PRELIMINARY ASSESSMENT OF THE APPLICATION OF THE CANADIAN FOREST FIRE DANGER RATING SYSTEM (CFFDRS) TO ALASKAN ECOSYSTEMS

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The CFFDRS in Alaska

- The ***Alaska Interagency Fire Community*** adopted the CFFDRS in July 1992, as it was believed that the CFFDRS was more applicable to Alaskan ecosystems
- Since its adoption, there has been little ground-truthing of the CFFDRS
- Inconsistent use of the system within and among fire management agencies

Literature Review Request

The ***Alaska Interagency Fire Community*** developed a list of topics regarding the use of the CFFDRS in Alaska for which they wished to evaluate the *'state of knowledge'*:

1) Overwintering stations: pros and cons
2) Fuel moisture measurements and comparisons
3) Adjustment of mid-season indices based on fuel measurements
4) Whether data trends or raw values are more important for fire behavior prediction
5) Impacts of using solar noon vs. non-solar noon observations
6) Effects of errors in precipitation reporting
7) Analysis of any Alaskan data
8) Justification for thresholds in fire danger rating charts

The Assessment

- Although >60 documents were reviewed, the summary only provides a **preliminary assessment** of the most relevant resources available that address the list of topics
- The evaluation of the *'state of knowledge'* is intended to assist the ***Alaska Interagency Fire Community*** with:
  - Identifying *knowledge gaps*
  - Developing strategies to assist wildfire managers with the use and adaptation of the CFFDRS in Alaska

Knowledge Gaps

1) Overwintering procedures do not contain all of the processes that impact initial spring moisture contents in boreal forest feathermoss sites in permafrost
   - The use of overwintering procedures should be evaluated each year, as the default DC value of 15 does not necessarily work well in Alaska

2) The scale of the DMC and DC fuel moisture codes needs to be defined for Alaska fuels
   - An Alaska specific calibration equation needs to be developed that includes data from several locations across multiple fire seasons

3) The fire climatology in relation to the FWI System fuel moisture codes and fire behavior indexes has not been clearly defined for Alaska
   - This information is needed to develop fire danger rating thresholds

Strategies to Address *Knowledge Gaps*

1) Increasing **communication** between wildfire management agencies, especially in regards to procedures regarding the spring start up values of the DC
2) Compiling datasets collected over several years from across Alaska to develop an **Alaska specific calibration equation** relating sampled fuel moisture contents to the FFMC, DMC and DC
3) Developing innovative, cost-effective **methods to estimate fuel moisture on a larger scale** (e.g., relating SAR data to the FWI System fuel moisture codes)
4) **Initiating research partnerships** both within and between the ***Alaska Interagency Fire Community*** and potential collaborators at research institutes (e.g., University of Alaska)
5) Developing a **research plan** that prioritizes the information needs of the ***Alaska Interagency Fire Community*** in regards to its application of the CFFDRS to Alaska
6) **Comparing the fit of the CFFDRS and the NFDRS** to Alaskan forests. The ***Alaska Interagency Fire Community*** currently implements aspects of both the CFFDRS and the NFDRS

Where to Find the CFFDRS Assessment?

- http://www.frames.gov/partner-sites/afsc/partner-groups/fire-behavior-modeling-group/modeling-products-guides/

Acknowledgements

- Special thanks to the following for assistance:
  - Tom St. Clair
  - Robert Ziel
  - Sharon Alden
  - Brenda Wilmore
  - Jennifer Northway
  - Randi Jandt
  - Jennifer Barnes
  - Eric Miller
  - Frank Cole
  - Devon Barnes (University of Alberta)
  - Marty Alexander (retired Canadian Forestry Service)
  - Cordy Tymstra (Alberta Environment & Sustainable Resource Development)

Comparisons of the Overwintered Drought Code

- Questions
  - What difference does overwintering make in the CFFDRS indices?
  - Are these differences relevant for fire management and fire suppression decisions?
  - What are the breakpoints where the differences would make a difference?

PREDICTIVE SERVICES

Comparisons of the Overwintered Drought Code

- What we found.
  - Differences lessen through the season particularly when there is ample rainfall.
  - The differences in the BUI between overwintering and default are greatest with a high DMC, high overwintered DC and low defaulted DC.
  - The differences in the FWI become irrelevant as the differences between the DC's decrease and as the defaulted DC climbs above 200.

PREDICTIVE SERVICES

Overwintering

- Ending fall DC
- Over winter precipitation
  - Must be estimated from snowpack in most cases.
- User selected factors to adjust for local condition such as “chinook prone” or “poorly drained.”
- These are applied in a calculation to come up with a spring starting DC that may be higher than the default of 15.
- If the calculation comes out lower, 15 is used.

PREDICTIVE SERVICES

	Carryover Fraction	Precip Fraction	Fall DC	Winter Precip (mm)	Fall Moisture (%)	Spring Moisture (%)	Spring DC	Remarks
PABI	1	0.9	568	84	193	491	195	Estimated from snow course data
OKL	1	0.9	491	95	234	571	135	Estimated from snow course data
BTA	0.75	0.9	565	120	195	572	134	Estimated from snow course data
BTA	0.75	0.5	565	120	195	383	295	Estimated from snow course data
DON	0.75	0.75	540	120	207	510	180	Estimated from snow course data
JCK	0.75	0.75	528	120	214	515	176	Estimated from snow course data

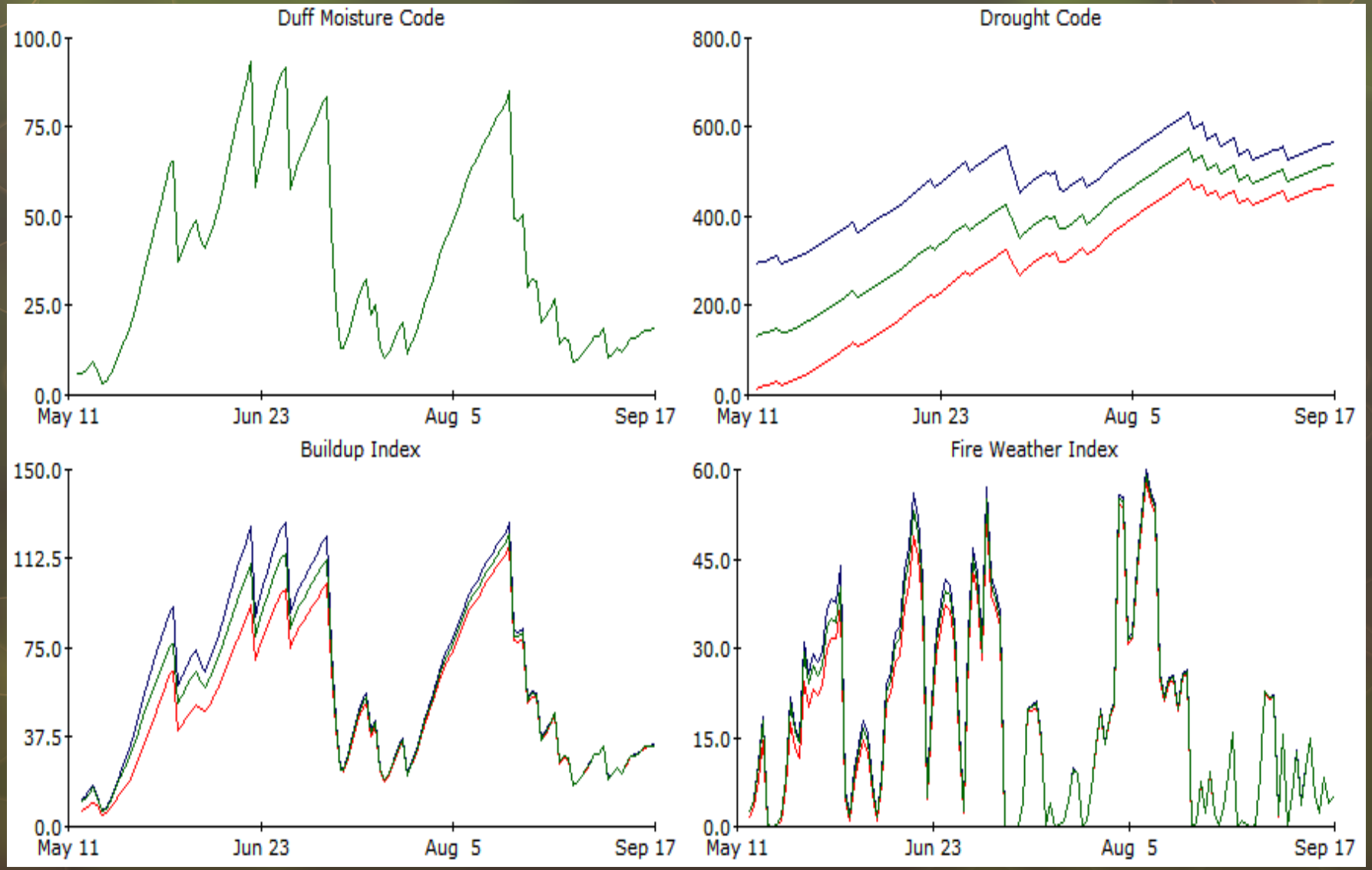
PREDICTIVE SERVICES

BTA Overwintering Discussion 2013

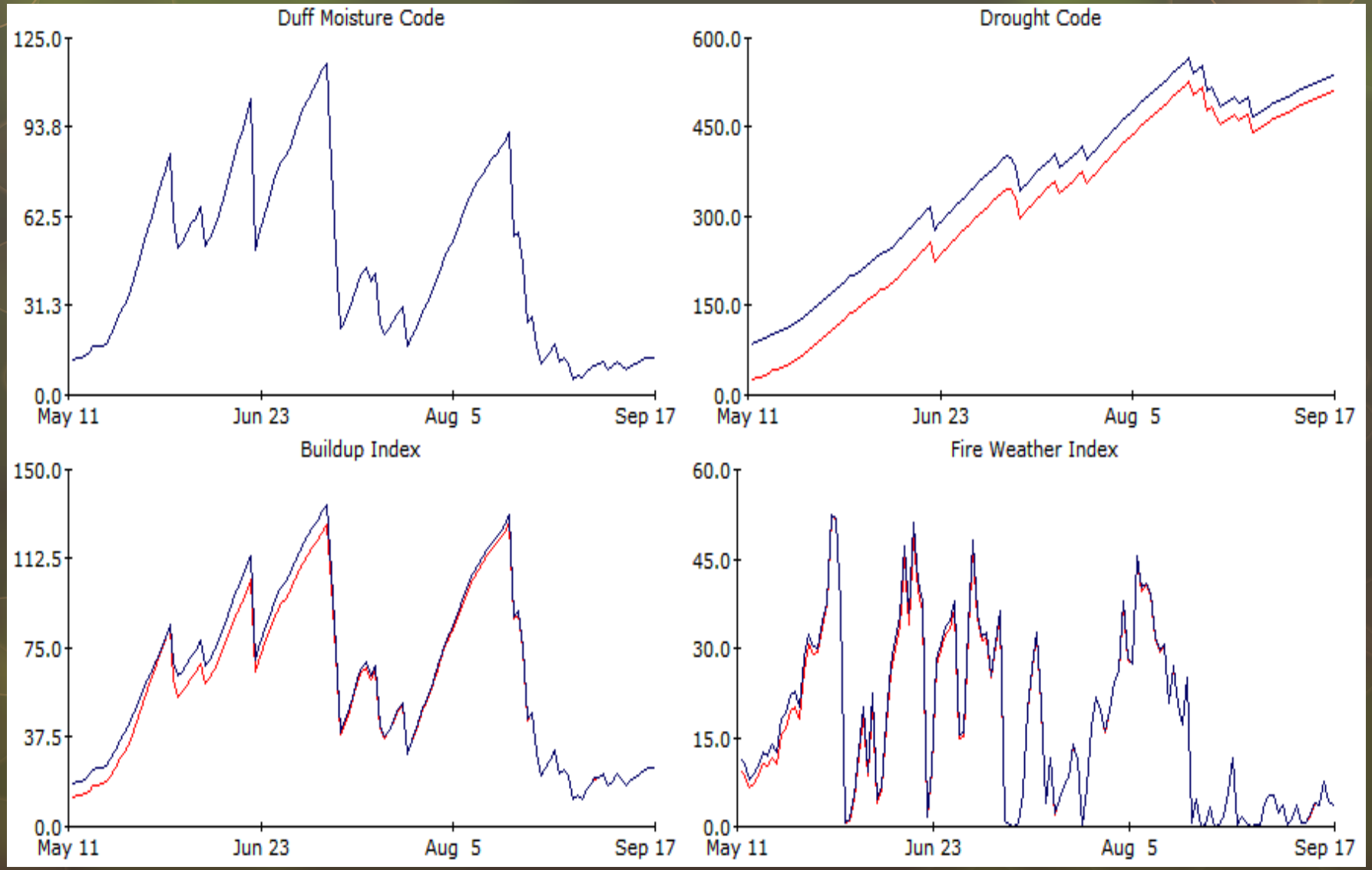
- BTA chosen due to high overwintered DC of 134 or 295
  - Depending on Precipitation effectiveness factor of 0.9 or 0.5
- Although the DC differences are significant through most of the season, the BUI and FWI differ less.
- Greater BUI differences when the DMC is greatest and early in the season.
- Lesser differences later in the season when the DC's are higher and closer.

PREDICTIVE SERVICES

BTA 2013 DC-15, DC-134, DC-295



OKL 2013 DC-15, DC-77



What are the Differences in Fire Behavior Calculations?

- Fire Behavior Tables for rates of spread use BUI ranges of 20.
- This means that the intensity rating would usually only differ by one class, if at all. The greatest differences would be with a high ISI.
- Are these differences relevant and are they seen in the observed fire behavior?

PREDICTIVE SERVICES

What are the Differences in Fire Behavior Calculations?

- Fire Behavior Tables for rates of spread use BUI ranges of 20.
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2.5.5 C-2, Boreal Spruce

Open, Rate of Spread in ch/hr

Multiply by 1.1 to get feet/min

Divide by 80 to get miles/hour

Divide by 3 to get meters/min

Torching, **Active Crown Fire**

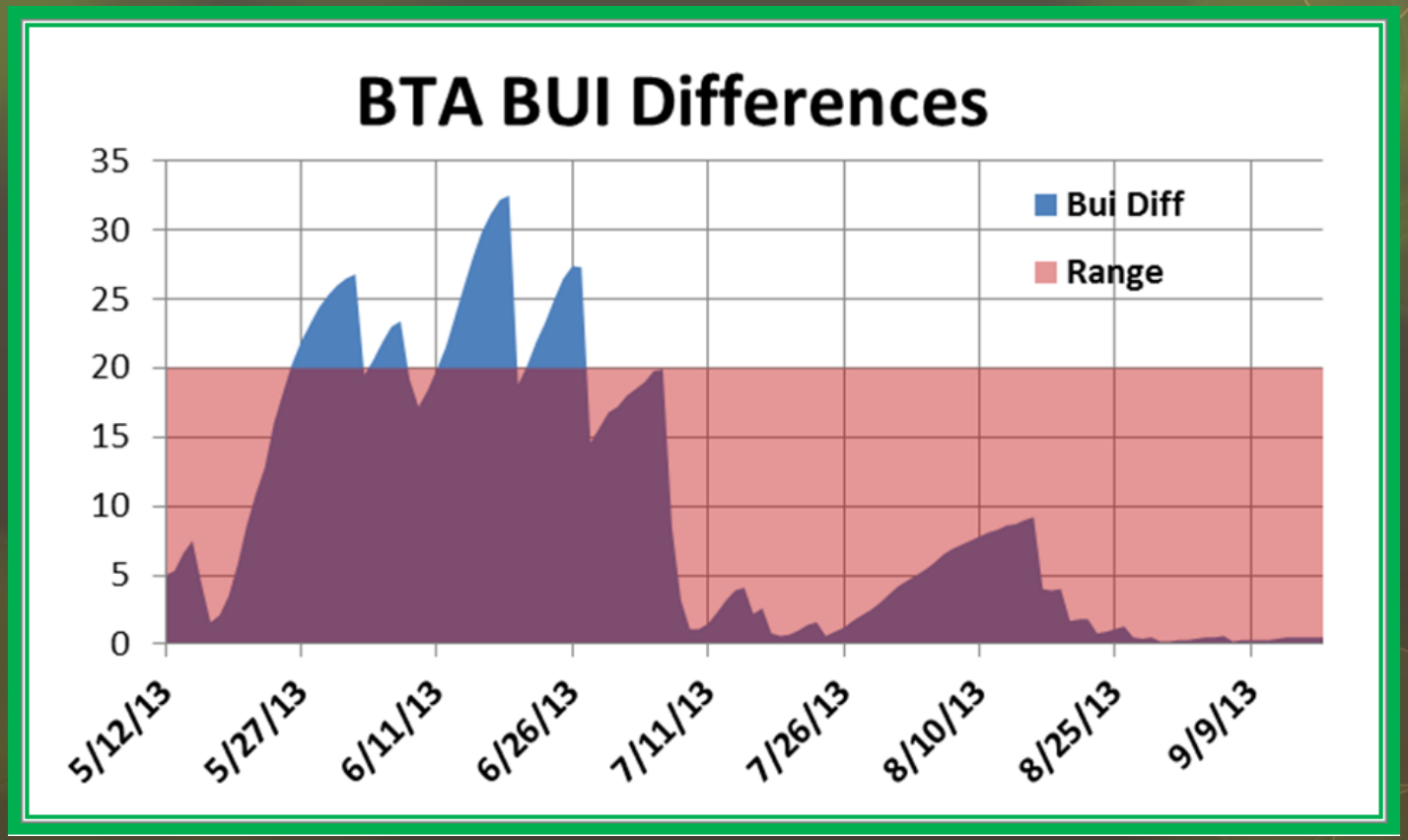
Intensity Class		Flame Length	FLI kW/m	FLI BTU/ft/sec
1	up to	1	10	3
2	up to	4	500	145
3	up to	8	2000	578
4	up to	12	4000	1156
5	up to	18	10000	2891
6	> than	18	10000	2891

Buildup Index (BUI)

ISI	10	30	50	70	90	110	130	150	170	190
1	0.3	1	1	2	2	2	2	2	2	2
2	0.9	3	4	4	5	5	5	5	5	5
3	2	6	7	8	8	9	9	9	9	9
4	3	8	11	12	12	13	13	13	14	14
5	4	11	15	16	17	18	18	18	19	19
6	5	15	19	21	22	23	23	24	24	24
7	6	18	23	26	27	28	29	29	30	30
8	7	22	28	31	32	34	34	35	35	36
9	8	25	32	36	38	39	40	41	41	42
10	9	29	37	41	43	45	46	47	48	48
11	10	33	42	46	49	51	52	53	54	54
12	11	37	47	52	55	57	58	59	60	61
13	12	41	52	57	61	63	64	66	66	67
14	14	45	57	63	66	69	70	72	73	74
15	15	49	62	68	72	75	77	78	79	80
16	16	52	66	74	78	81	83	84	85	86
17	17	56	71	79	84	87	89	91	92	93
18	18	60	76	84	89	93	95	97	98	99
19	20	64	81	90	95	99	101	103	104	105
20	21	68	86	95	101	104	107	109	111	112
21	22	72	91	100	106	110	113	115	117	118
22	23	75	95	106	112	116	119	121	123	124
23	24	79	100	111	117	122	125	127	129	130
24	25	83	105	116	123	127	130	133	135	136
25	26	86	109	121	128	133	136	139	141	142
26	27	90	114	126	133	138	142	144	146	148
27	28	93	118	131	138	143	147	150	152	154

PREDICTIVE SERVICES

Differences Between Overwintered and Default BUI

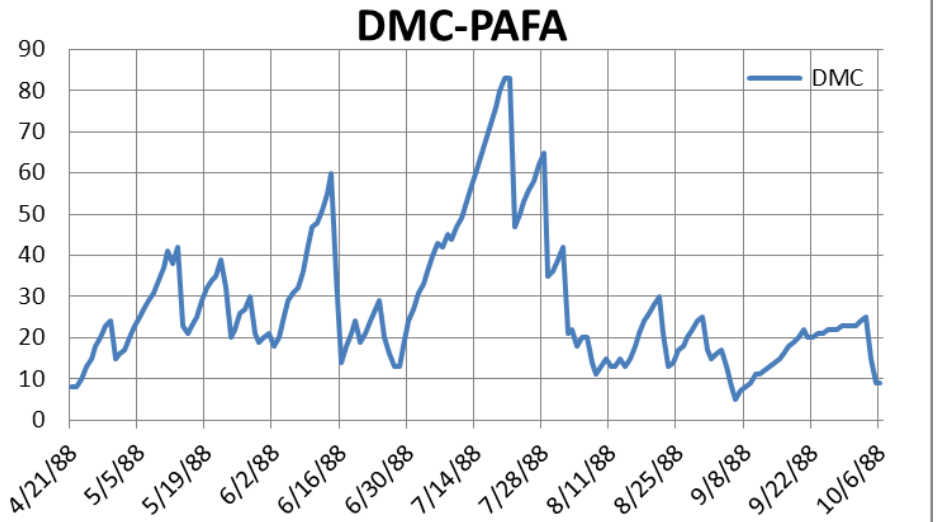


PREDICTIVE SERVICES

PAFA 1988

- PAFA (Fairbanks Intl Airport) 1988 was chosen because it was the extreme example of a high starting overwintered DC of 460.
- BUI and FWI differences are greatest early in the season when the default DC is low and the DMC is high.
- This was a busy year with 2.1 million acres burned and an extended dry period from the end of June through most of July and heavier rainfall at the end of July with the DMC dropping to season ending values.

PREDICTIVE SERVICES


DMC-PAFA
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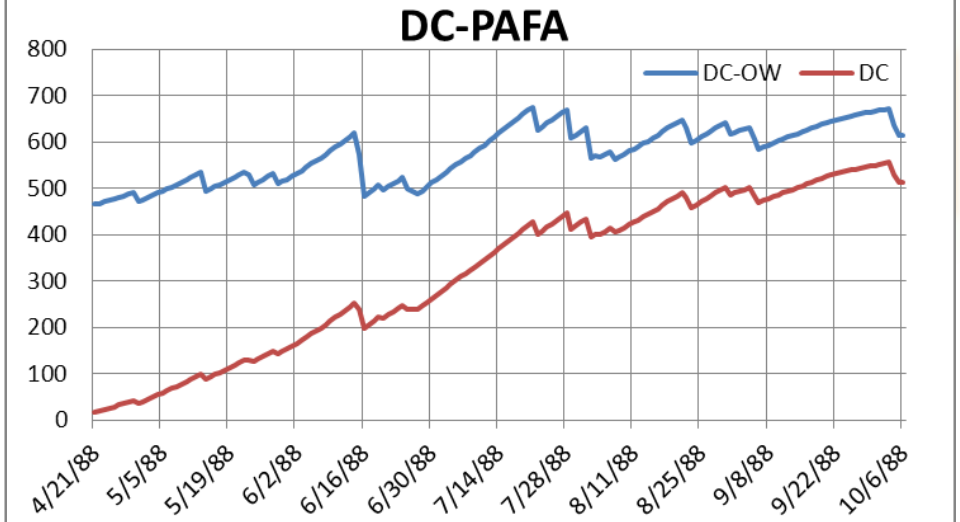
DC-PAFA
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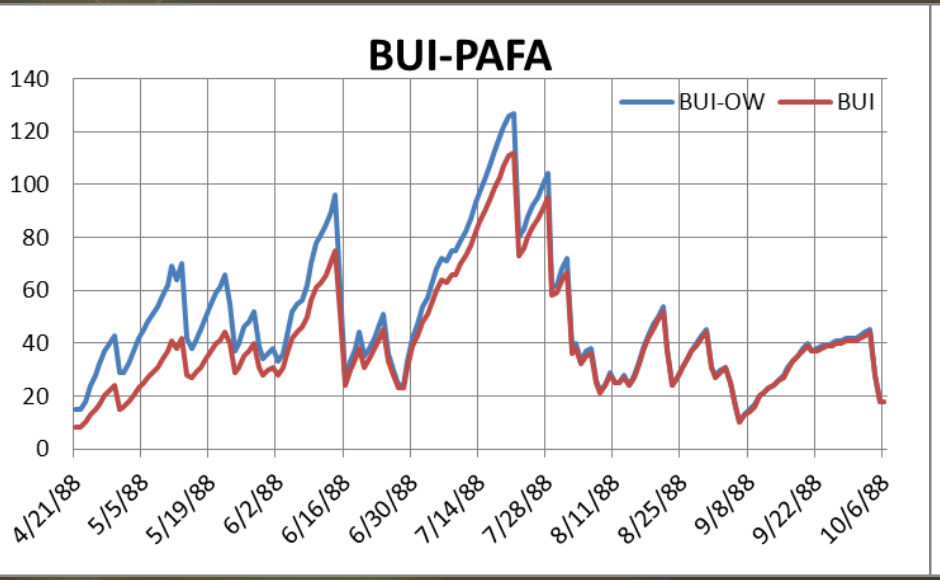
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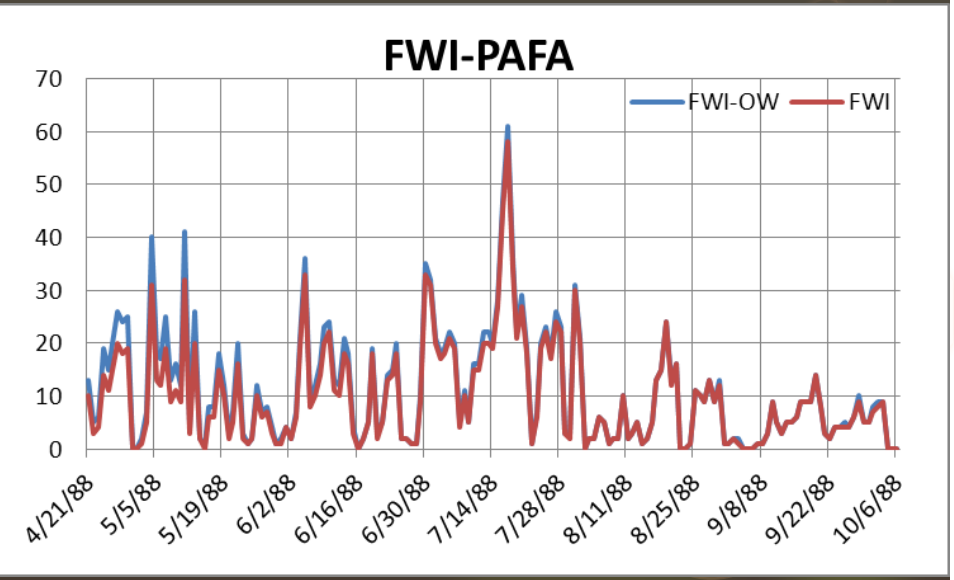
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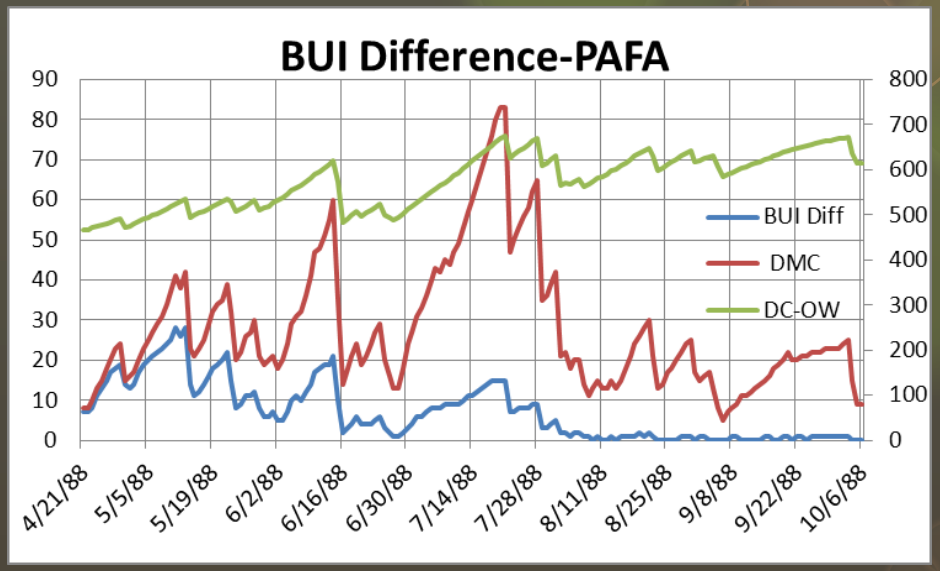
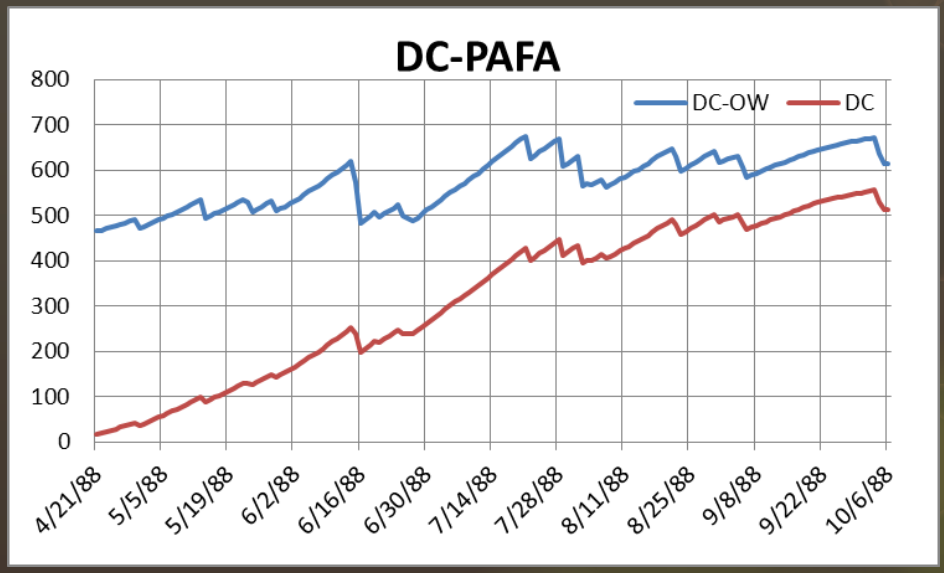
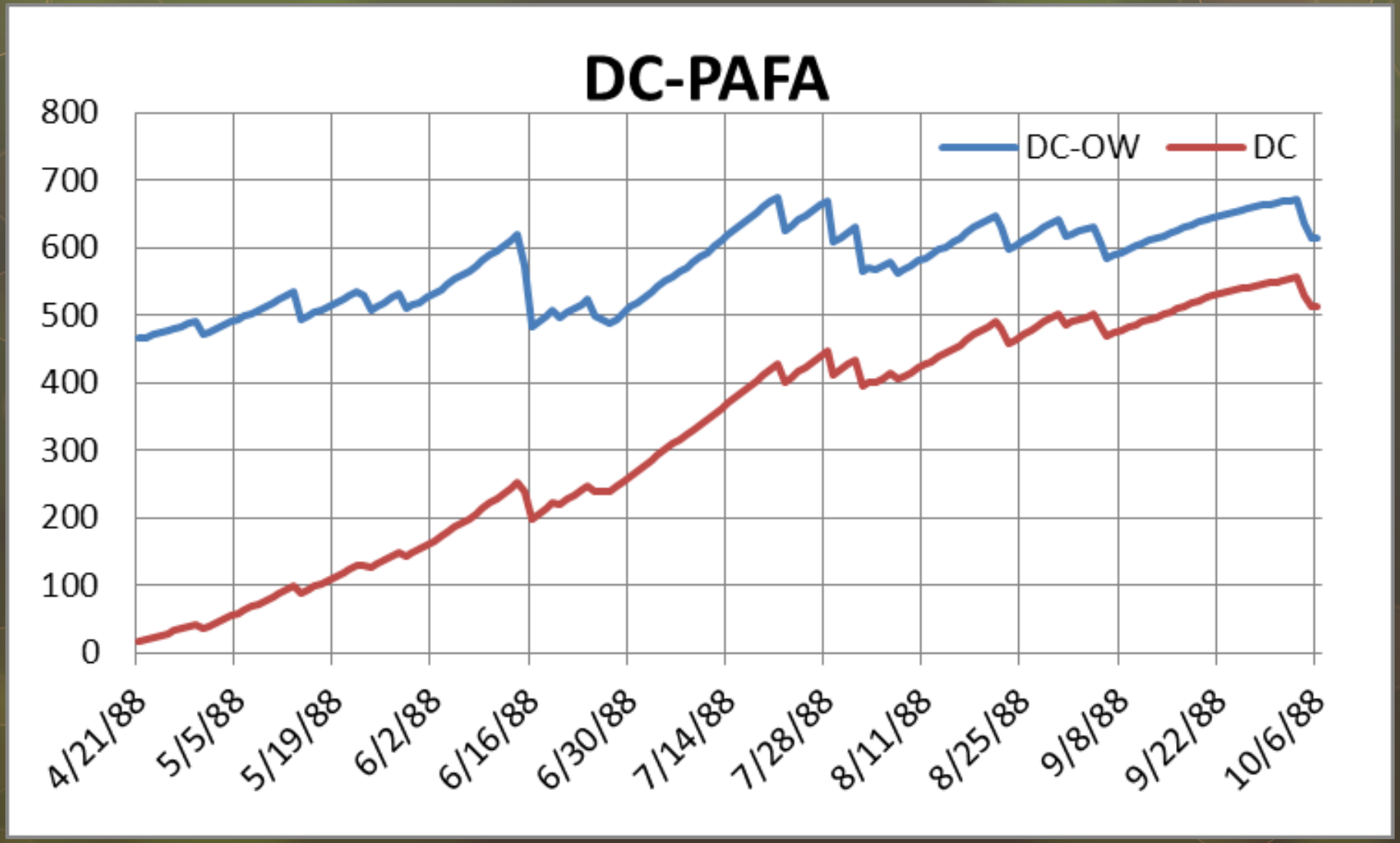
- When would the differences have made a difference?
- What decisions are being made or informed by these indices?
- Largest differences are earlier in the season and after an extended dry period-high DMC.



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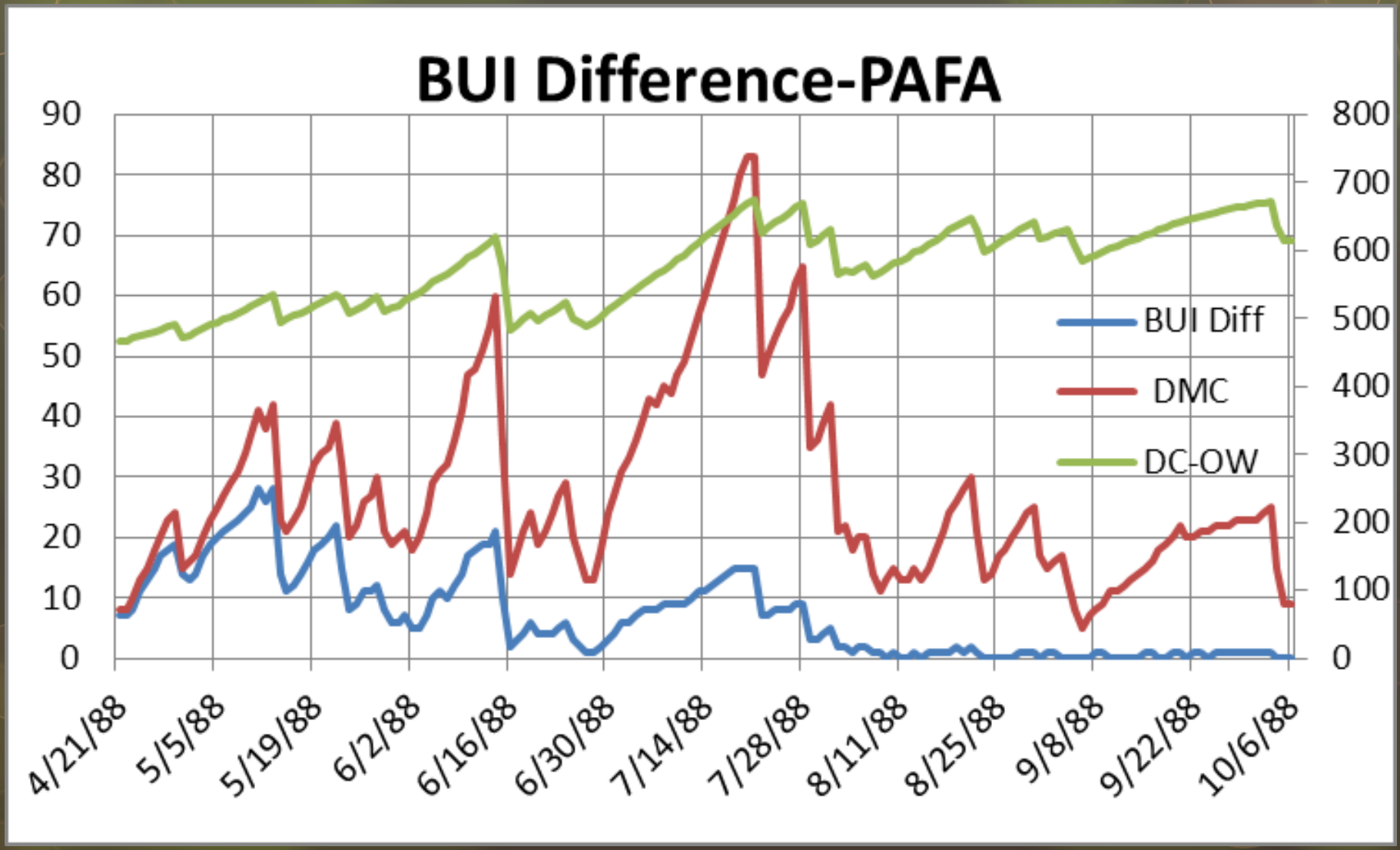
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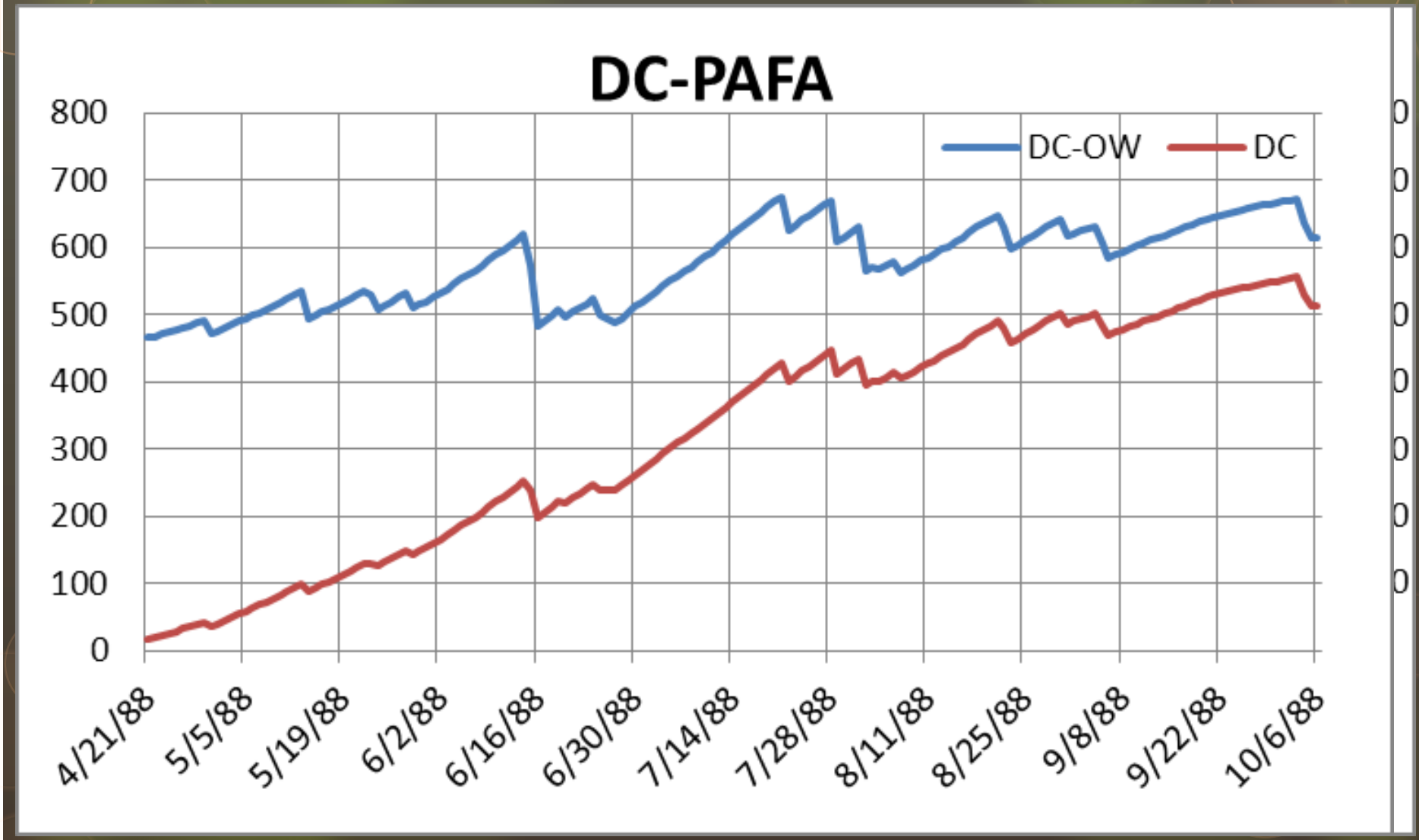
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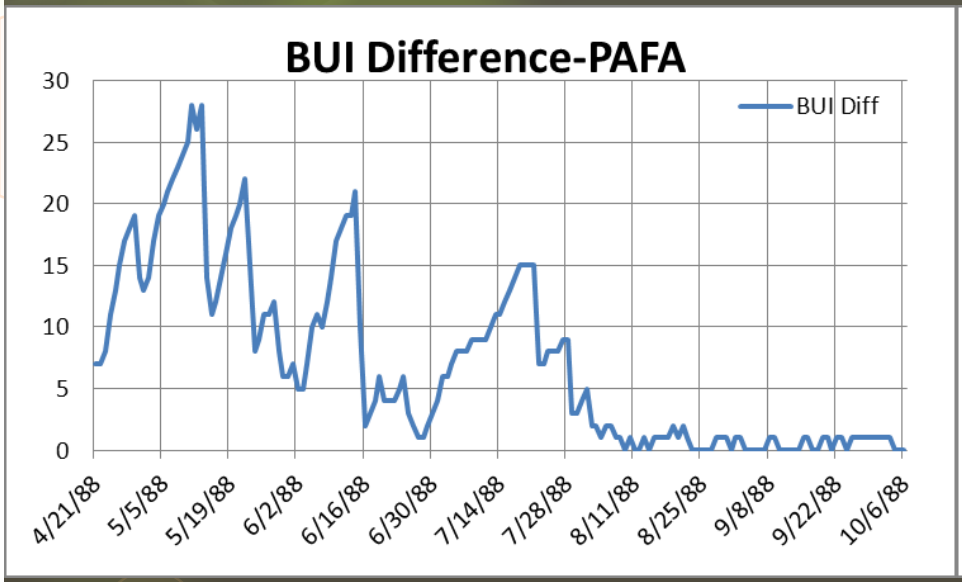
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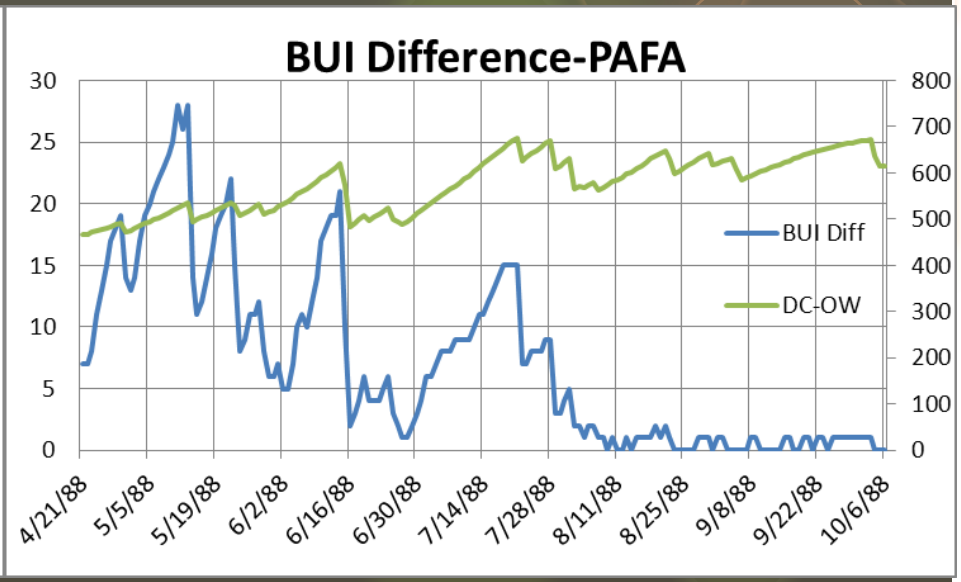
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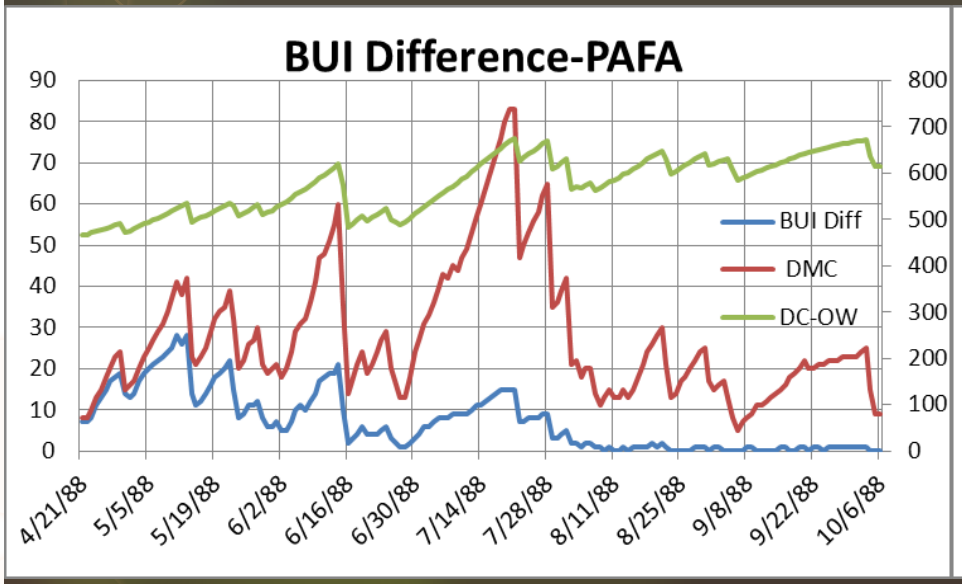
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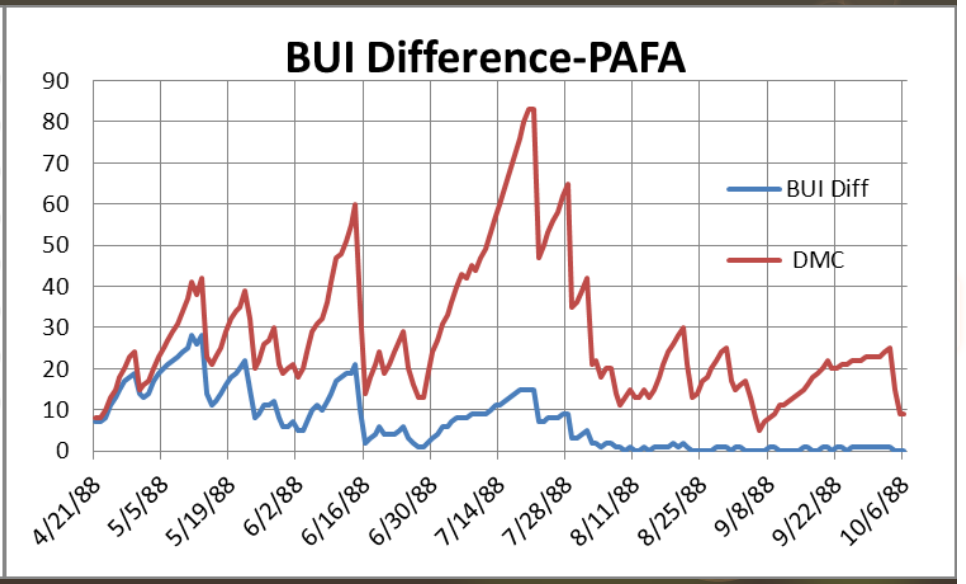
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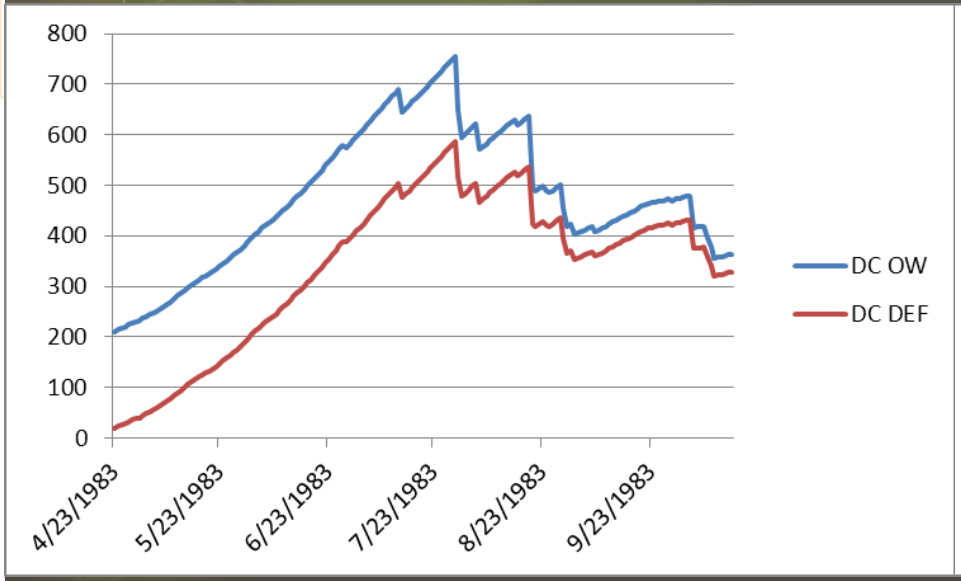
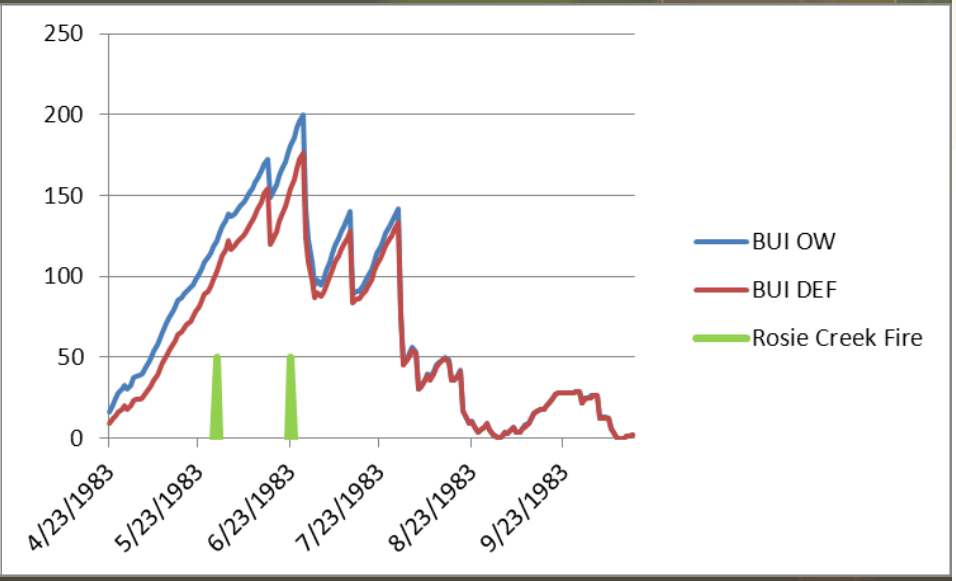
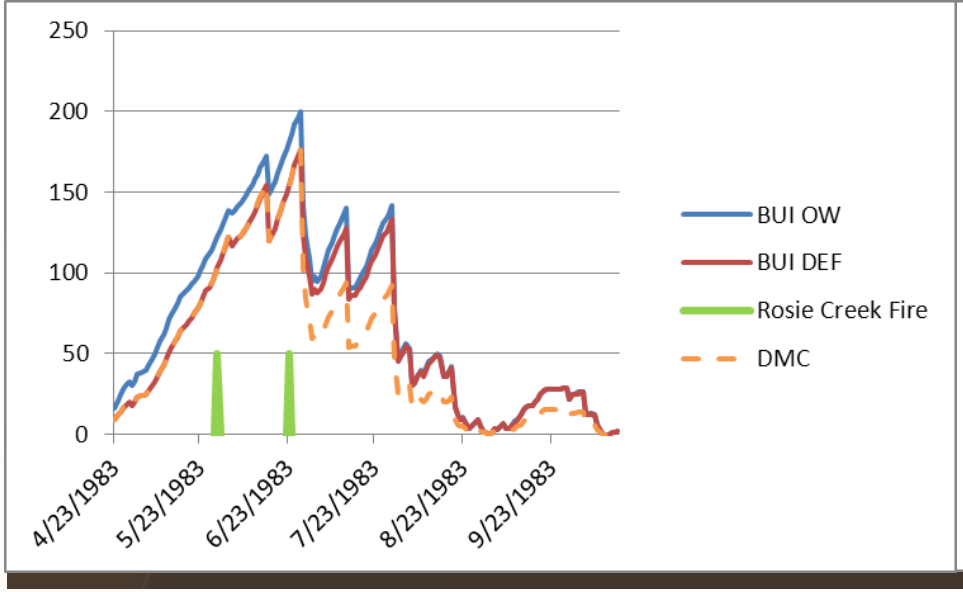
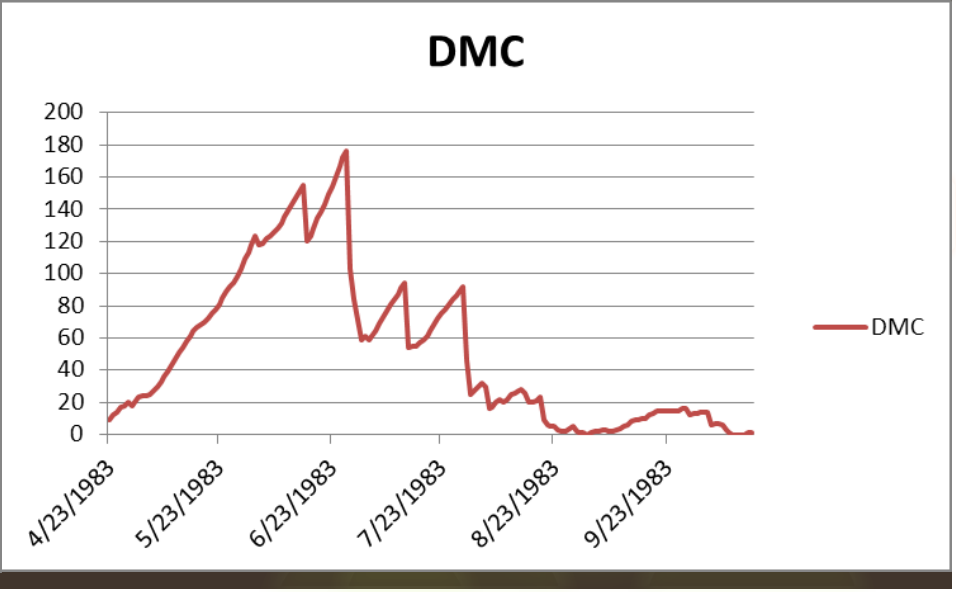
PAFA 1983-Rosie Creek Fire









PAFA 1983

- PAFA 1983 was chosen because of the nearby and early season Rosie Creek Fire and the likelihood that fire behavior and burn severity information would be available.
- BUI and FWI differences are greatest early in the season when the default DC is low and the DMC is high.
- This was a “typical” year with rainfall occurring at the end of July and the DMC dropping to end-of-season values.

PREDICTIVE SERVICES

Overwinter Comparisons

- What we found
  - Differences lessen through the season particularly when there is ample rainfall.
  - The differences in the BUI between overwintering and default are greatest with a high DMC, high overwintered DC and defaulted DC less than 200.
  - The differences in the FWI become less relevant as the differences between the DC's decrease and as the defaulted DC climbs above 200.
- What we really want to know
  - How do these differences relate to what is on the ground?
- Currently some stations are overwintered and some not, based on the protection area or zone management.
  - Should we have a statewide standard?

PREDICTIVE SERVICES