Factors Affecting the Accuracy of Surface Soil Moisture Content Estimation With a Combination of Active and Passive Microwave Data

Brian Miller & Paul Bullock
Department of Soil Science
University of Manitoba

UNIVERSITY OF MANITOBA

Objective

- To identify the influence of surface factors on the observed values of a combined active/passive remotely sensed layer from the PALS sensor

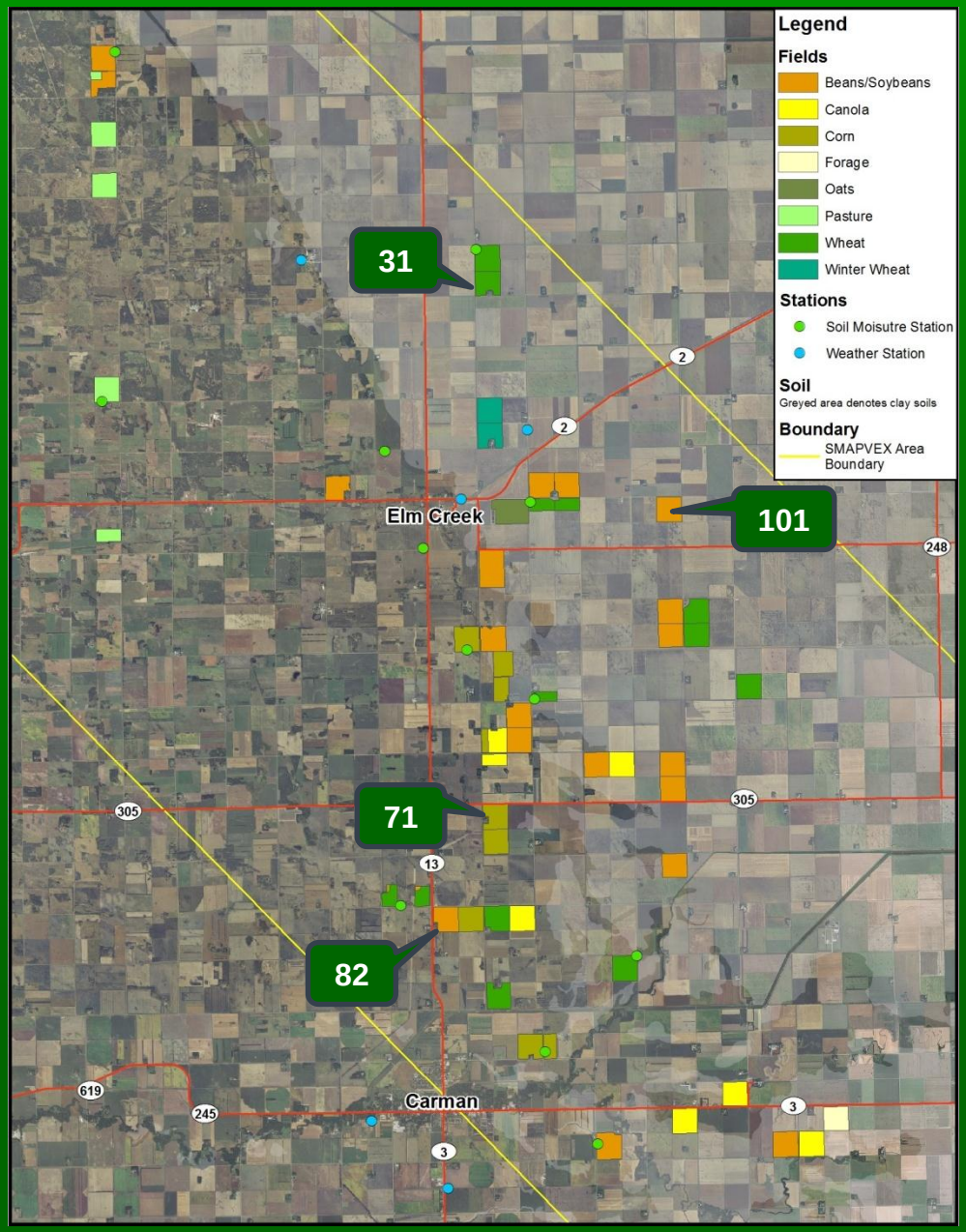
Outline

- Area of Interest

- Soil moisture
  - Field team samples
  - *In situ* data (USDA, SAGES, MAFRI)
- Biomass
- Weather

- PALS

Area of Interest



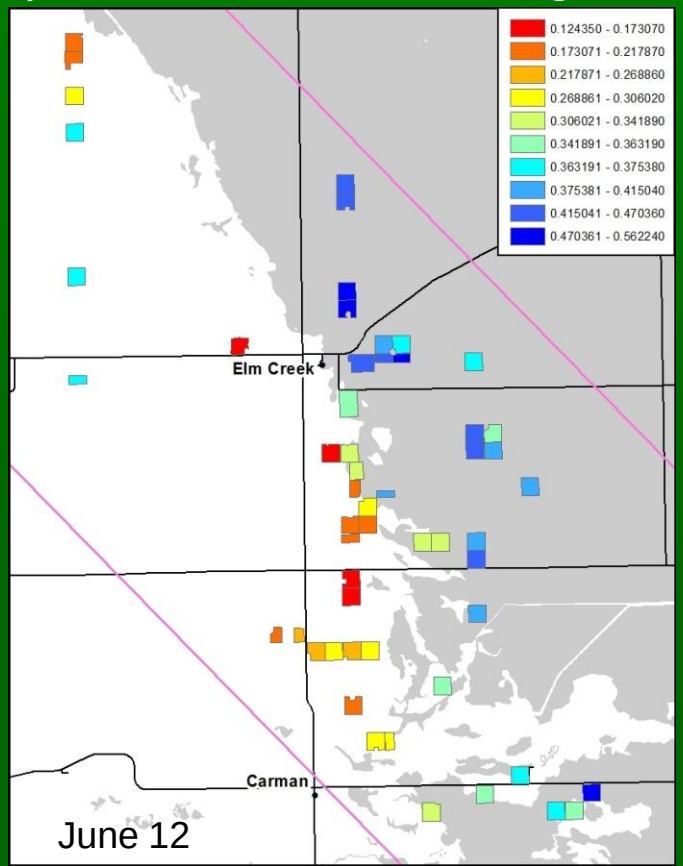
Focus on 55 Ag fields in the SE part of SMAPVEX12 footprint

Area of Interest

- 9 crop types
  - Create 5 groups
    1. Bean/Soybean
    2. Corn
    3. Canola
    4. Wheat, Winter Wheat & Oat
    5. Pasture/Forage
- Variety of textures
  - Particle size analysis:
    - Up to 94% sand, 70% clay content

Soil Moisture

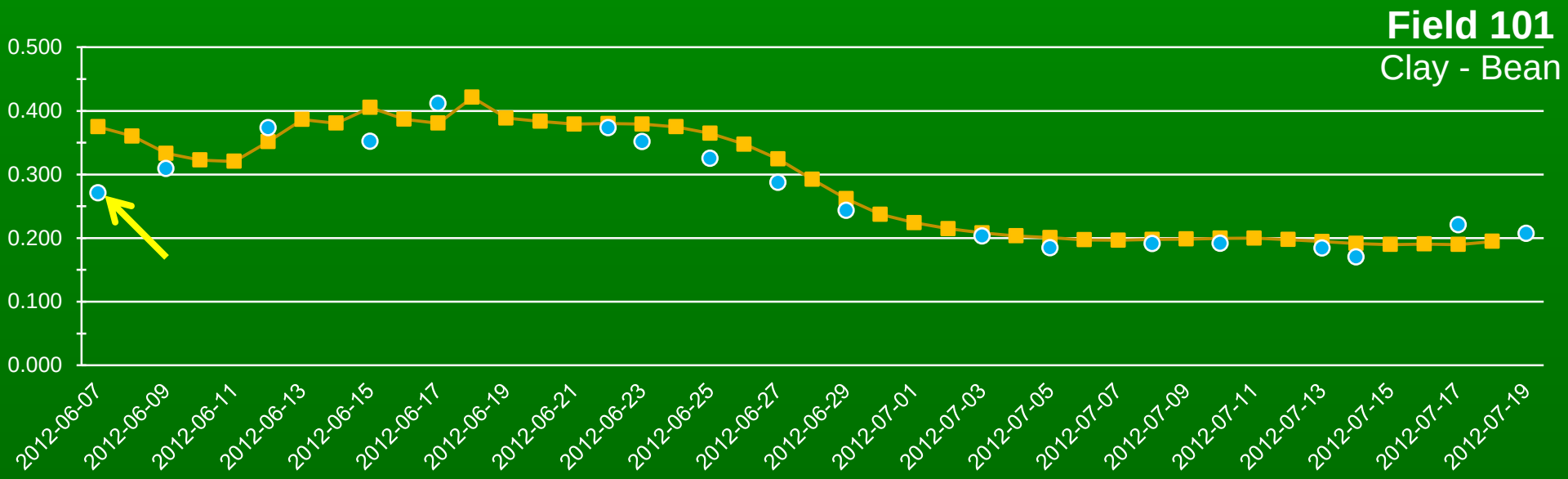
- Creation of field averages from field teams for all sampling days
  - Averages made up of >=24 of 48 readings

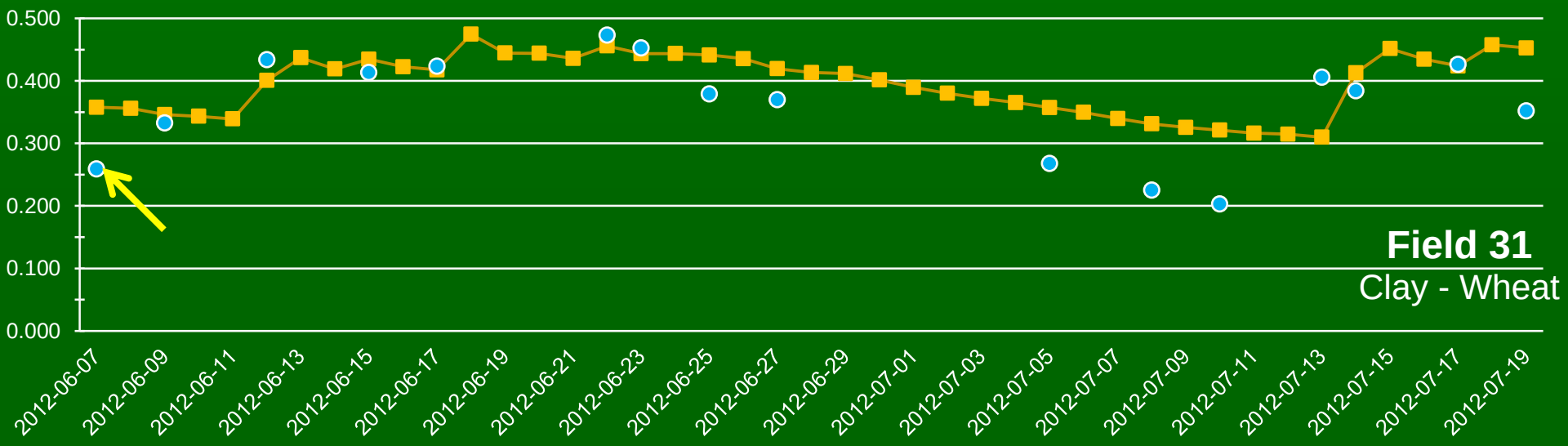


Soil Moisture

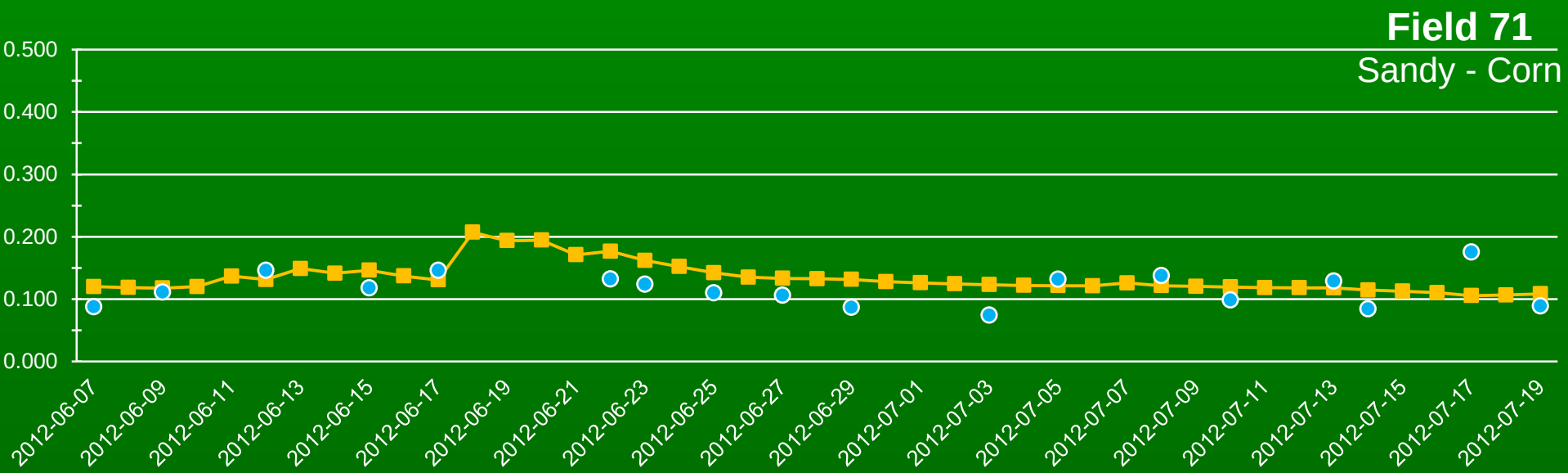
- USDA data used to create “sampling time average” moisture values
  - 7:00 am – 11:00 am average daily
- Days without field data can be used to help fill gaps
  - Plot constant moisture vs. flight days
- MAFRI station data for fields 11, 22, 85
- SAGES moisture data not yet available

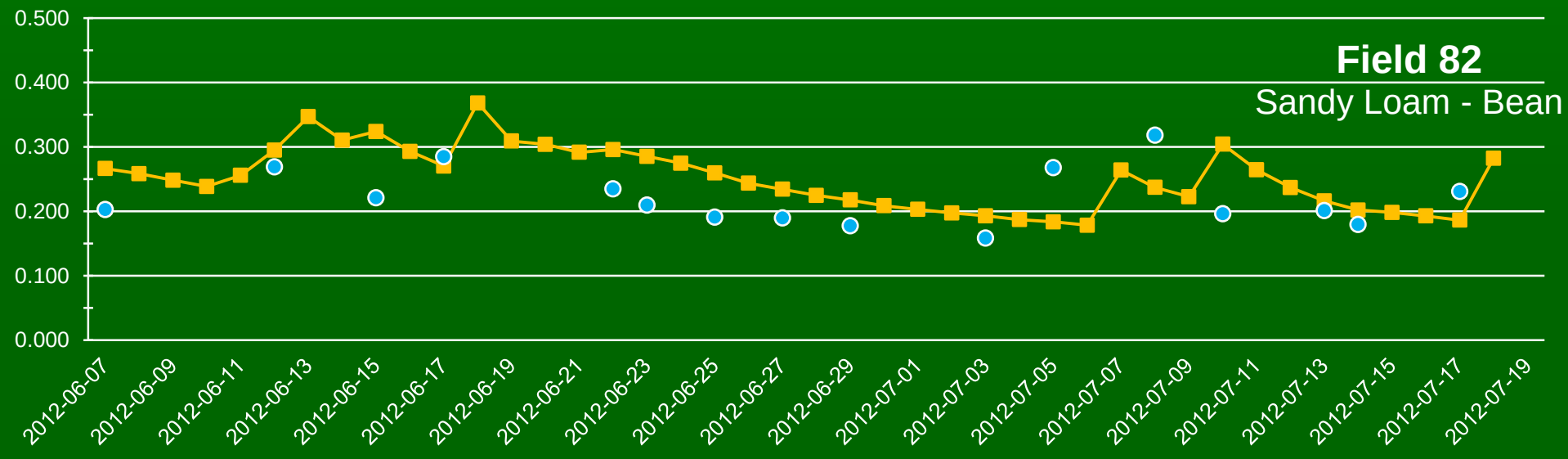
Soil Moisture





Soil Moisture

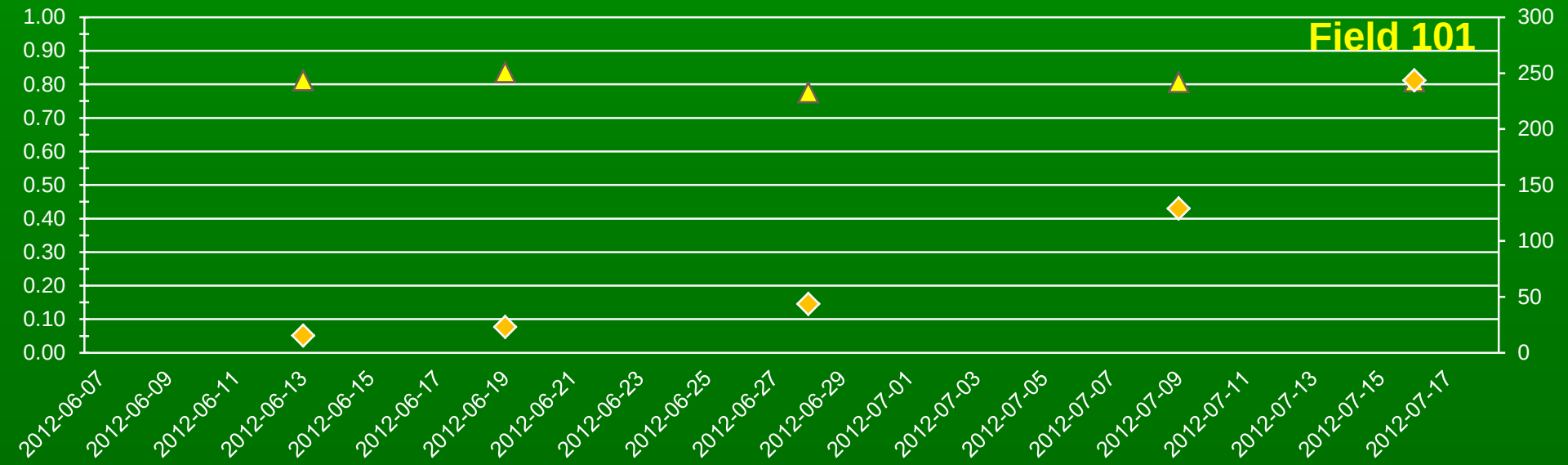




Biomass

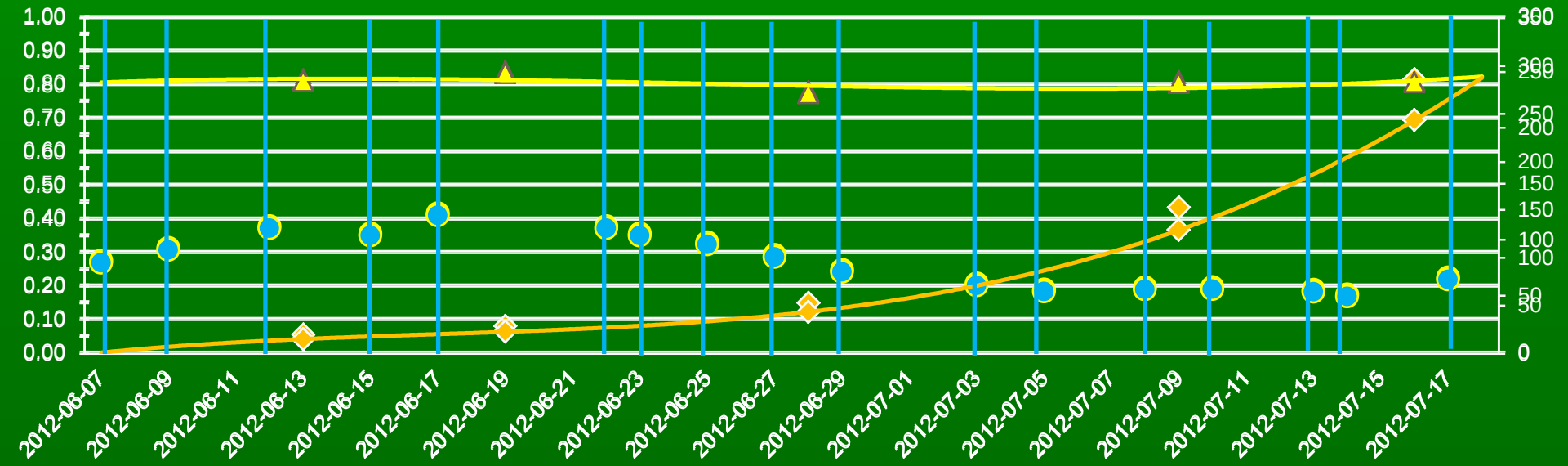
- Daily field averages created using corrected oven-dried moisture content
  - One factor for most crops, “stepped” value for corn
- Averages of all plants sampled on field each day
  - Special treatment for mixed fields? (62, 12)
- Fewer actual samples per field will require interpolation of water content on flight days

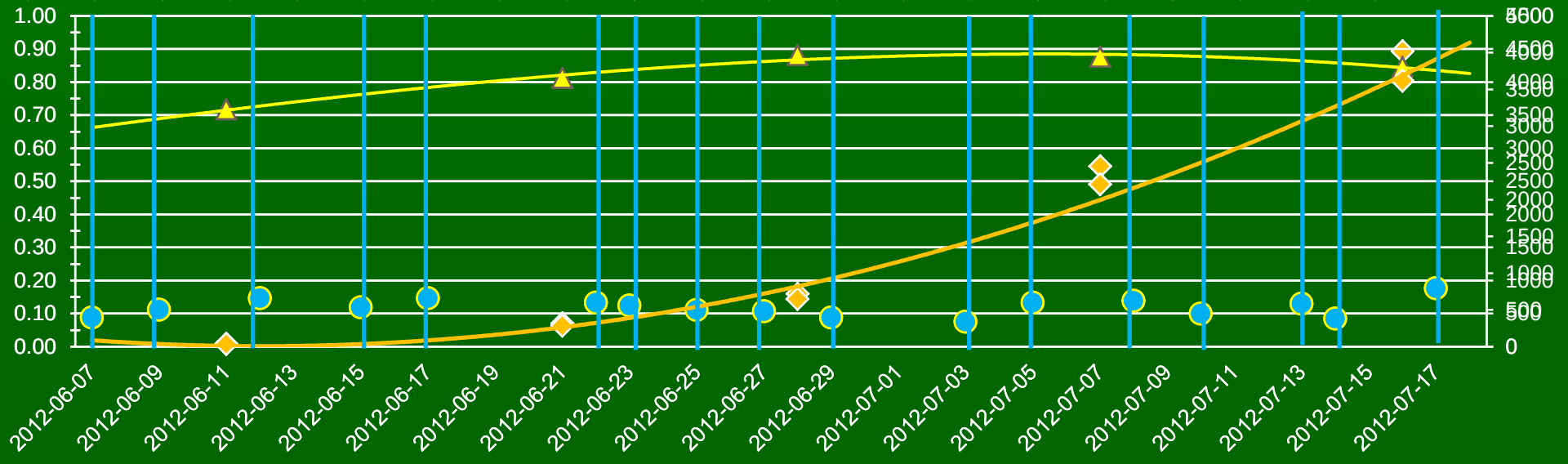
Biomass


Field 101
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
300
250
200
150
100
50
0
2012-06-07
2012-06-09
2012-06-11
2012-06-13
2012-06-15
2012-06-17
2012-06-19
2012-06-21
2012-06-23
2012-06-25
2012-06-27
2012-06-29
2012-07-01
2012-07-03
2012-07-05
2012-07-07
2012-07-09
2012-07-11
2012-07-13
2012-07-15
2012-07-17


Field 71
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2012-06-07
2012-06-09
2012-06-11
2012-06-13
2012-06-15
2012-06-17
2012-06-19
2012-06-21
2012-06-23
2012-06-25
2012-06-27
2012-06-29
2012-07-01
2012-07-03
2012-07-05
2012-07-07
2012-07-09
2012-07-11
2012-07-13
2012-07-15
2012-07-17

Biomass


1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
300
250
200
150
100
50
0
2012-06-07
2012-06-09
2012-06-11
2012-06-13
2012-06-15
2012-06-17
2012-06-19
2012-06-21
2012-06-23
2012-06-25
2012-06-27
2012-06-29
2012-07-01
2012-07-03
2012-07-05
2012-07-07
2012-07-09
2012-07-11
2012-07-13
2012-07-15
2012-07-17


1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2012-06-07
2012-06-09
2012-06-11
2012-06-13
2012-06-15
2012-06-17
2012-06-19
2012-06-21
2012-06-23
2012-06-25
2012-06-27
2012-06-29
2012-07-01
2012-07-03
2012-07-05
2012-07-07
2012-07-09
2012-07-11
2012-07-13
2012-07-15
2012-07-17

Weather

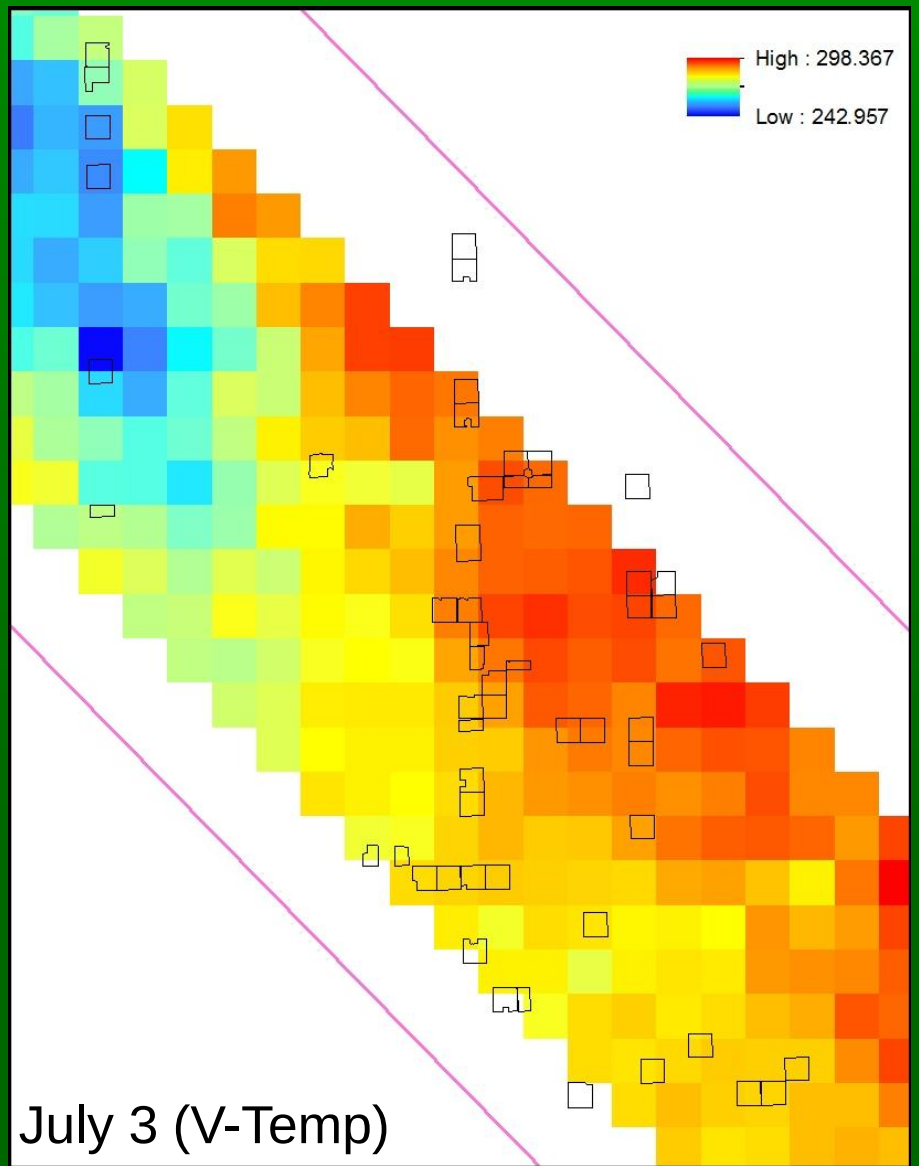
- Precipitation data from MAFRI, SAGES, WeatherFarm & EC
- Interpolate daily value for fields with no measured value
  - Daily totals synced with sampling times→ 7:00 am – 6:00 am
- Can be plotted against constant moisture values from USDA/MAFRI/SAGES

PALS

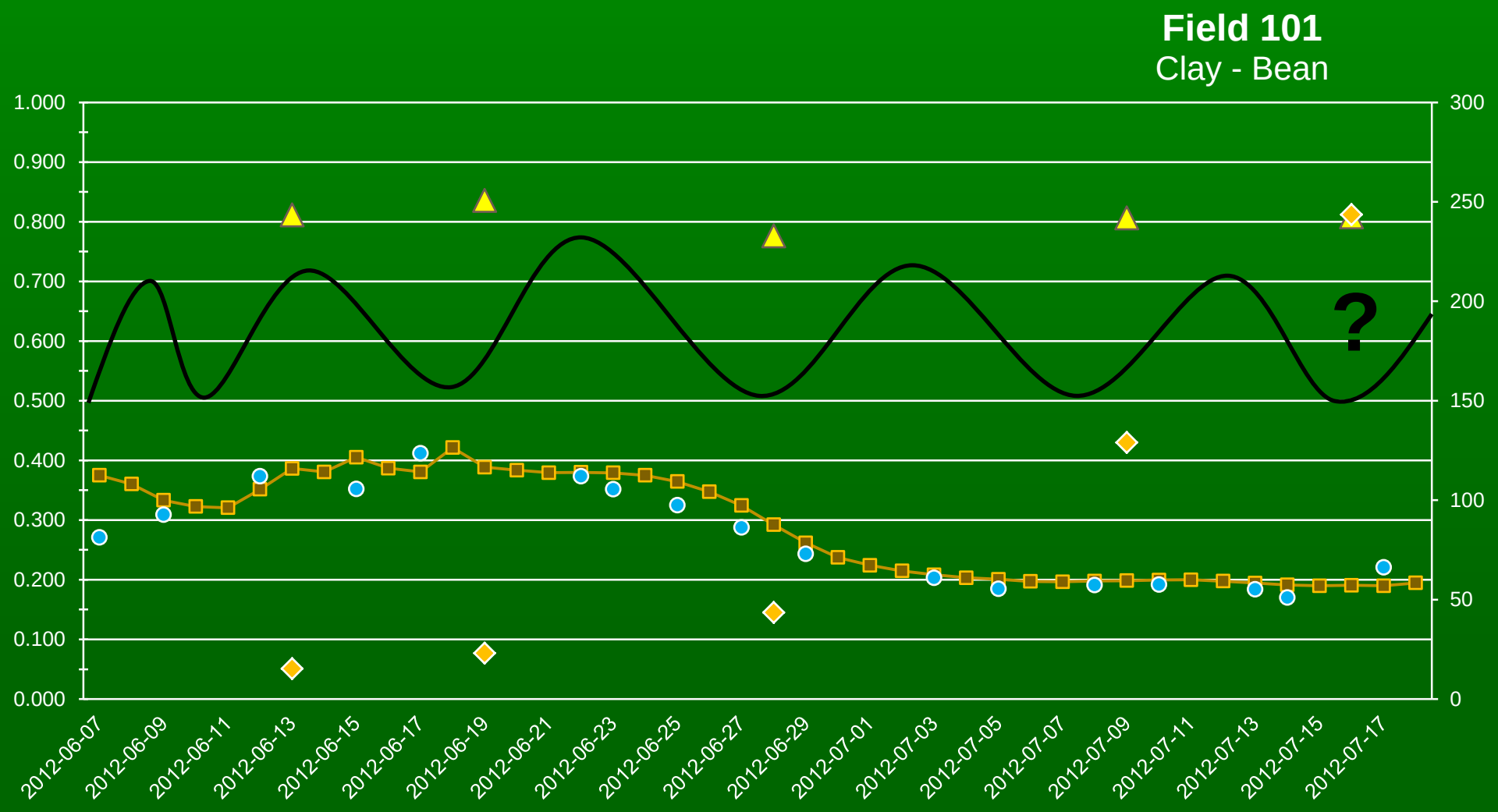
- Version 1 passive
  - H-Temp, V-Temp, RTIR
- Beta active
  - HH, VV, HV, VH polarization

- Use of a combined value assigned to field for each flight day

PALS



PALS


Field 101
Clay - Bean
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
300
250
200
150
100
50
0
?
2012-06-07
2012-06-09
2012-06-11
2012-06-13
2012-06-15
2012-06-17
2012-06-19
2012-06-21
2012-06-23
2012-06-25
2012-06-27
2012-06-29
2012-07-01
2012-07-03
2012-07-05
2012-07-07
2012-07-09
2012-07-11
2012-07-13
2012-07-15
2012-07-17

THANK YOU

Comments?

Questions?