**913**	**1027**	**1142**
50 Lux 12 hours per day	"Museum Standard" display condition	**4.57**	**46**	**91**	**137**	**183**	**228**	**274**	**325**	**365**	**411**	**457**
120 Lux 12 hours per day "Kodak Display Years" (1)	Average home illumination level for photos is ~ 60 lux. 90% of all displayed photos do not exceed 120 lux (1).	**1.90**	**19**	**38**	**57**	**76**	**95**	**114**	**133**	**152**	**171**	**190**
228 Lux 12 hours per day	Relatively bright home or office. Note the simple 1:1 relationship between "years on display" and Mlux-hr values at this condition.	**1.00**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
450 Lux 12 hours per day "WIR Display Years" (2) Also equals 500 lux for 11.8 hours per day	A bright home or commercial office building illumination level is 200-500 lux. Also, good illumination for color critical viewing and color matching tasks begins at about 500 lux.	**0.51**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**41**	**46**	**51**
2000 Lux 12 hours per day	Commercial Gallery. Also, critical color evaluation standards call for 2000 lux and a D50 illumination source.	**0.114**	**1.1**	**2.3**	**3.4**	**4.6**	**5.7**	**6.8**	**8.0**	**9.1**	**10.3**	**11.4**
5000 Lux 12 hours per day	E.g., Sunlight through a window striking print at an angle.	**0.046**	**0.5**	**0.9**	**1.4**	**1.8**	**2.3**	**2.7**	**3.2**	**3.7**	**4.1**	**4.6**
10,000 Lux 12 hours per day	South-facing window in U.S.A. , e.g., storefront display with photos directly facing window.	**0.023**	**0.2**	**0.5**	**0.7**	**0.9**	**1.1**	**1.4**	**1.6**	**1.8**	**2.1**	**2.3**

Light levels commonly encountered in the real world fluctuate widely throughout indoor print display environments and produce large variations in how long it takes for artwork to acquire light-induced damage. Use this table as a guide to estimate how many "years on display" (denoted in red text) it takes to accumulate an equivalent light exposure dosage. Review the test results to decide which Megalux-hour dose has caused fading to your level of concern (e.g., just noticeable, easily noticeable, objectionable, etc.). Then choose the "Light Exposure" description that best represents how your print is likely to be displayed. You may want to obtain a lux meter and make some measurements in your own display environment!

Note that as the years of display time increase, light-induced fading can be eclipsed by other serious aging mechanisms such as fading and/or staining caused by heat, humidity, and air pollutants. Mould damage can also occur at high humidity. Even when colorants remain water fast, direct contact with liquids may result in physical deformation and staining of the substrate. Also, temperature and especially strong seasonal humidity fluctuations can cause physical cracks and/or flaking, etc., over time. Handling damage such as scratching, abrasion, tears and creases, and catastrophic damage by smoke, fire, flood, etc., also destroy print quality over time. Thus, as illumination levels are reduced other forms of print degradation take on greater probability of occurrence.

(1) Eastman Kodak cited this exposure condition with a 90% confidence limit as a rationale for estimating print fading times of traditional color photo materials in typical home display environments. However, for light fading claims regarding its line of pigment-based inkjet printers, Kodak adopted the higher level of 450lux/12 hours per day which is also used by Wilhelm Imaging Research, Inc. (See below).

(2) Wilhelm Imaging Research (WIR) standardized its light fastness ratings on 450 lux for 12 hours per day in order to estimate the years on display necessary to reach "easily noticeable" fading. This average daily light exposure dosage, at an assumed 75˚F/60%RH temperature and humidity level, has become a de facto industry standard for most industry-sponsored predictive "years of life" light fading estimates in the absence of a published International Standards Organization (ISO) test standard. The table above readily shows how much error occurs in such "print lifetime" predictions as actual real world light levels for prints on display routinely deviate above and below the assumed 450 lux intensity value.

Aardenburg Imaging & Archives

About this Report

This report contains light fastness information about a sample test print produced by a specific digital printing system. "System" refers to all hardware, software, and materials used to make the finished print. The hardware, software, material components, and printmaker's skills contribute to the final image quality and image permanence. The tested sample is made with current or recently discontinued stocks of commercially available products unless otherwise stated. Each sample has been prepared by Aardenburg Imaging & Archives or one of its members in accordance with customary print making practices unless otherwise noted. The sample may also contain additional finishing materials such as overcoats and laminates which are also noted when used. Finally, the sample has been tested under standardized conditions that are defined on the Sample Description page (see page 4). AaI&A makes every effort to ensure but cannot guarantee that the samples are properly identified and documented and that test results are accurate. For this reason, AaI&A also strives to test independently produced sample replicates in order to increase sampling confidence and to provide information on process variability. Please compare the results in this report to replicate test samples when the data become available.



The magnitude and visual appearance of fading depends not only on the chosen printing system but the chosen image as well. In other words, different images are comprised of different colors, and the fading relationships between those colors dictate how the image will look as it fades. The sample print in this test report was made by reproducing the digital image shown on the left. It contains 30 standard colors. 24 of the colors are colorimetrically matched to the Macbeth ColorChecker™ chart viewed under D50 illumination. The remaining six colors supplement the ColorChecker™ array with four additional skin tone colors, one patch for paper white, and another for maximum black. The additional colors

Information about the fading characteristics of the product is provided in three ways:

1) You can visually assess the fading. The target images reproduced in this report are digitally reconstructed from the spectrally measured color data rather than scanning or otherwise reproducing the physical print by conventional techniques. This method ensures a colorimetrically accurate representation of the print appearance as the print fades. A calibrated monitor is recommended to experience the best possible reproduction of the test sample appearance. The side-by-side "before and after" presentation of the target images simulates looking at a perfect copy of the unexposed original print along side the same print after light exposure. You can also use Adobe Reader's full screen mode to cycle through the pages and "animate" the fading.

2) I* Color and tonal accuracy scores are reported. This report includes I* metric scores that compare the color and tonal relationships of the light exposed samples to the color and tonal relationships existing in the original print prior to light exposure. Perfect I* scores of 100% can be approached when no significant fading occurs. Average scores above 90% generally indicate excellent retention of original quality, 80% good, 70% fair, etc., but your conclusions may vary depending on your image quality requirements. I* color rates the retained color accuracy (hue and chroma) while I* tone rates the retained tonal accuracy (lightness and contrast). The score is on a percentile scale where 100% is a perfect match between the comparison image (e.g., "after" light exposure) and the reference image (e.g., "before" any light exposure). 0% I* color means no color accuracy is left. 0% I* tone means essentially no tonality remains and all image information content is lost. Negative I* values have significance as well and contribute to the average I* score when they occur. Negative I* color values mean false color has occurred, for example, when a skin tone turns green or a neutral gray becomes distinctly colorful. Negative I* tone scores mean visual contrast between colors has become inverted (i.e., like the tonal relationships in a photographic film negative). Serious image quality problems must arise before false colors and/or tones appear. For more information on the I* metric, please refer to the AaI&A web site.

3) Color changes are also reported using the classic color difference model, ΔE. Note that ΔE values lose perceptual scaling significance when they become large (e.g., > 15). Also, the ΔE equation does not unambiguously measure changes in image contrast. This limitation is generally not a problem for paints and textiles, but can be a serious oversight when evaluating photographic images. Properly tracking changes in image contrast was a major reason behind the development of the I* metric.

Table I: The Conservation Display Rating Criteria Set	
Upper Exposure limit (calculated from the average score for all sampled colors)	Overall average I* Color score ≥ 90% and overall average I* tone score ≥ 90%
Lower Exposure limit (calculated from the average score for the worst 10% of the sampled colors)	I* Color score for worst ten percent of sampled colors ≥ 80% and I* tone score for worst ten percent of sampled colors ≥ 80%
Physical Properties Requirement	No cracking, crazing, flaking, delamination, or physical deformation of image receiver layer observed during the ***conservation display rated*** exposure range.
"Worst ten percent" refers to those 10% of the color samples from within the sampled image population that exhibit the greatest amount of change.	

The I* metric was conceived as a colorimetric algorithm to measure and track changes in image color and tonal accuracy with respect to an original reference image.[1,2] It scores the retained color and tonal accuracy on a percentile scale from a state of perfect matching (i.e., 100%) to a state of no color and tonal accuracy (i.e., 0%). It also scores any state where false rendering of the reference image tone and color quality has occurred (i.e., negative I* values for color and tone which signify falsely substituted colors and/or tonal reversals). The I* metric is an excellent foundation upon which to build criteria for acceptable change in color and tonal accuracy.

For more information on the Aardenburg Conservation Display ratings, please see the article entitled: : "An Overview of the Aardenburg Imaging Conservation Display Ratings".

Other relevant articles are:

1) Mark McCormick-Goodhart, Henry Wilhelm, and Dmitriy Shklyarov,"A 'Retained Image Appearance' Metric For Full Tonal Scale, Colorimetric Evaluation of Photographic Image Stability," IS&T's NIP20: International Conference on Digital Printing Technologies, Final Program and Proceedings, IS&T, Springfield, VA, October 3–November 5, 2004, pp. 680–688.

2) Mark H. McCormick-Goodhart, "An Introduction to the I* Metric," Aardenburg Imaging & Archives, February 7, 2007

These papers and more are available in PDF format on the documents page of the Aardenburg website:

https://www.aardenburg-imaging.com/documents/