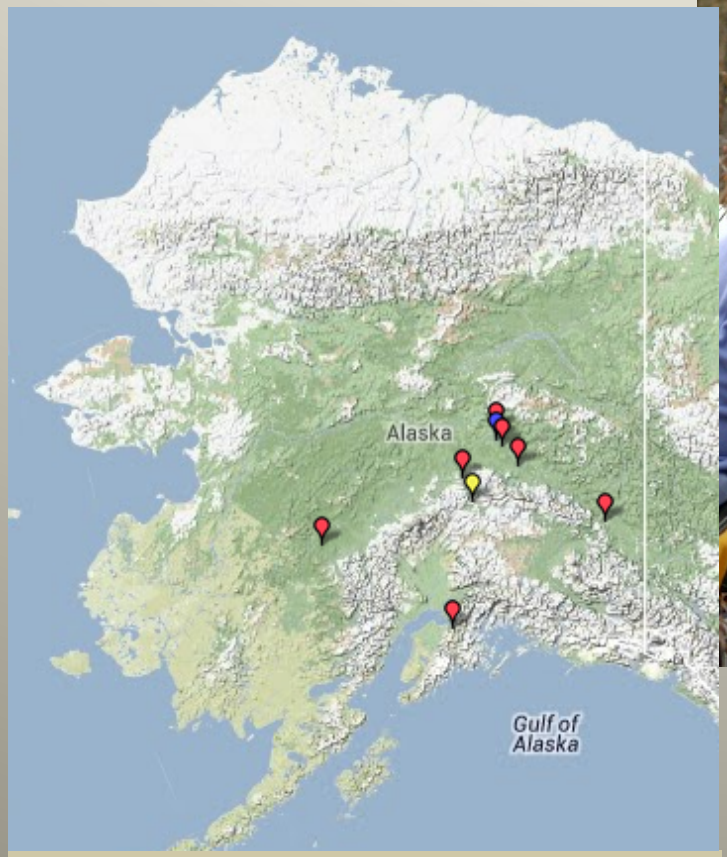
2012-2013 Fuel Moisture Campaign – What have we learned?



Seasonal sampling 2012-2013

2013 Fuel Moisture Workshop. AFS Photo, M. Ugstad

Jennifer Barnes - NPS AKR Fire Ecologist

Eric Miller - BLM-AFS Fire Ecologist

2014 Spring FMO Mtg/AFSC workshop

Fuel moisture relates to:

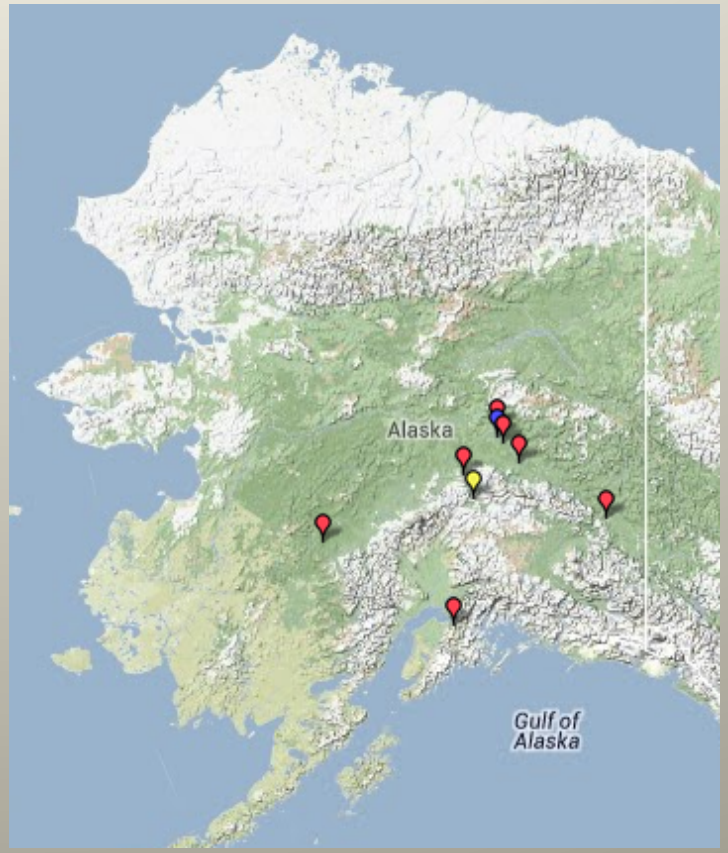
- Fire danger
- Fire behavior & effects

Fuel Moisture Types

- **Duff (Moss & Organics)**
- **Foliar (Spruce)**
- **Live herbaceous (Grass & Forbs)**
- **Live woody (Shrubs)**

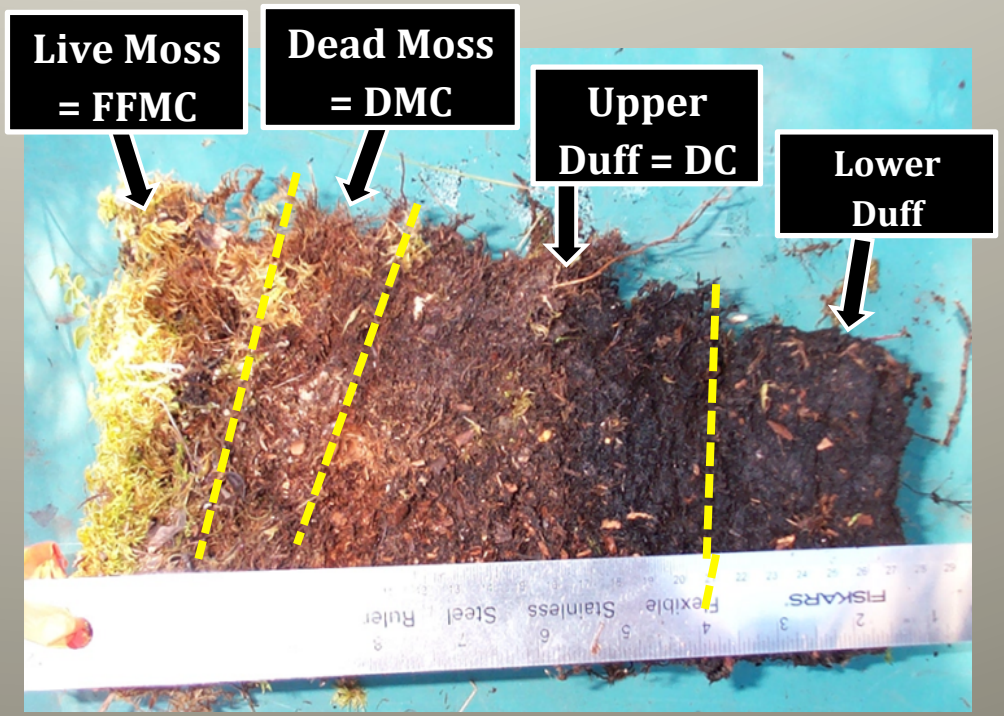
2012-2013 Spring Moisture Workshops & Seasonal Fuel Moisture Sampling

- Intent to quantify fuel moisture trends for
  - CFFDRS calibration
  - Fire behavior analysis
- Two seasons
  - 10 Sites
  - 80 Sample events
  - ~320 duff plugs
- Duff & Live Fuel Moisture



Duff Sampling and CFFDRS

- Utilize standard published equations to convert duff moisture to CFFDRS indices (DMC & DC)

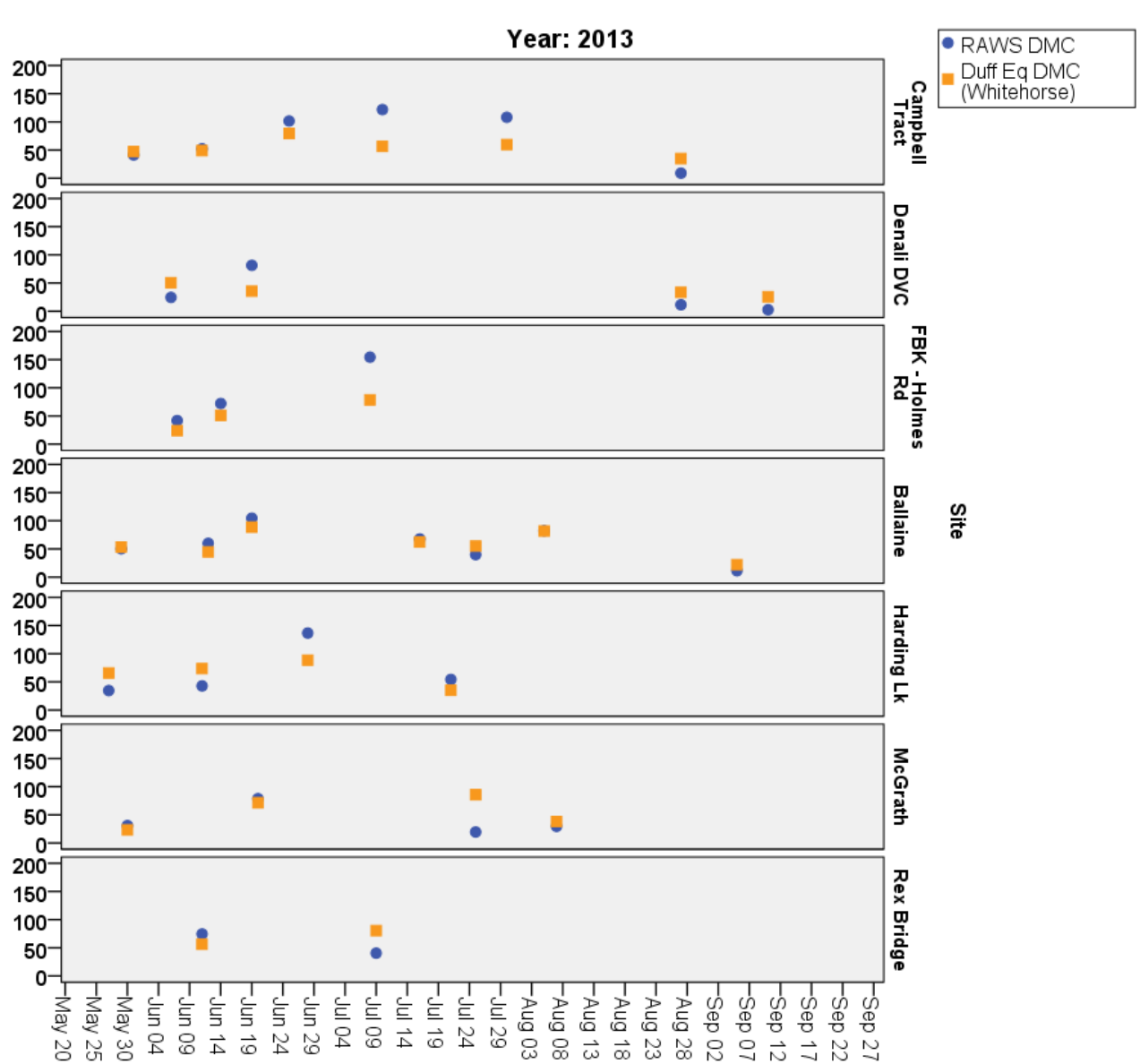


Duff Moisture and CFFDRS - DMC

2013 Sites

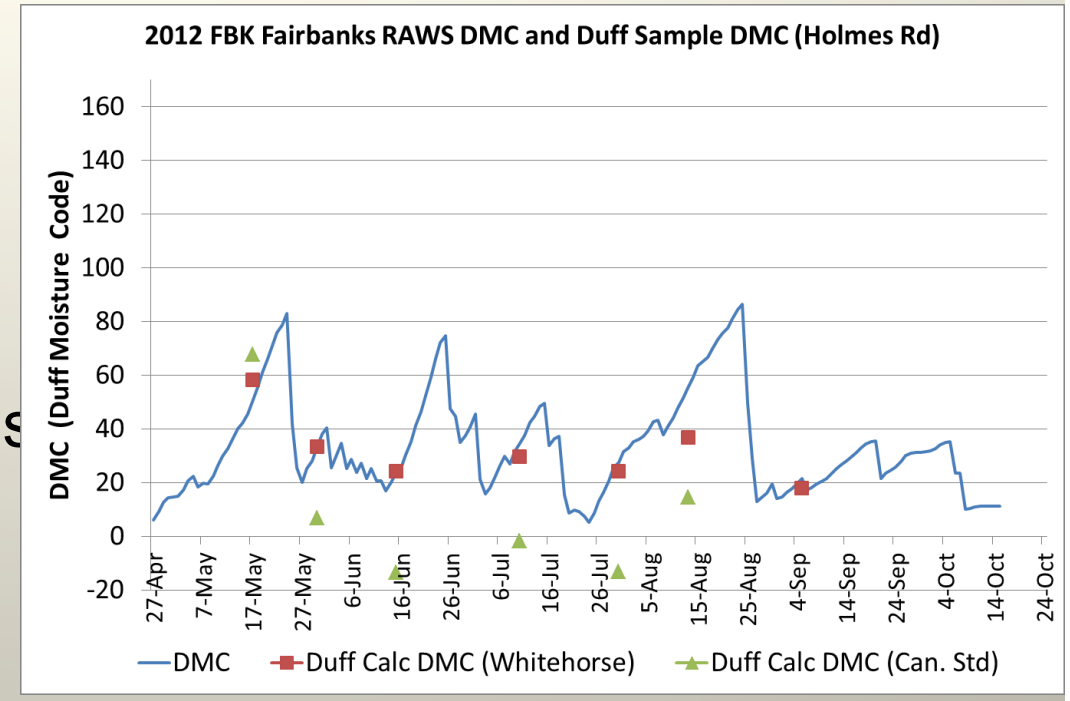
- Blue dots DMC RAWS

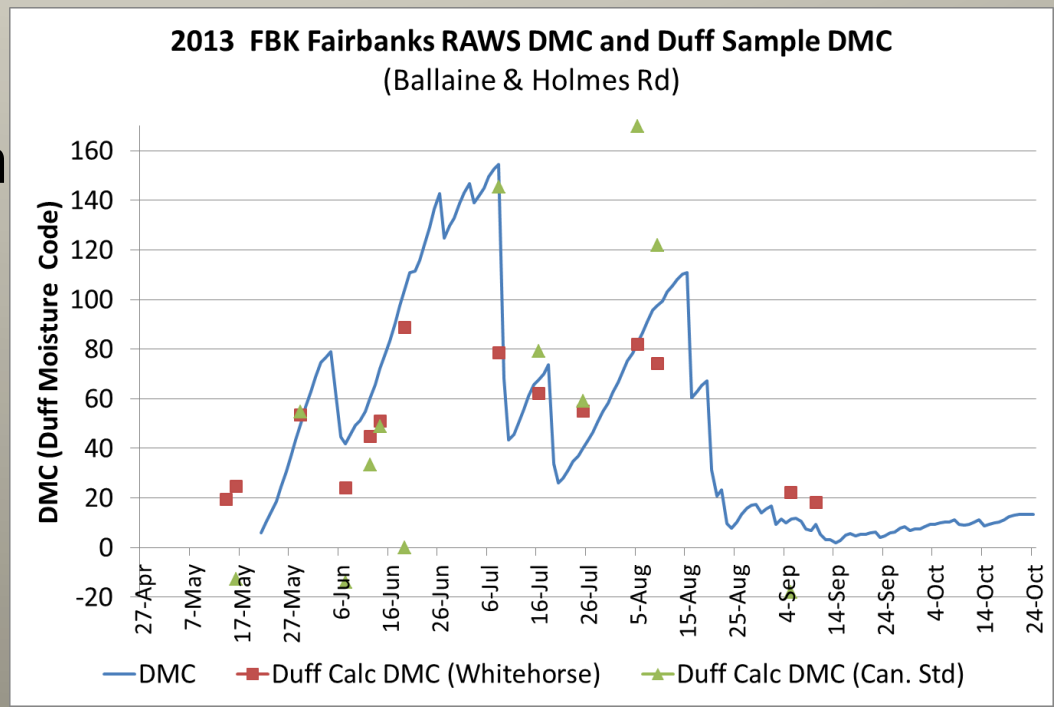
-Orange sqr DMC Calc from Duff



DMC - Duff Field Samples FBK

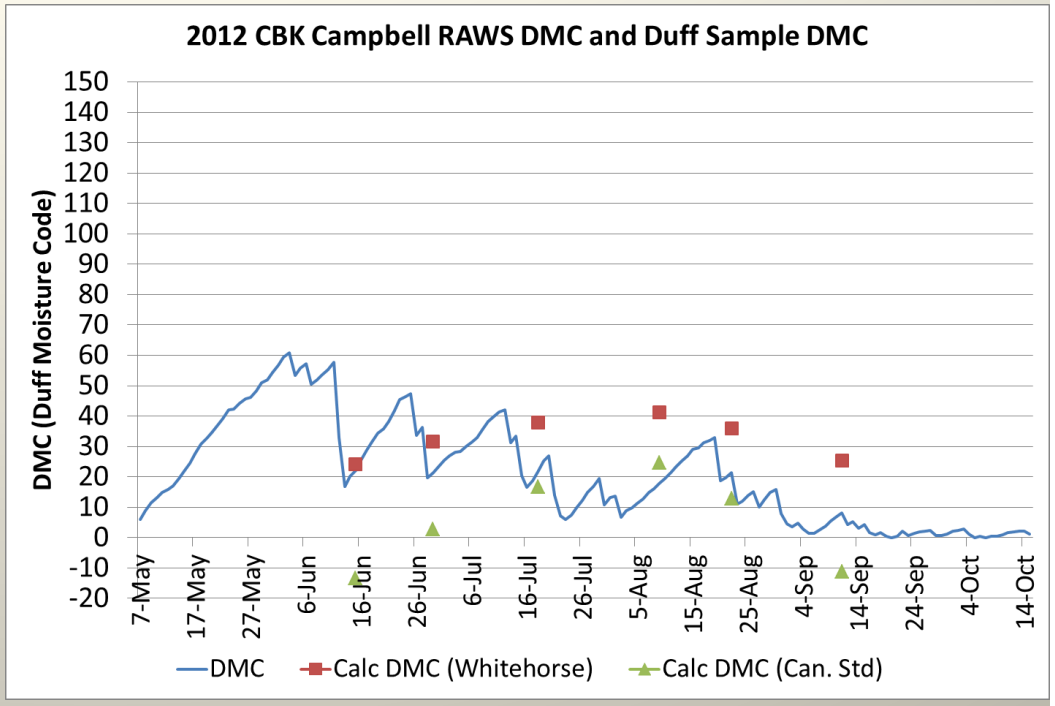
- DMC RAWS shows seasonal weather patterns (2012 cooler/wetter)
- FBK - Duff moisture follows DMC fairly well
- Whitehorse YKN equation does well
- Canadian standard equation does not work (negative values)

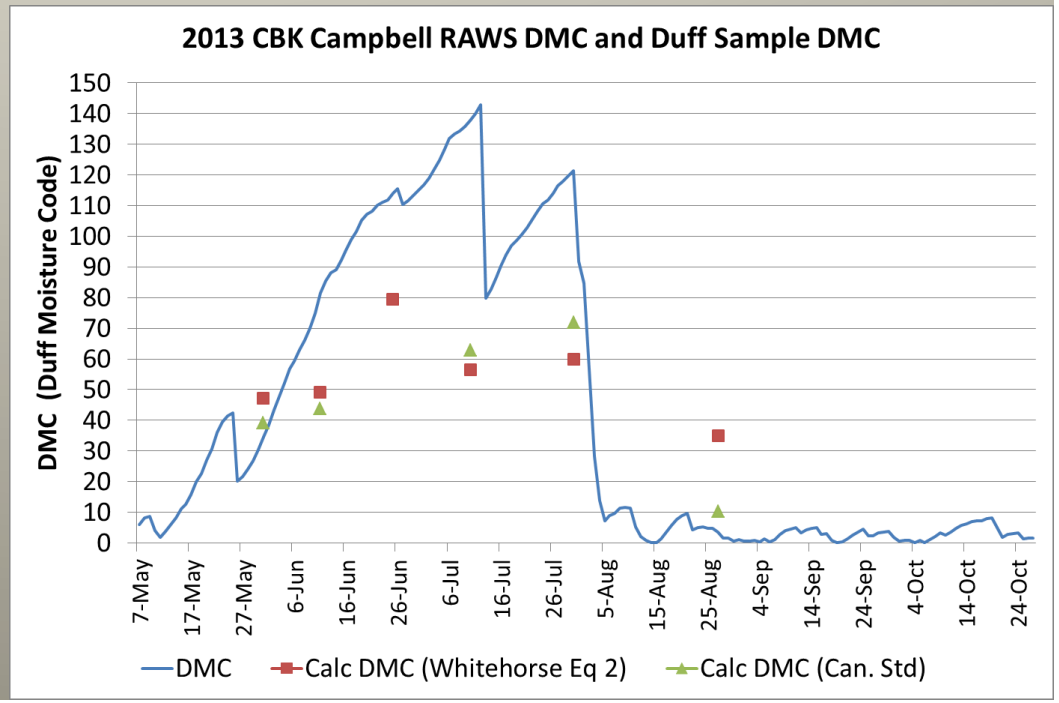




DMC - Duff Sampling Anchorage

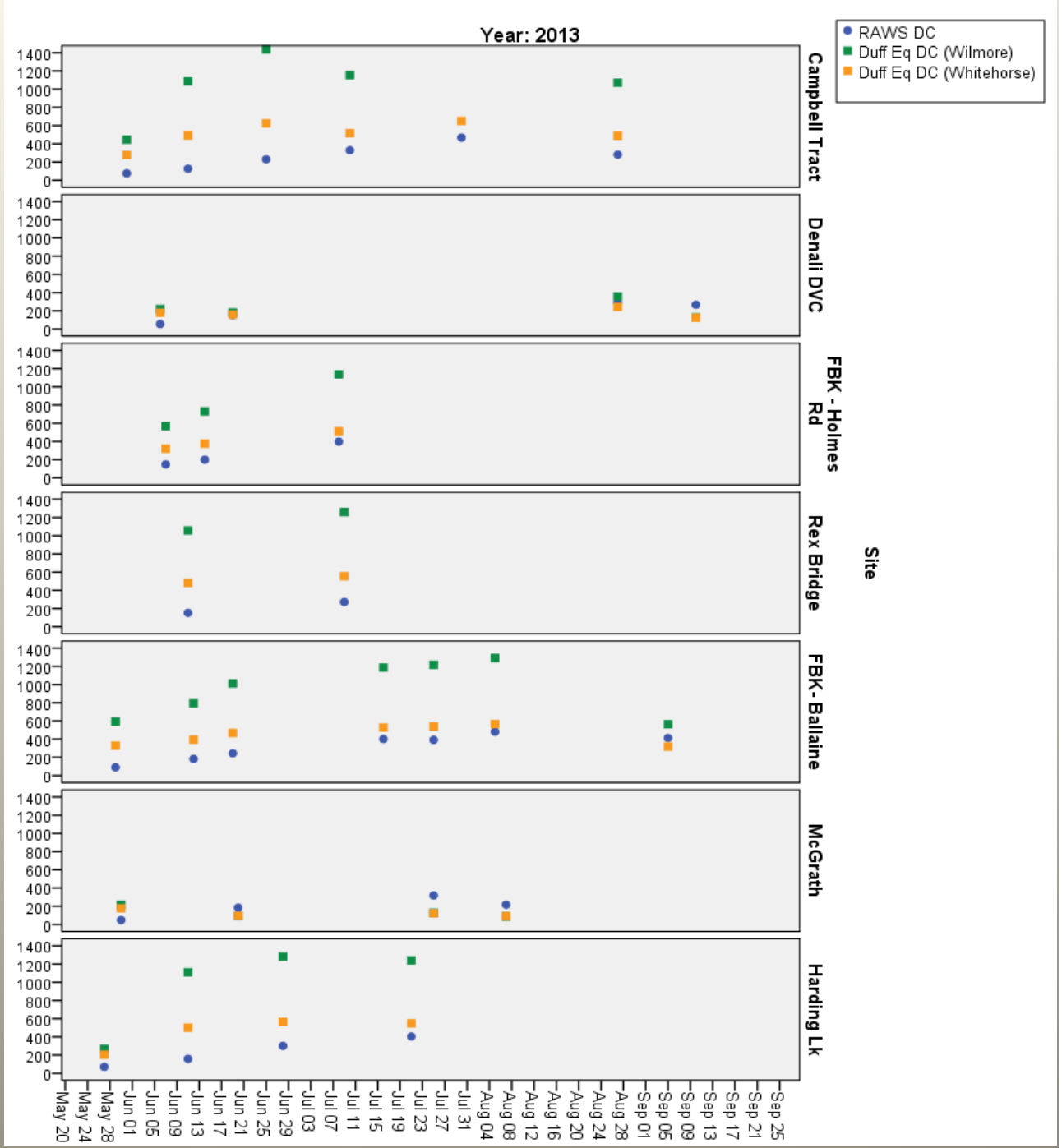
- DMC RAWS shows seasonal weather patterns
- Campbell - Duff samples do not follow DMC RAWS well
- Which equation works or none?





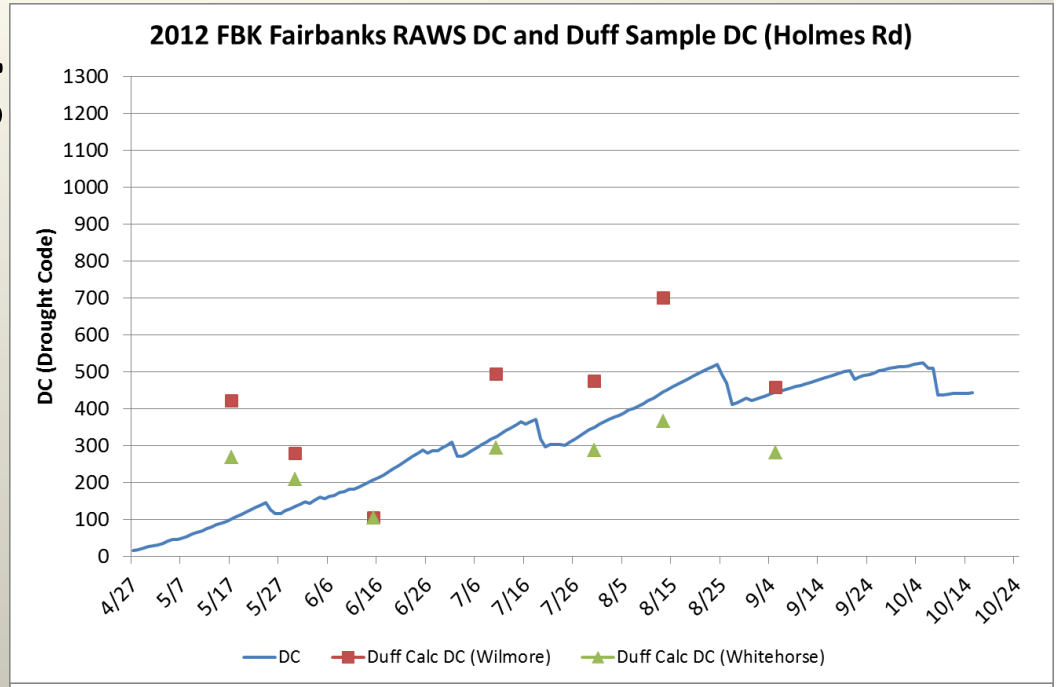
DC All Sites 2013

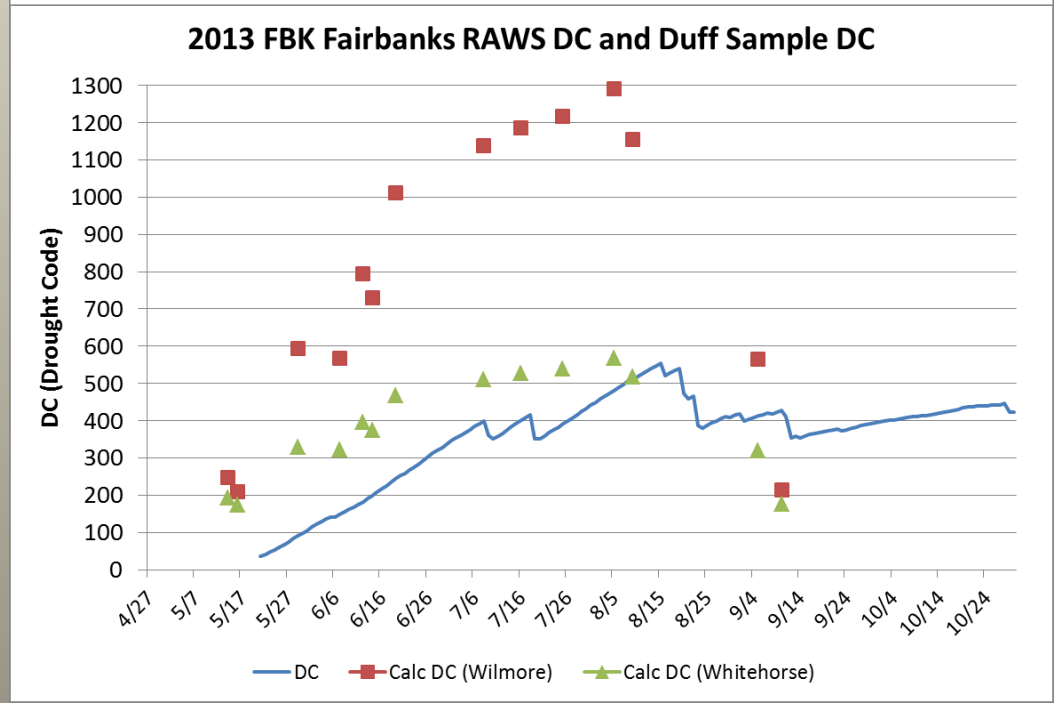
Consistent over-estimation of DC from duff plug MC equations



DC Duff Sampling Fairbanks

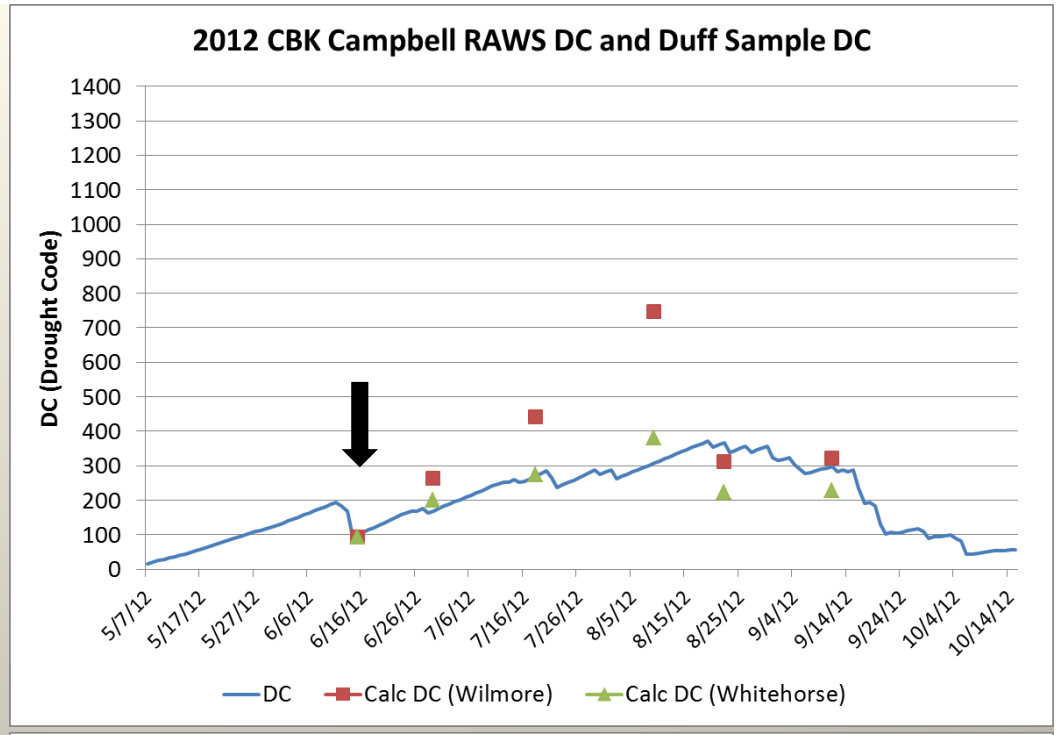
- DC from RAWs does not show seasonal difference
- Start date effects & 2013 was overwintered
- Wilmore equation is off the charts (not good)

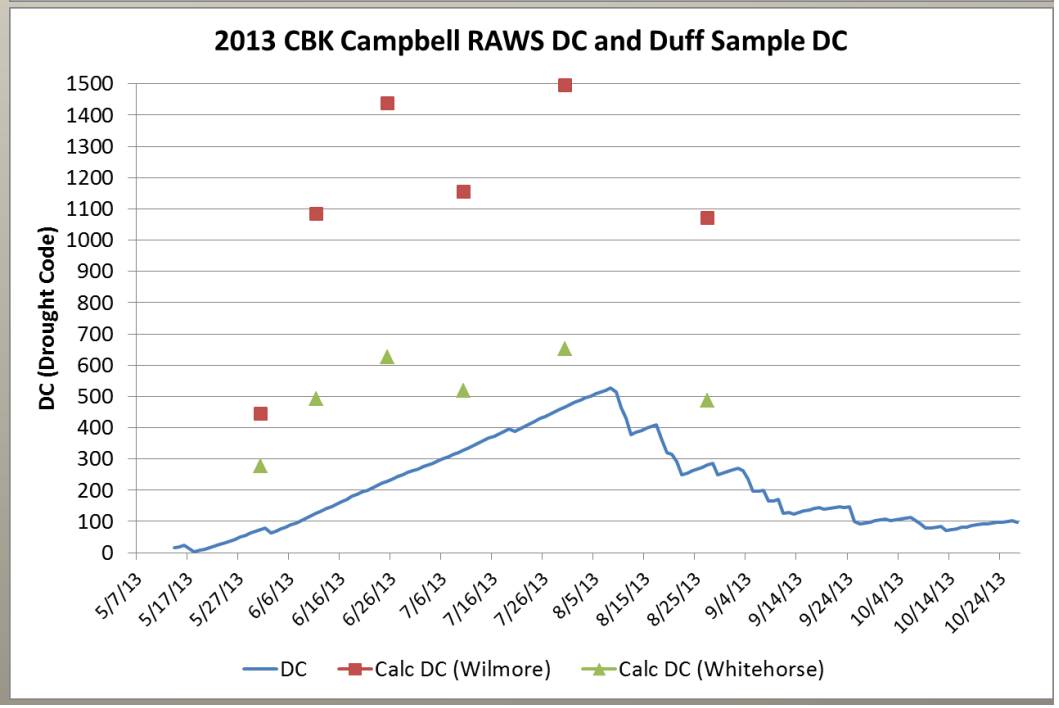




DC Duff Field Sampling - ANC

- CBK reset in 2012 but not 2013
- Yukon Eqn better than Wilmore's





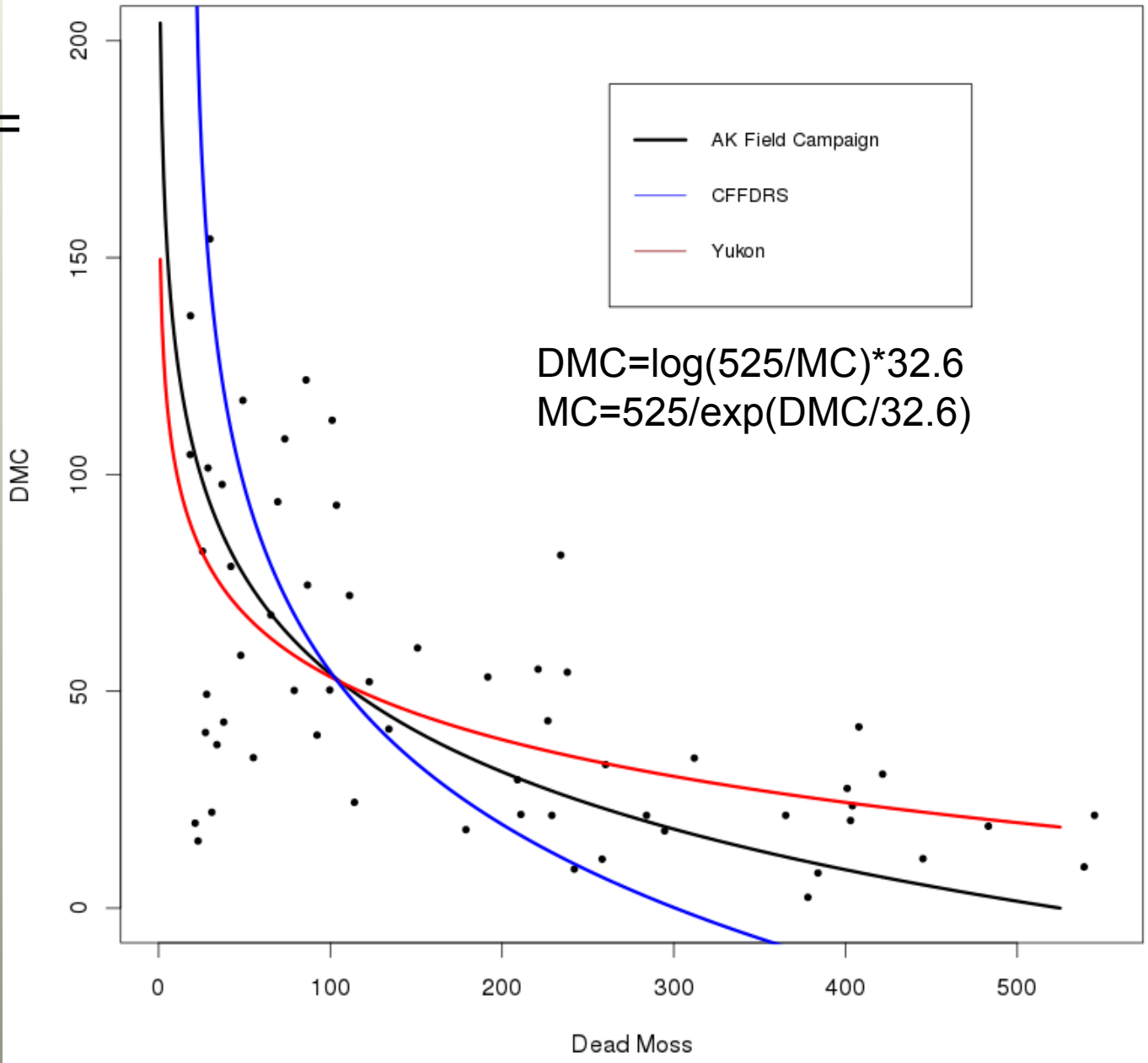
New Calibration Equations

New Equations

- New equations developed from AK campaign
- Equation form
  - Index is set to zero when the duff is at field capacity MC~525%
  - No upper bound to the index

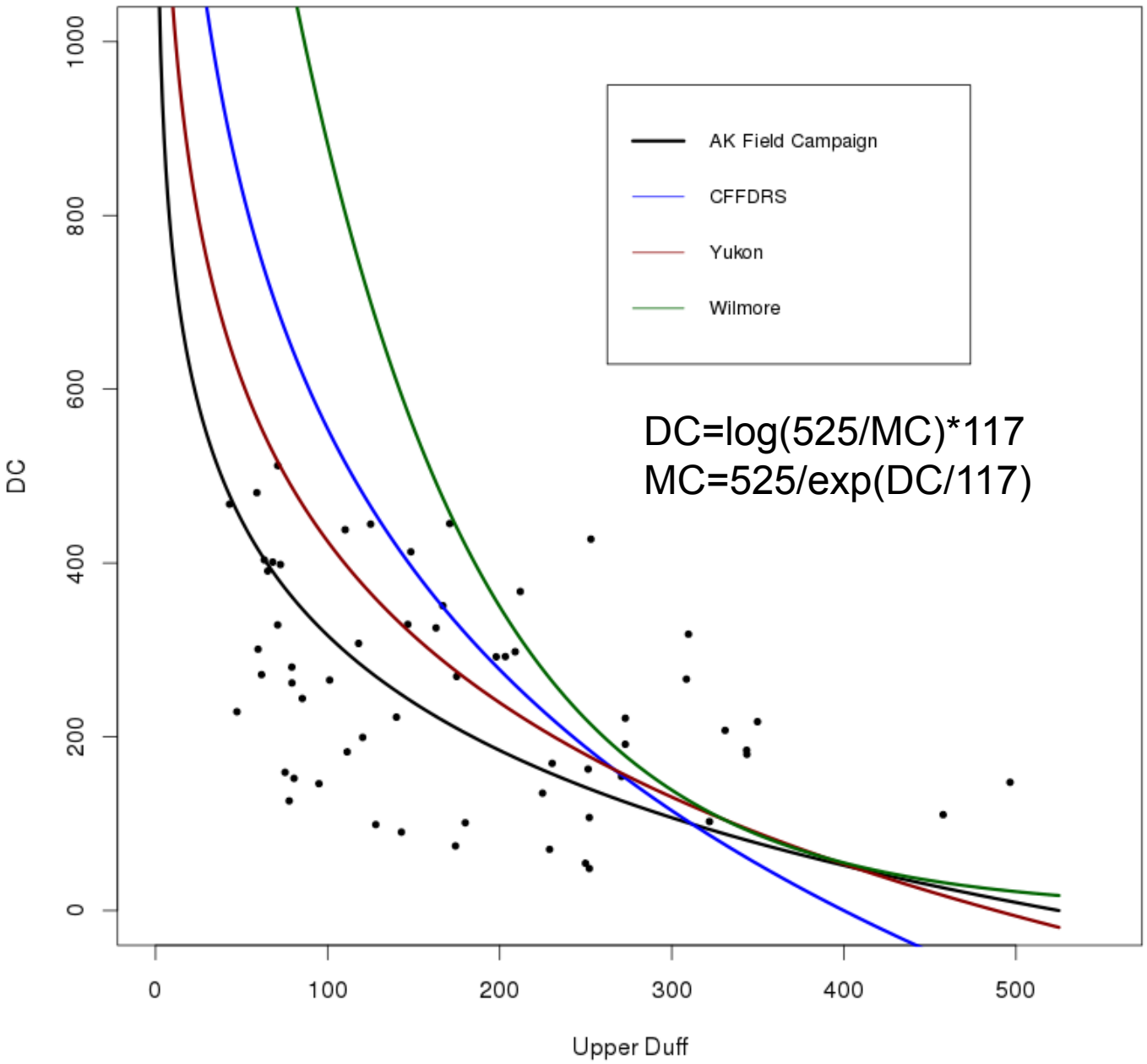
DMC

- FC =525%
- Upper limit = Inf
- Still quite a bit of error
- Similar to Yukon equation
- Need DMC >150



DC

- FC =525%
- Upper limit = Inf
- Scatter is huge
- Wilmore Eqn predicts > DC at low MC
- Similar to Yukon
- Need drier season, DC >500



Sources of Error

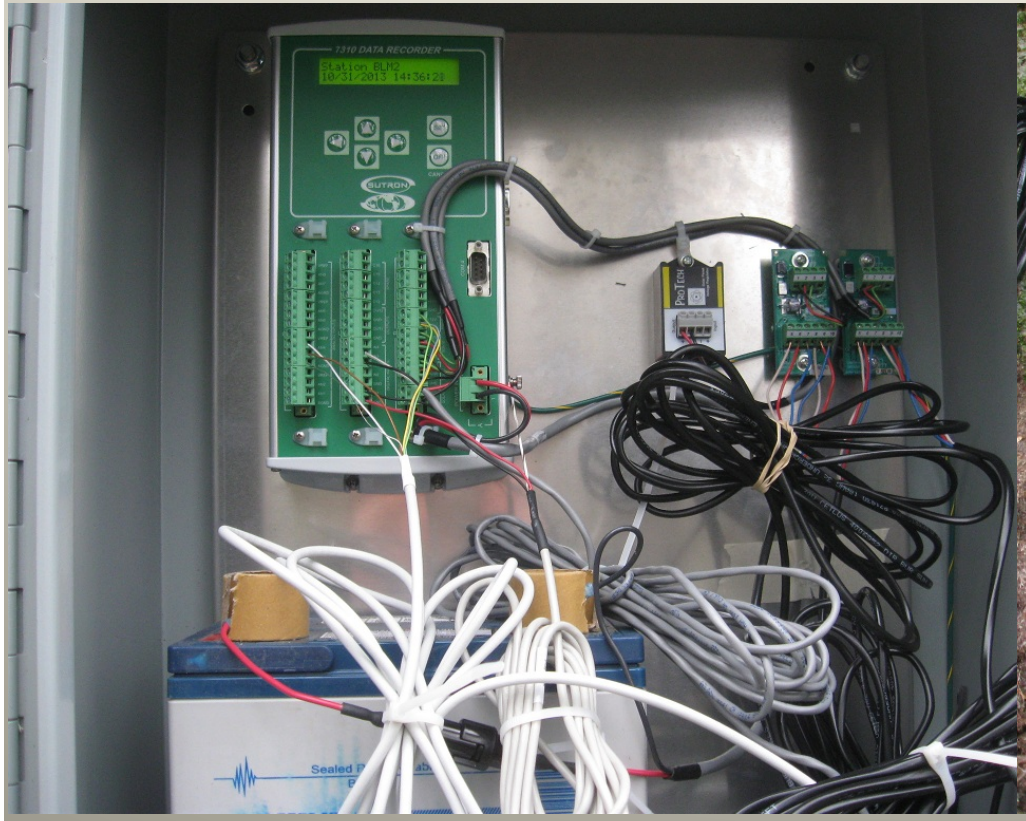
- Proximity to RAWS
- Overwinter vs default
- Spatial variability
  - Duff properties
  - Drainage
- Insufficient sample size
- Observer error
  - (e.g, sphagnum, not drying long enough, etc)
- Geographic variability (Alaska Range, E vs W)
  - Synoptic weather
  - Duff properties (ash content, moss species, etc)

Dataloggers

Duff Dataloggers

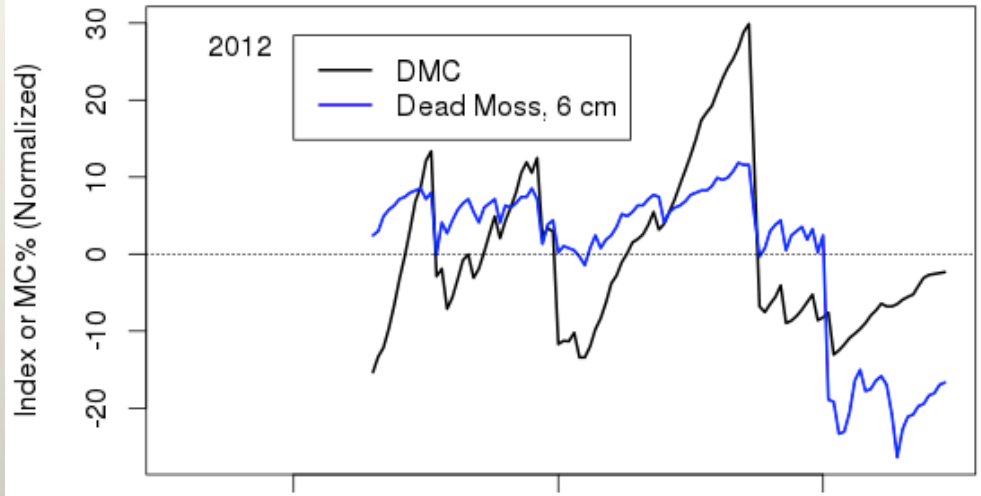
- Hobo weather stations fitted with soil moisture sensors in 2012
- Duff moisture measured at 6 and 13 cm depth every 15 minutes for 2-1/2 years
- Repeated measure of a single point in space beneath a weather station

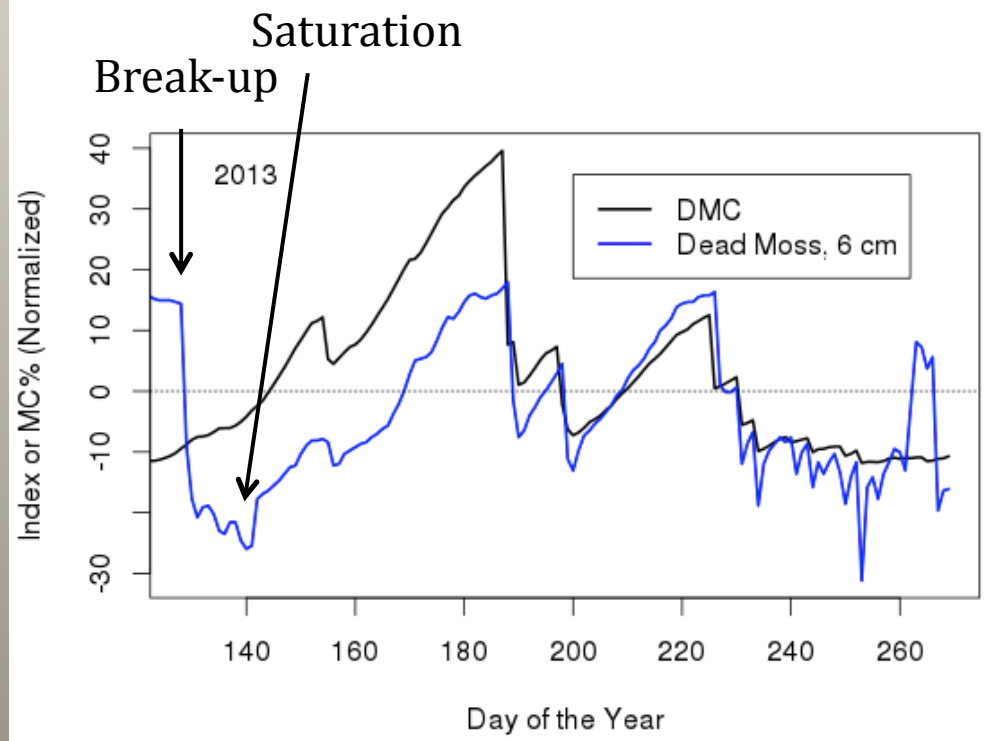
Duff Dataloggers



•DMC

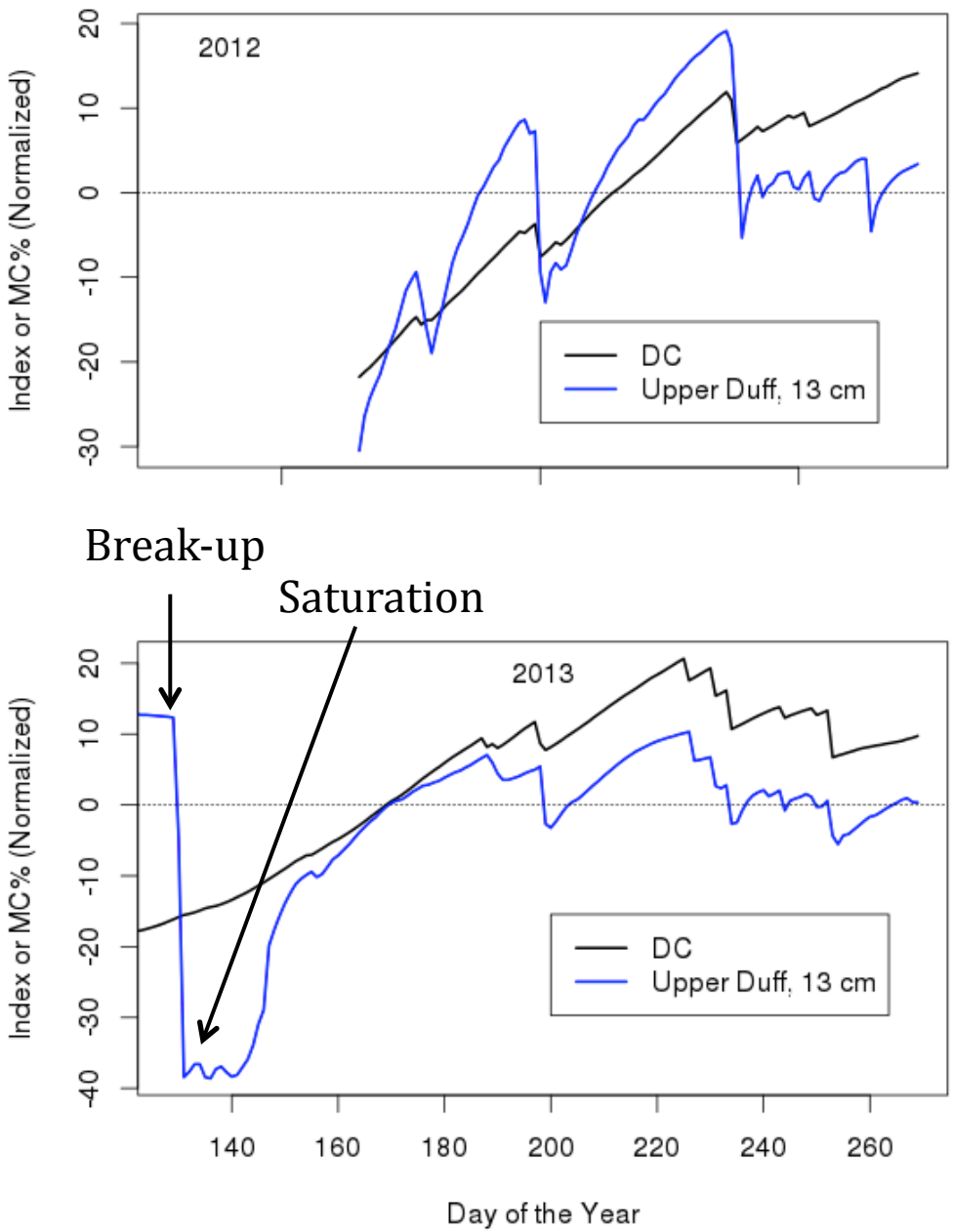
- Moist down, Dry up
- Resolution is far greater than sampling duff plugs
- MC seems to respond to something not picked up by the DMC
- MC is less responsive to Wx





•DC

- Moist down, Dry up
- Rapid spring drying followed by flat response in late summer
- Steady rise in DC
- MC is more responsive to Ppt



Duff Sampling: 2014 And Beyond

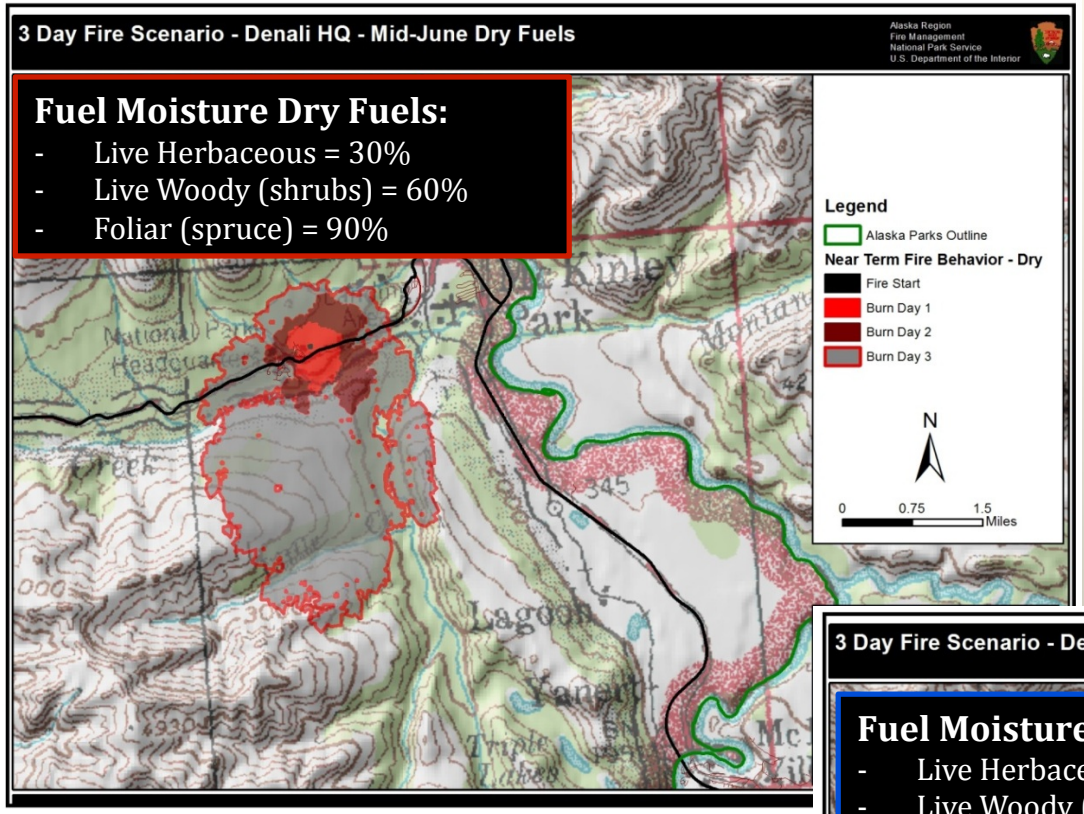
- Keep exploring geographic patterns
  - Copper Basin + Palmer + Galena
- Keep sampling and hope for DMC>150 and DC>500
- Address default/over-winter question
- Duff moisture / CFFDRS Summit?
- State-wide duff survey?

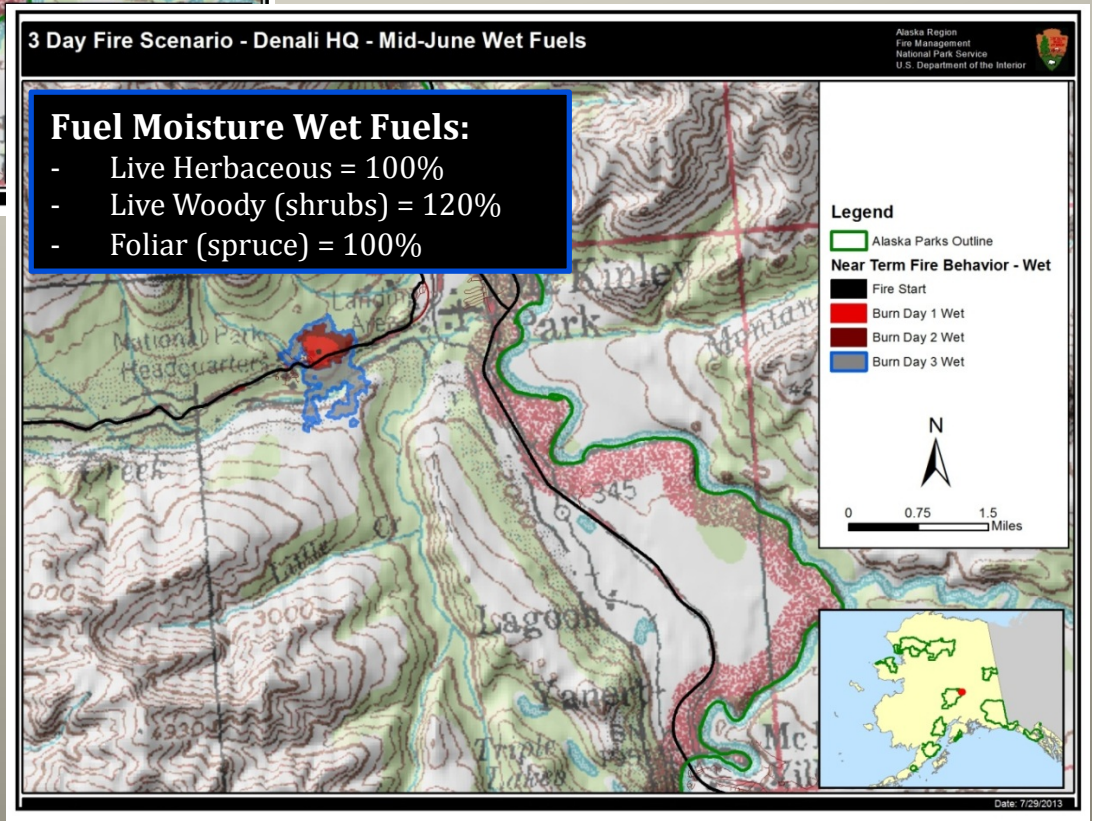
What about the other stuff that burns?

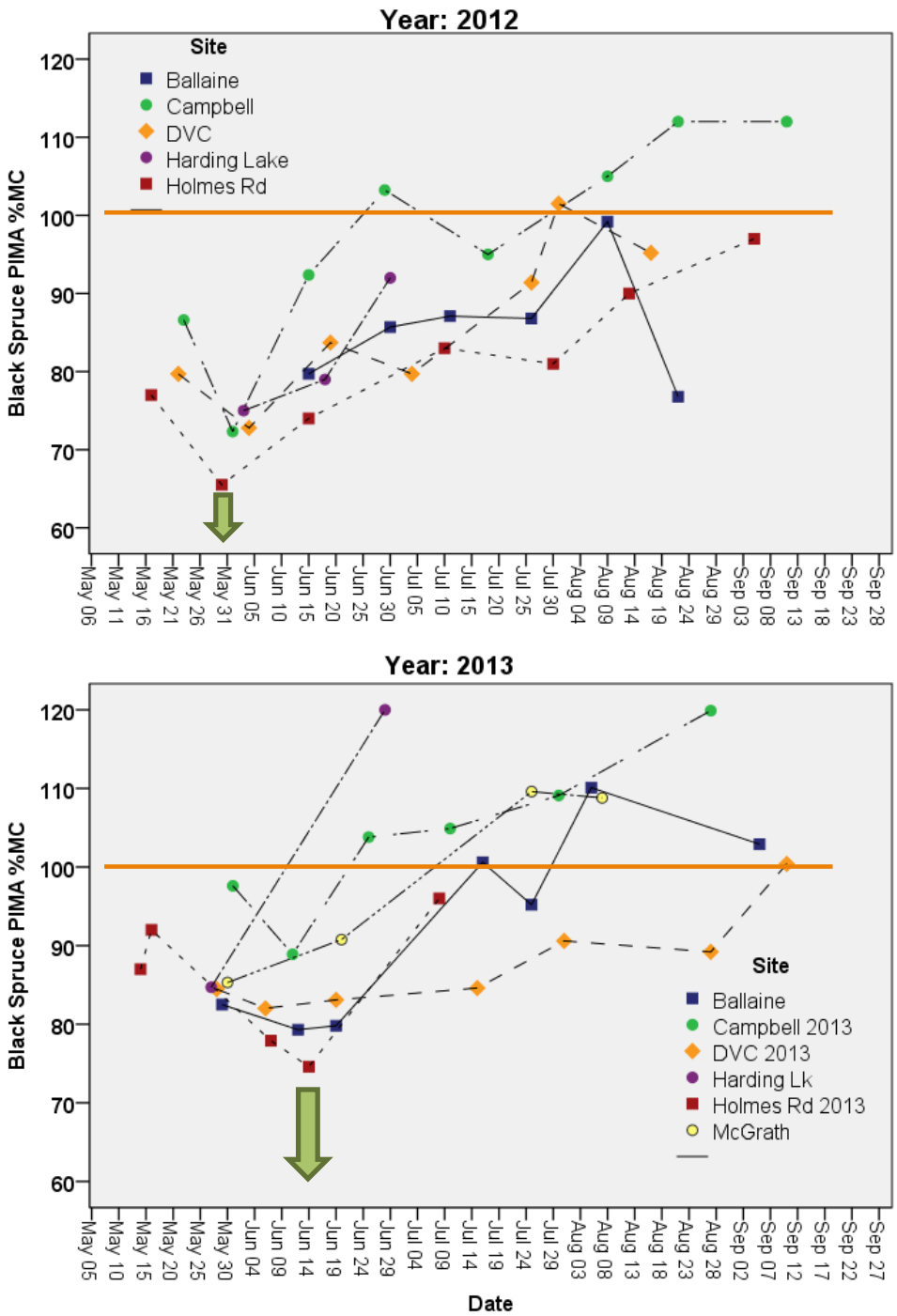
Live Fuel Moisture and Fire Behavior

- Foliar (Spruce)
- Live woody (Shrubs)
- Live herbaceous (Grass & Forbs)

Live Fuel Moisture & Fire Behavior – 3 day NTFB Scenario





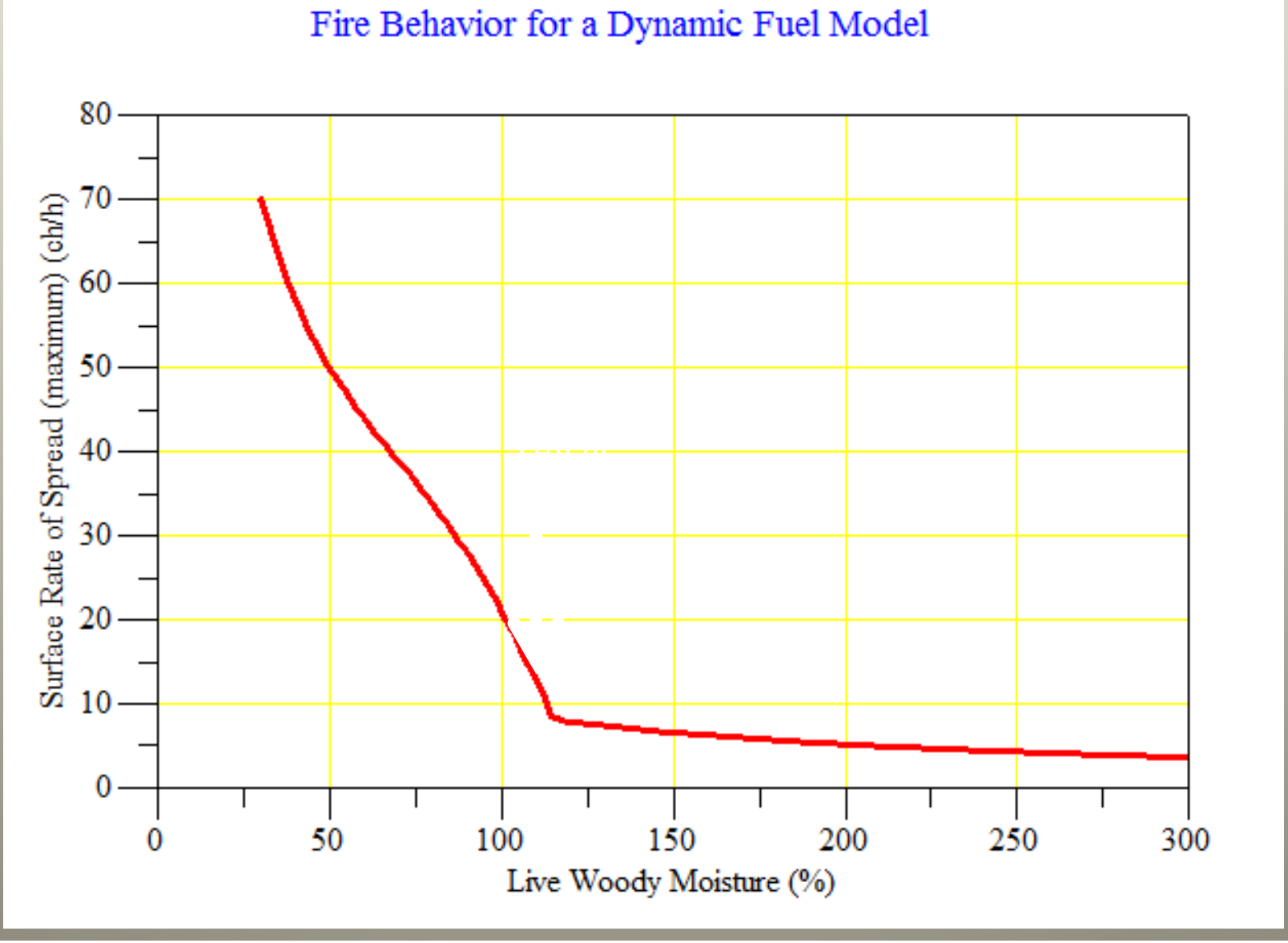


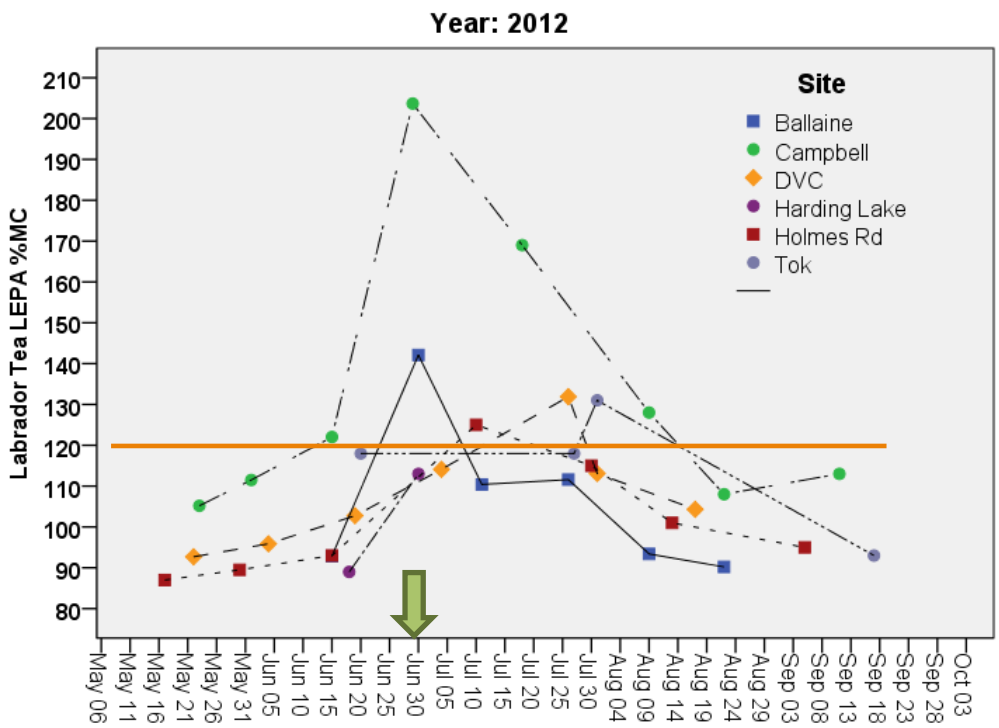
Black Spruce – Foliar Moisture

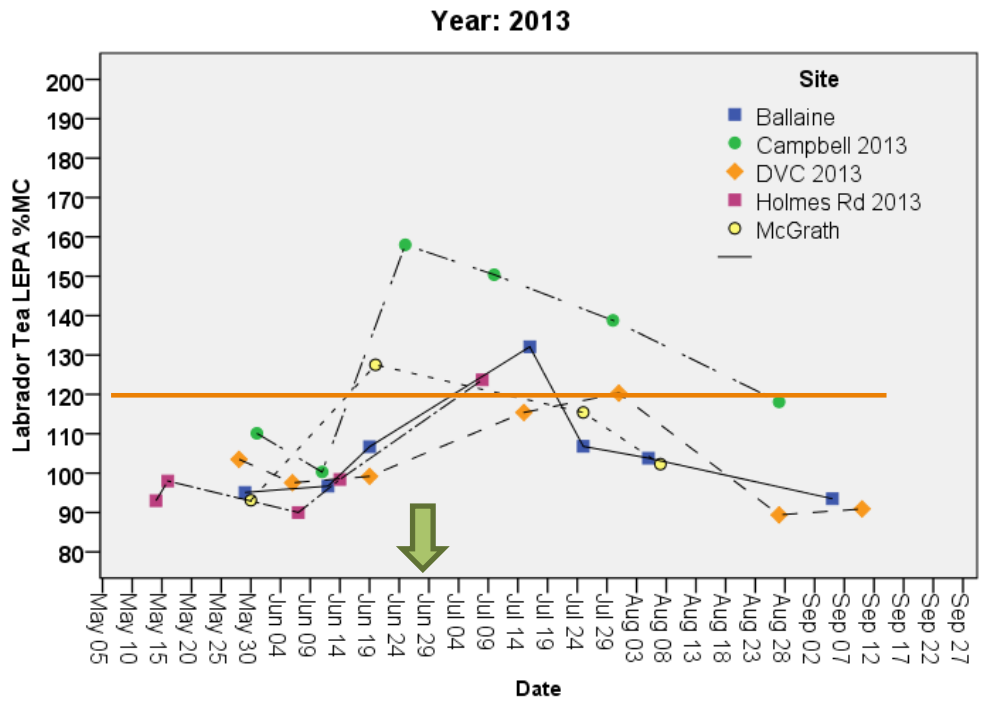
< 100 % MC – Increases crown fire potential

- Spring dip ⇩
  - 2012 ~ May 31
  - 2013 ~ June 14
- 2013 drier season -- but higher spruce fuel moisture?

Live Woody Fuel Moisture (Shrubs) Impacts rate of spread @ < 120

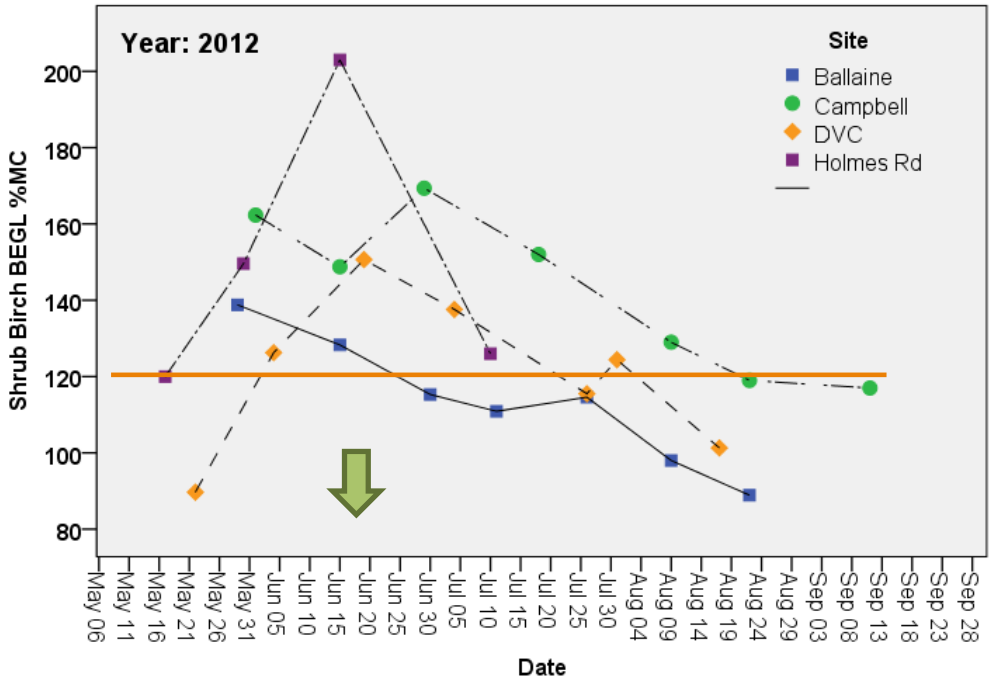


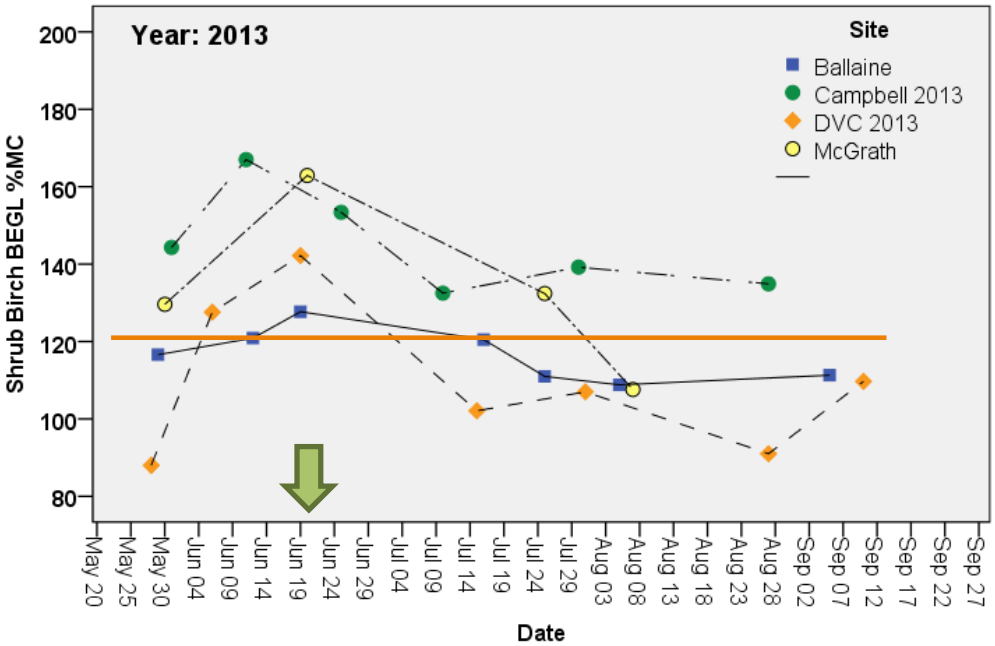




Labrador Tea Fuel Moisture

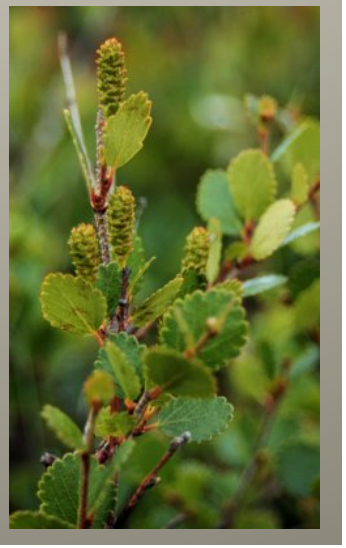
- Green-up – about same
  - 2012 ~ June 30
  - 2013 ~ June 30
- 2013 drier season – little drier fuel moisture



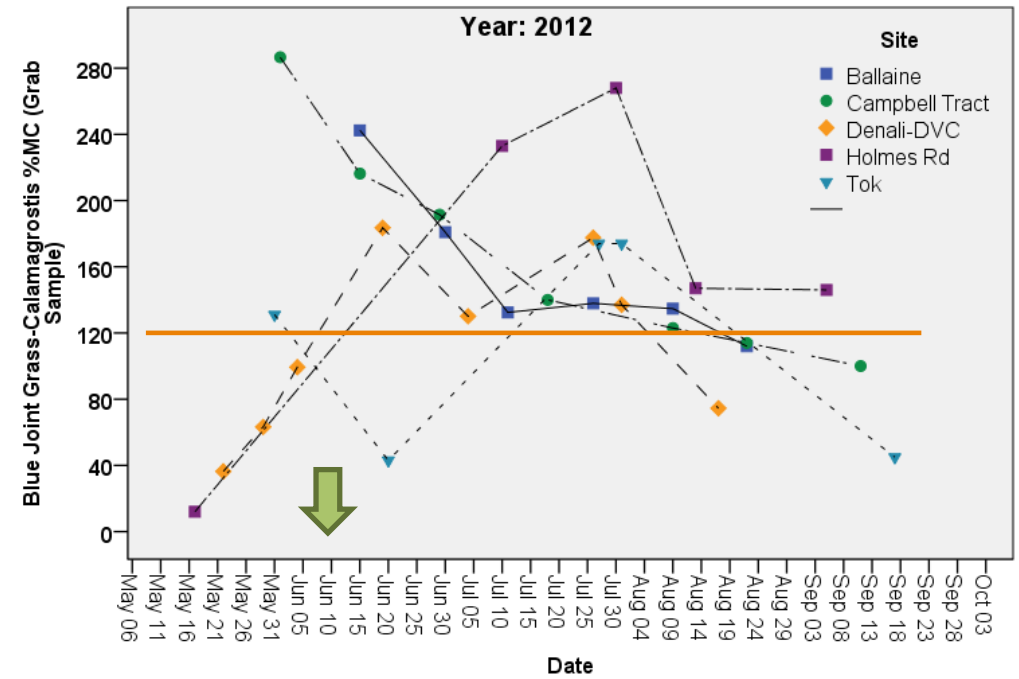


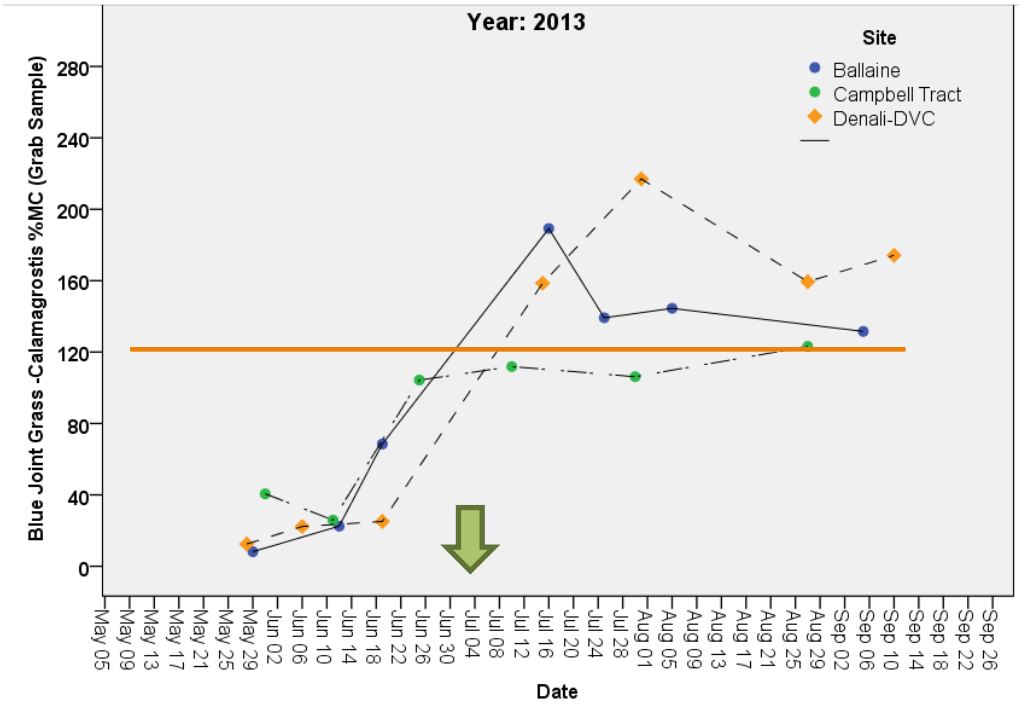
Shrub Birch Fuel Moisture

- Green-up – about same
  - 2012 ~ June 17
  - 2013 ~ June 19
- 2013 drier season – little drier fuel moisture

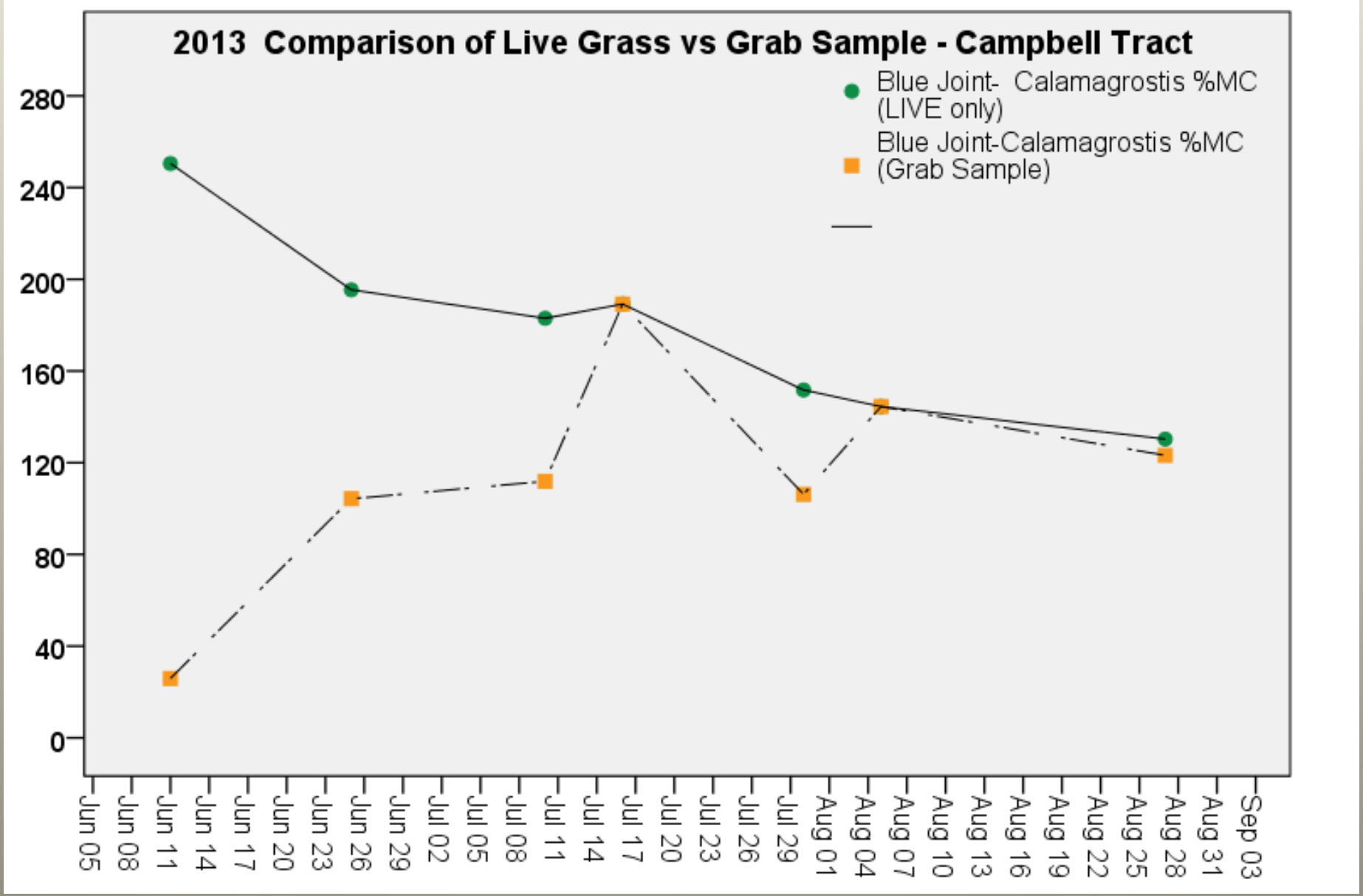


Herbaceous Calamagrostis Grass Fuel Moisture





- Green-up – different
  - 2012 ~ June 10
  - 2013 ~ June 30
- 2013 drier season – little drier fuel moisture


2013 Comparison of Live Grass vs Grab Sample - Campbell Tract
Blue Joint- Calamagrostis %MC (LIVE only)
Blue Joint-Calamagrostis %MC (Grab Sample)
280
240
200
160
120
80
40
0
Jun 05
Jun 08
Jun 11
Jun 14
Jun 17
Jun 20
Jun 23
Jun 26
Jun 29
Jul 02
Jul 05
Jul 08
Jul 11
Jul 14
Jul 17
Jul 20
Jul 23
Jul 26
Jul 29
Aug 01
Aug 04
Aug 07
Aug 10
Aug 13
Aug 16
Aug 19
Aug 22
Aug 25
Aug 28
Aug 31
Sep 03

What have we learned from Live Fuel Moisture Sampling?

Discoveries:

- Many AK plants have fuel moistures below National Charts during peak green-up = flammable
- Very weak signal of drought impact on plant fuel moisture (Climate change predictions?)
- Some plants respond to the timing of “spring” others appear to have a set phenology

Questions:

- Do spruce have higher fuel moistures during a dry summer? Why??
- What about fuel moisture of other dominant vegetation – willows, alder?

Next Steps…

- Continue sampling
- No training workshop – individual site training
- New sites for 2014
- CFFDRS/Duff sampling workshop next fall?
- Field guide to fuel moisture sampling - AFSC