Anticipating Success

Predicting Dates for Important Hive Events

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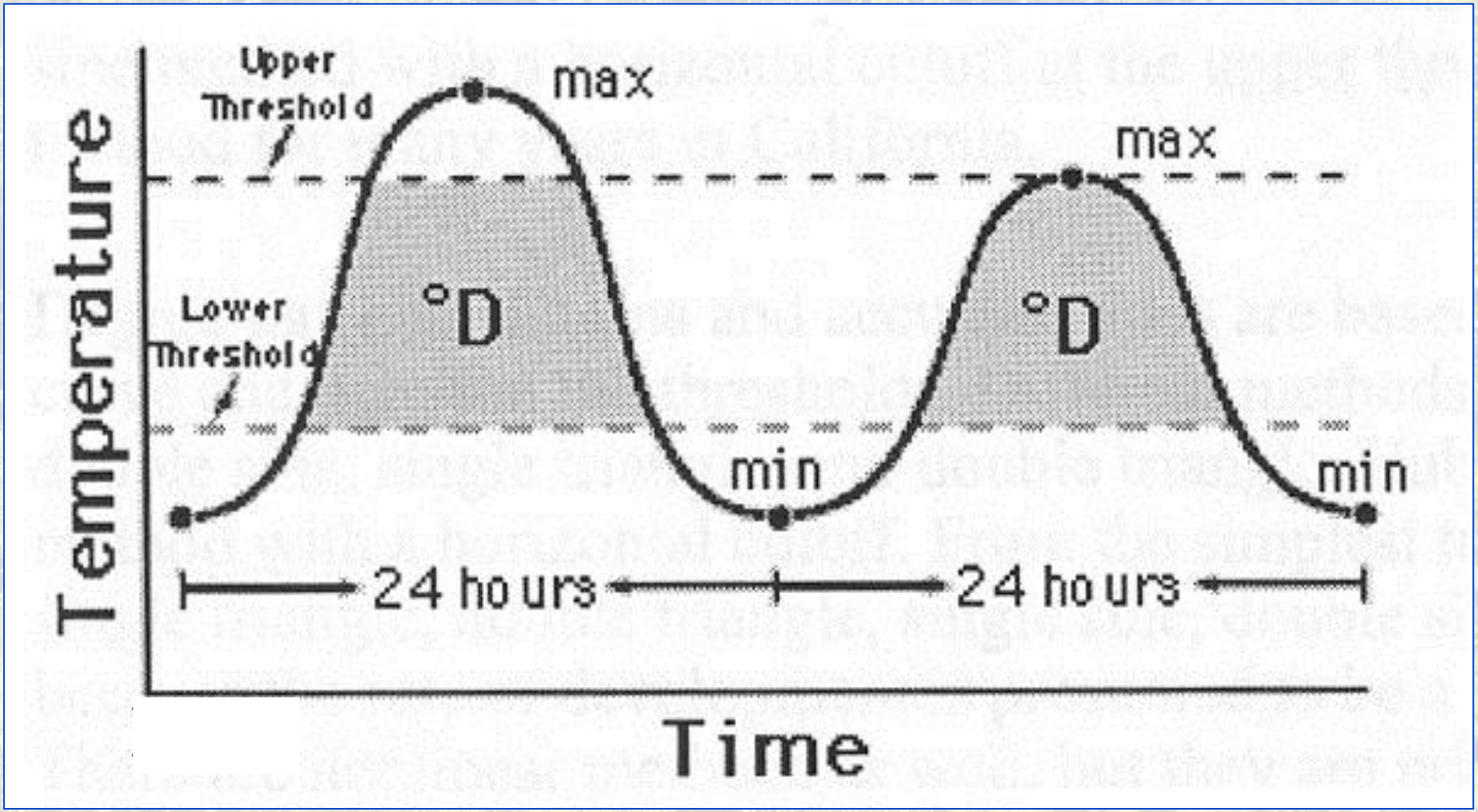
Winter Adaptation

- Cavity Dweller
- Food Storage
- Brood Suspension
- Life Span Extension
- Expandable Rectum
- Clustering Behavior

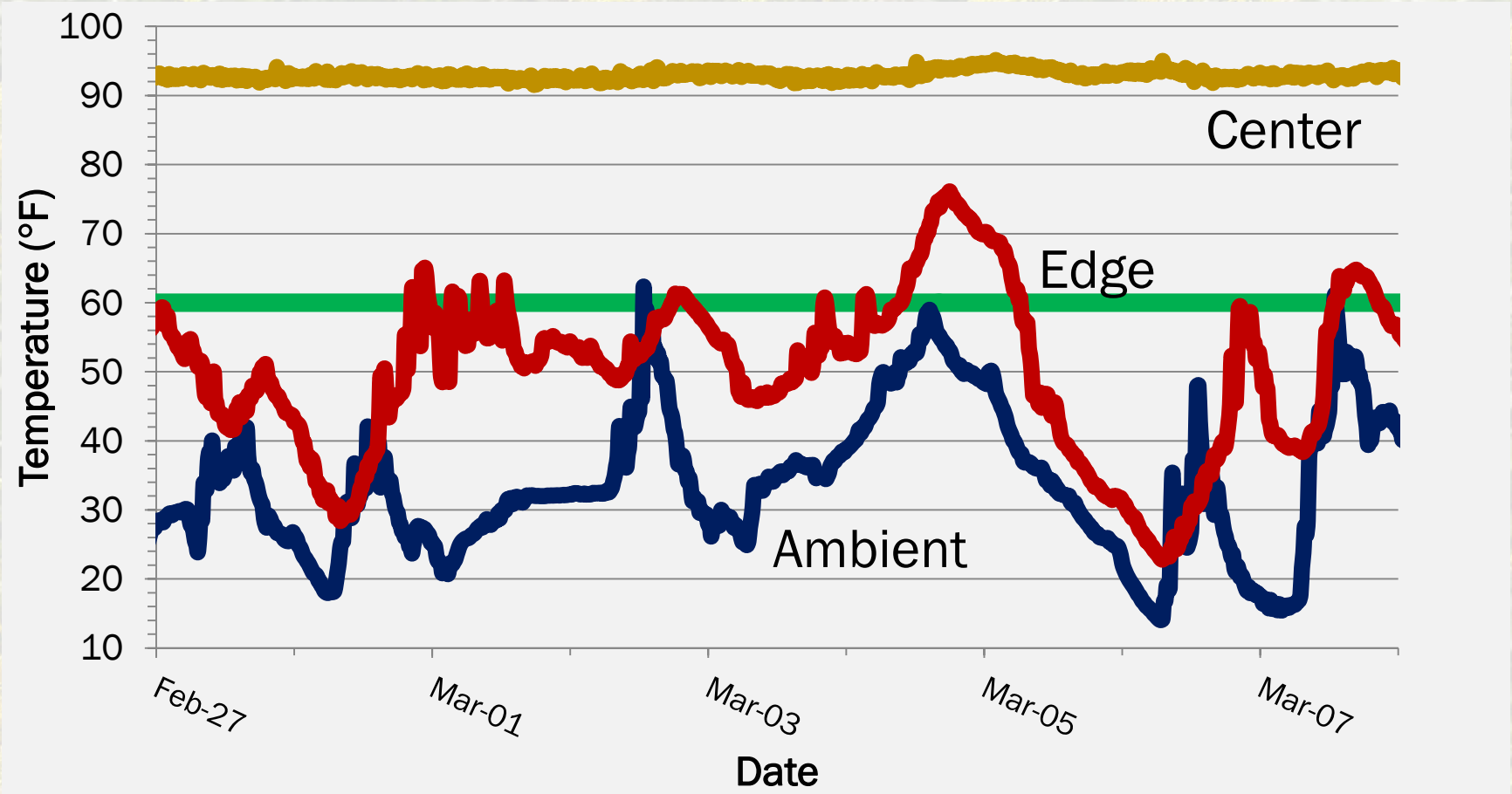
Temperature Threshold and Growth Rate Potential



Temperature Regulation

- Insect management
- Crop planting and harvest
- Designing orchards (and flower beds) for sequential bloom or fruit maturity
- Planning refuge plantings for beneficial insects
- Tracking global warming trends
- Predicting bloom dates (honey flow)

Winter Honey Bee Cluster and Hive Temperatures with Brood Present



Average Cluster Temperature: 93.1 ± 0.02 °F
Average Edge Temperature: 52.4 ± 0.36 °F
Average Ambient Temperature: 34.4 ± 0.32 °F

Predicting Bloom Dates

- Day length and other environmental factors can affect specific events in a plants life cycle
- Different cultivars frequently have different bloom periods
- Bloom Prediction Models include:
  - Calendar Date
  - Day length
  - Last frost date
  - Growing Degree Days (GDD)

Predicting Bloom Dates

- Plant growth responds to accumulating heat units to some degree.
- Bud swell, leaf emergence, flowering, fruiting, and other growth stages can be correlated to the cumulative daily temperature.
- Bloom dates correlates more precise when using Growing Degree Days (GDD).

Growing Degree Days

- Calculated from Average of daily maximum, T_{max}, and minimum, T_{min}, temperatures compared to a base temperature, T_{base}.
- GDD= $((T_{max} + T_{min})/2) - T_{base}$.
- T_{base} temperatures of 50°F or 60°F.
- Mean daily temperature lower than the base temperature GDD=0.
- Maximum temperature capped at 86°F.
- Minimum temperature limited to T_{base}.

Growing Degree Days

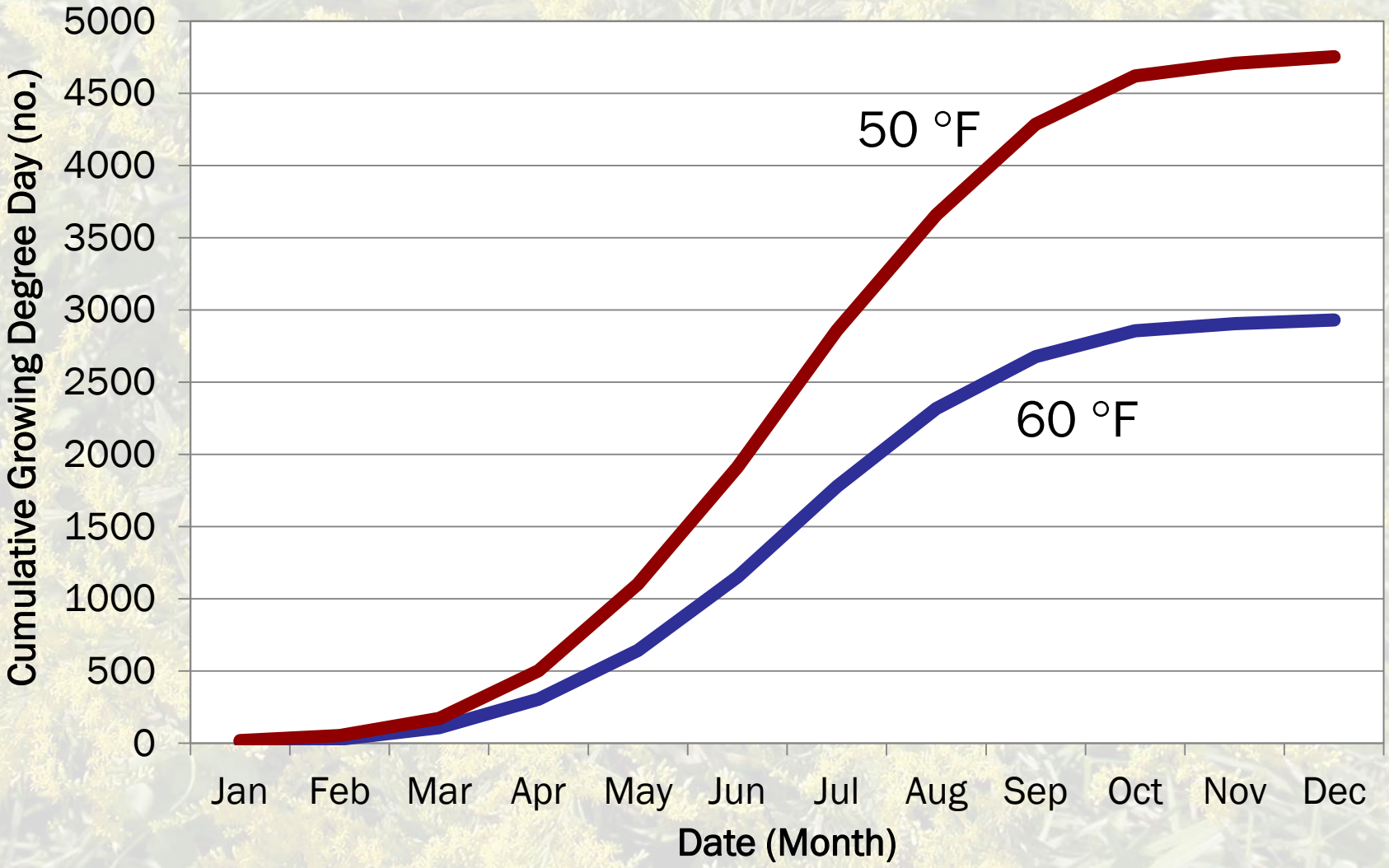
- High = 80 °F
- Low = 60 °F
- GDD = 80 plus 60 divided by 2 (70) minus 50 = 20

- High = 48 °F
- Low = 28 °F
- GDD = 50 plus 50 divided by 2 (50) minus 50 = 0

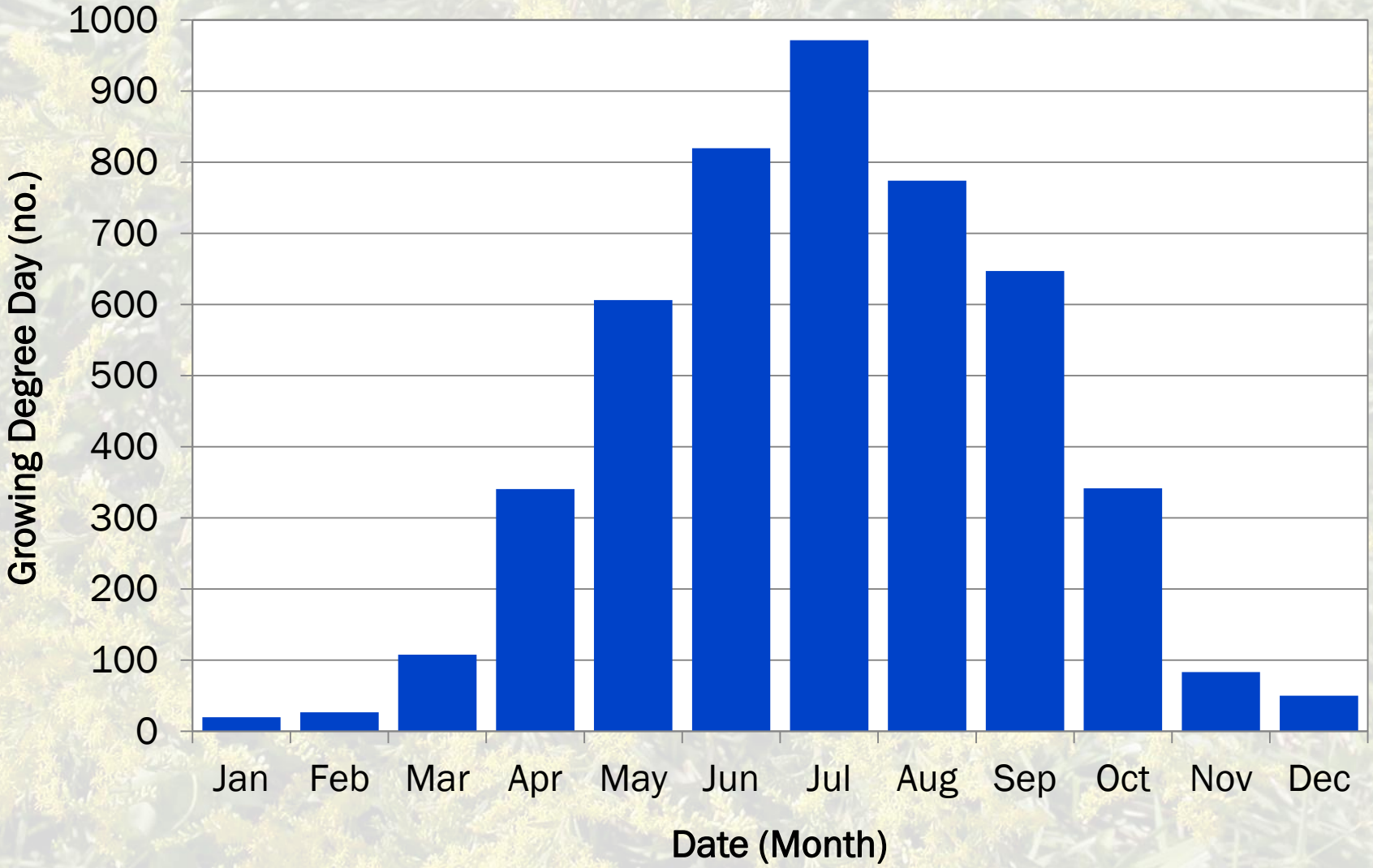
- High = 60 °F
- Low = 45 °F
- GDD = 60 plus 50 divided by 2 (55) minus 50 = 5

- High = 90 °F
- Low = 70 °F
- GDD = 86 plus 70 divided by 2 (78) minus 50 = 28

Growing Degree Days in Colonial Heights, VA



Growing Degree Days[1] in Colonial Heights, VA



[1]Accumulated value for the average daily temperature minus a base or minimum temperature of 50°F.

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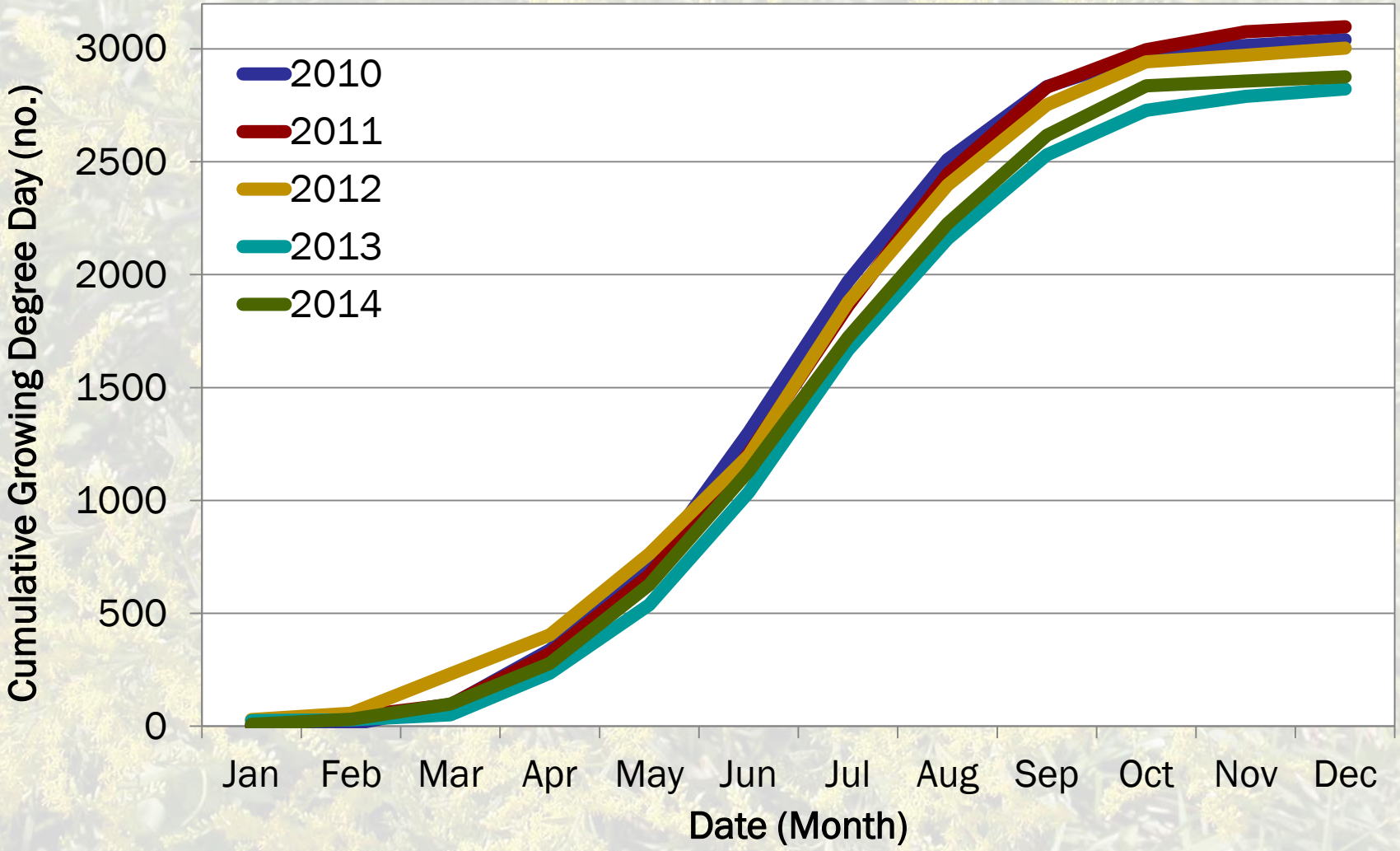
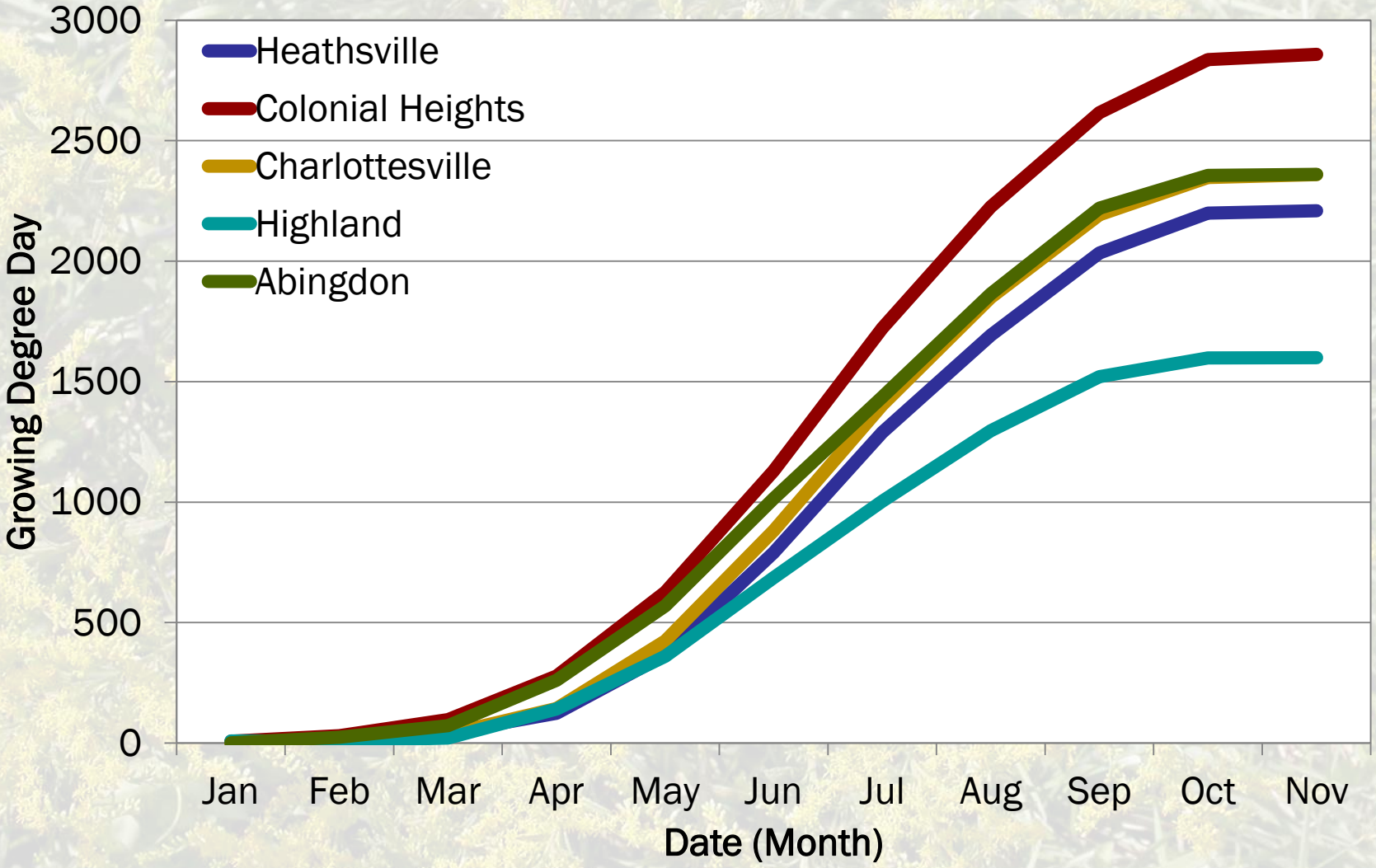


[1]Accumulated value for the average daily temperature minus a base or minimum temperature of 60°F.

2014 Growing Degree Days[1] in Virginia Regions



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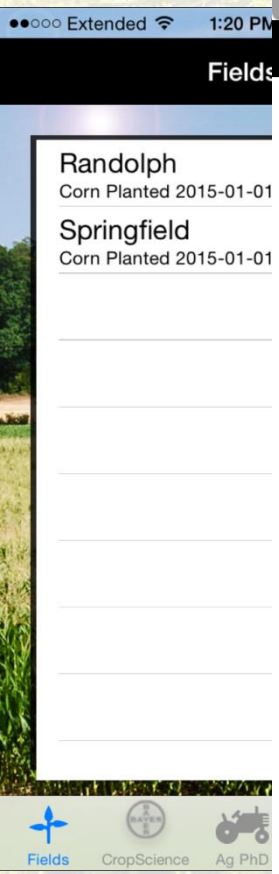
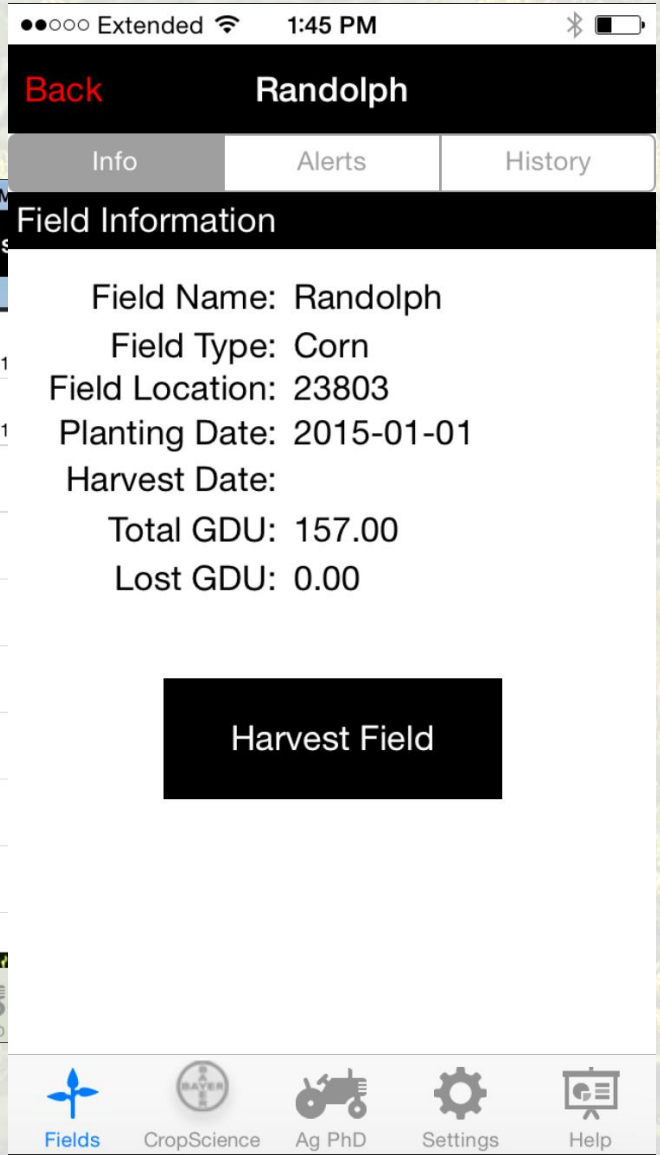
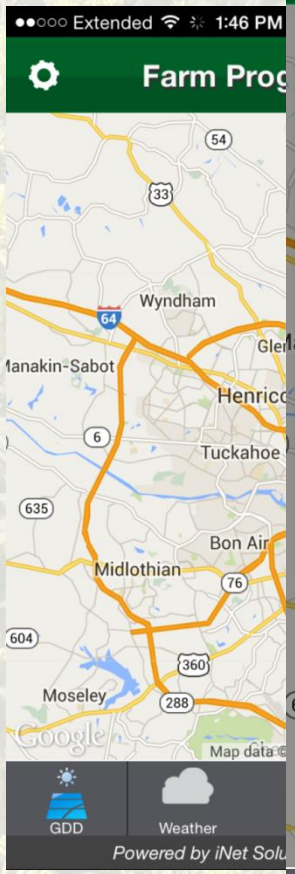
Growing Degree Day Information

- University of Virginia Climatology Office:
  climate.virginia.edu/online_data.htm
- The Weather Channel:
  www.yourweekendview.com/outdoors/agriculture/growing-degree-days
- Dupont Pioneer:
  www.pioneer.com/home/site/ca/agronomy/tools/gdu
- USA National Phenology Network: www.usanpn.org
- Weather Underground : www.wunderground.com/history/airport/
- Farm Progress: Mobile App (iTunes, Google Play)
- Ag PhD GDU Calculator: Mobile App (iTunes, Google Play)

GDD Mobile Apps



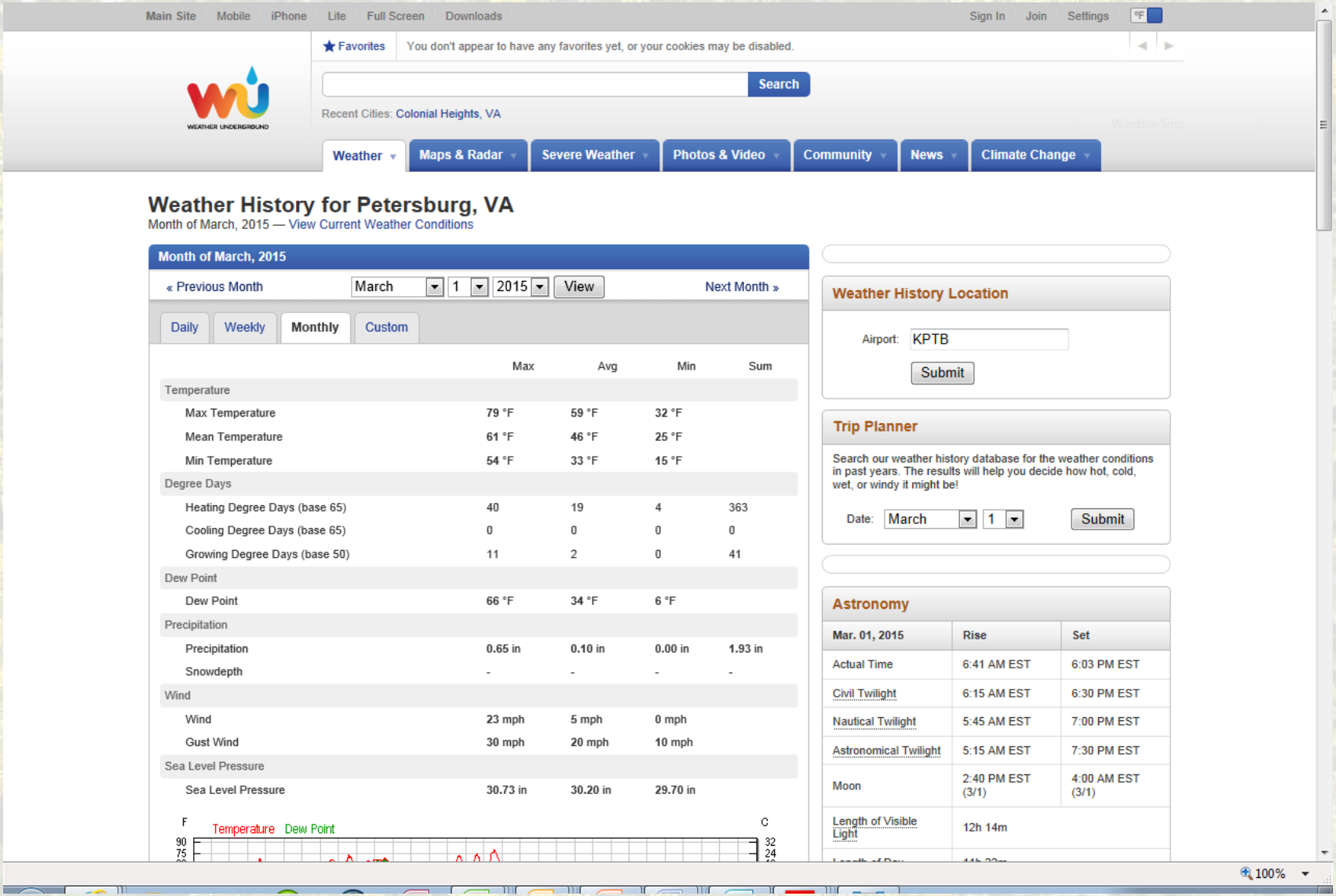




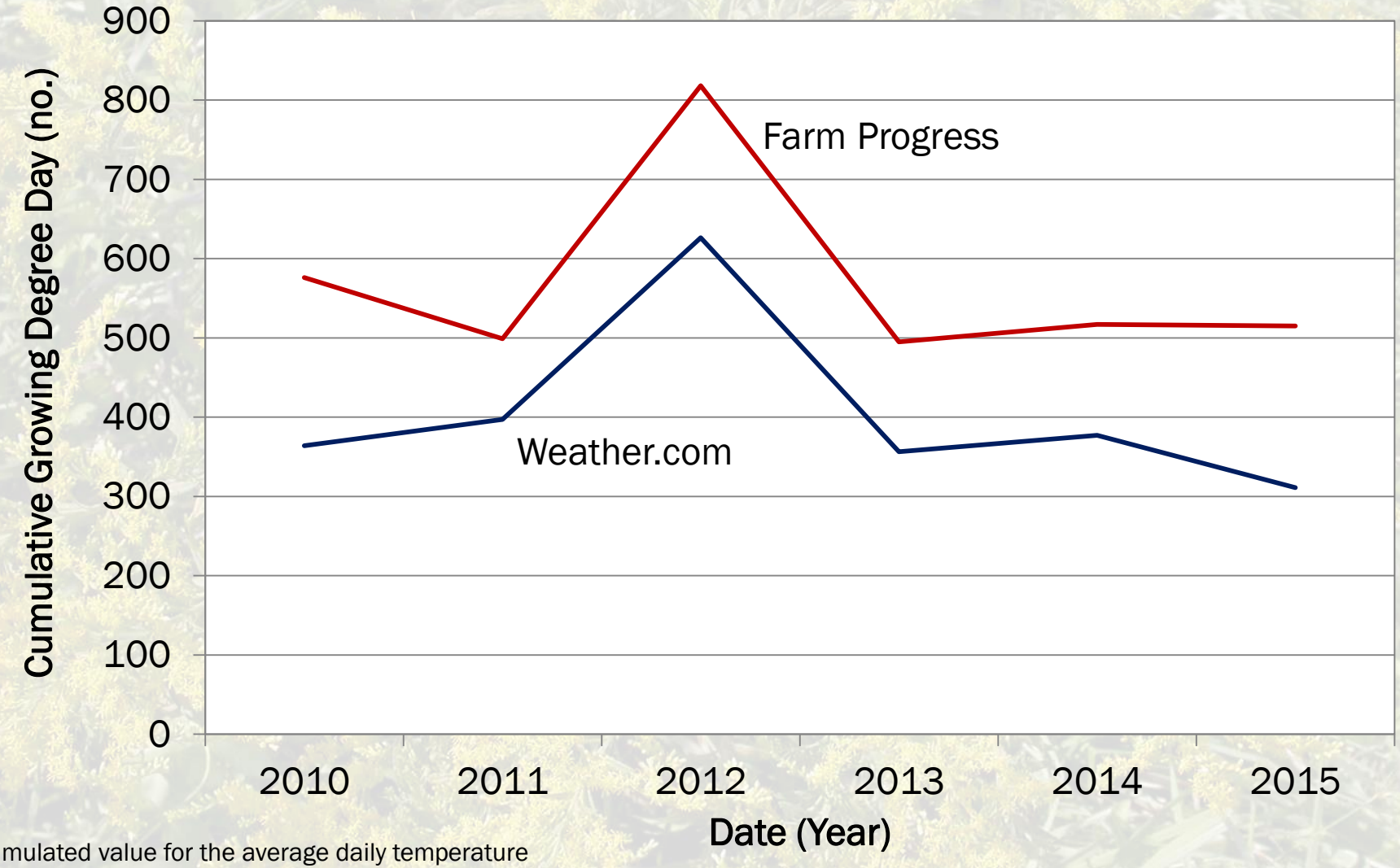
Airport Weather Information

City served	FAA	ICAO	Airport name
Wise	LNP	KLNP	Lonesome Pine Airport
Winchester	OKV	KOKV	Winchester Regional Airport
Williamsburg	JGG	KJGG	Williamsburg-Jamestown Airport
West Point	FYJ	KFYJ	Middle Peninsula Regional Airport
Washington, D.C. / Manassas	HEF	KHEF	Manassas Regional Airport (Harry P. Davis Field)
Washington, D.C. / Chantilly / Dulles	IAD	KIAD	Washington Dulles International Airport
Washington, D.C. / Arlington County	DCA	KDCA	Ronald Reagan Washington National Airport
Warrenton	HWY	KHWY	Warrenton-Fauquier Airport
Wallops Island	WAL	KWAL	Wallops Flight Facility (NASA)
Virginia Beach	NTU	KNTU	NAS Oceana (Apollo Soucek Field)

Weather Underground



Growing Degree Days in Colonial Heights, VA, on April 22nd



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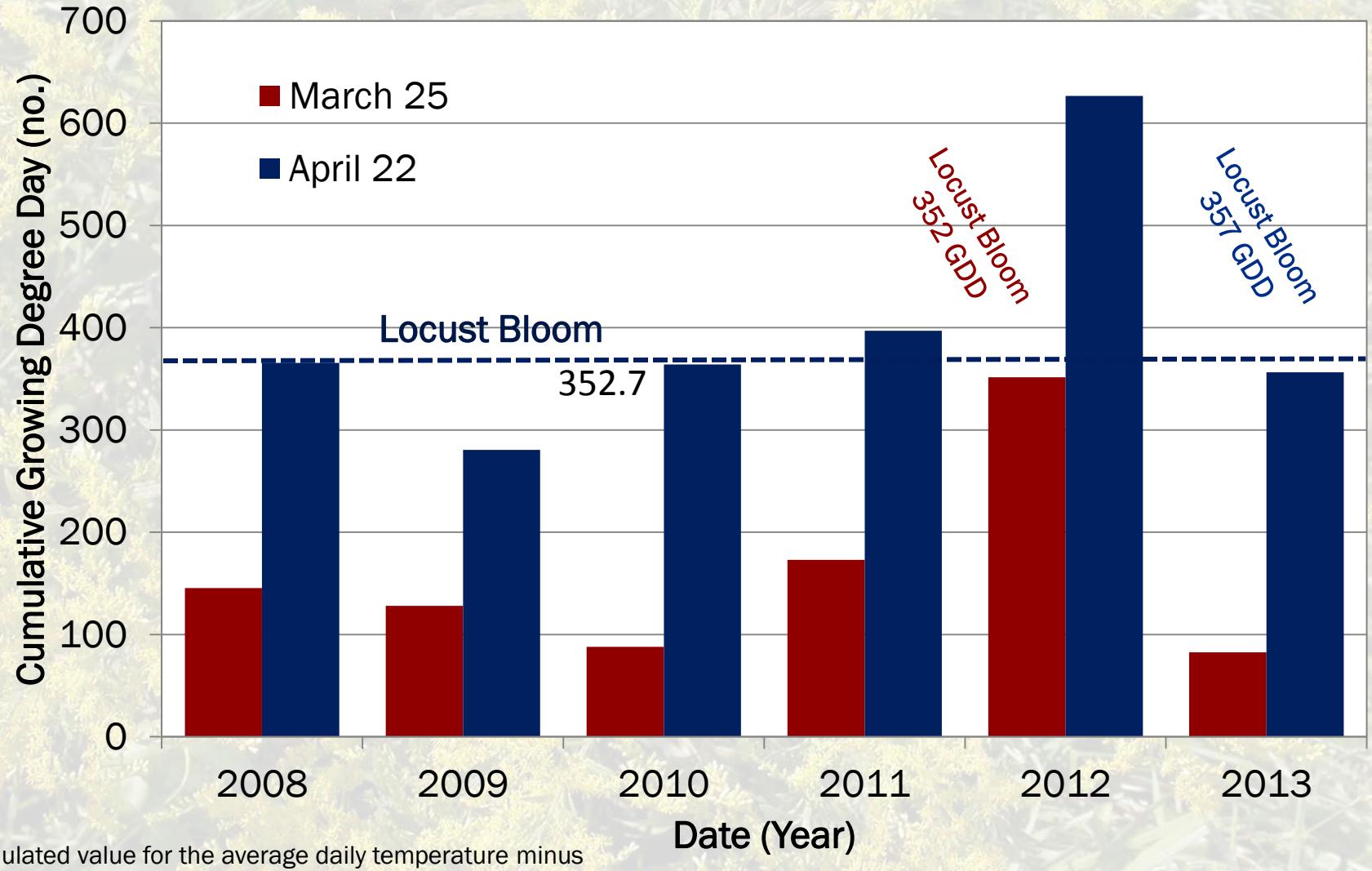


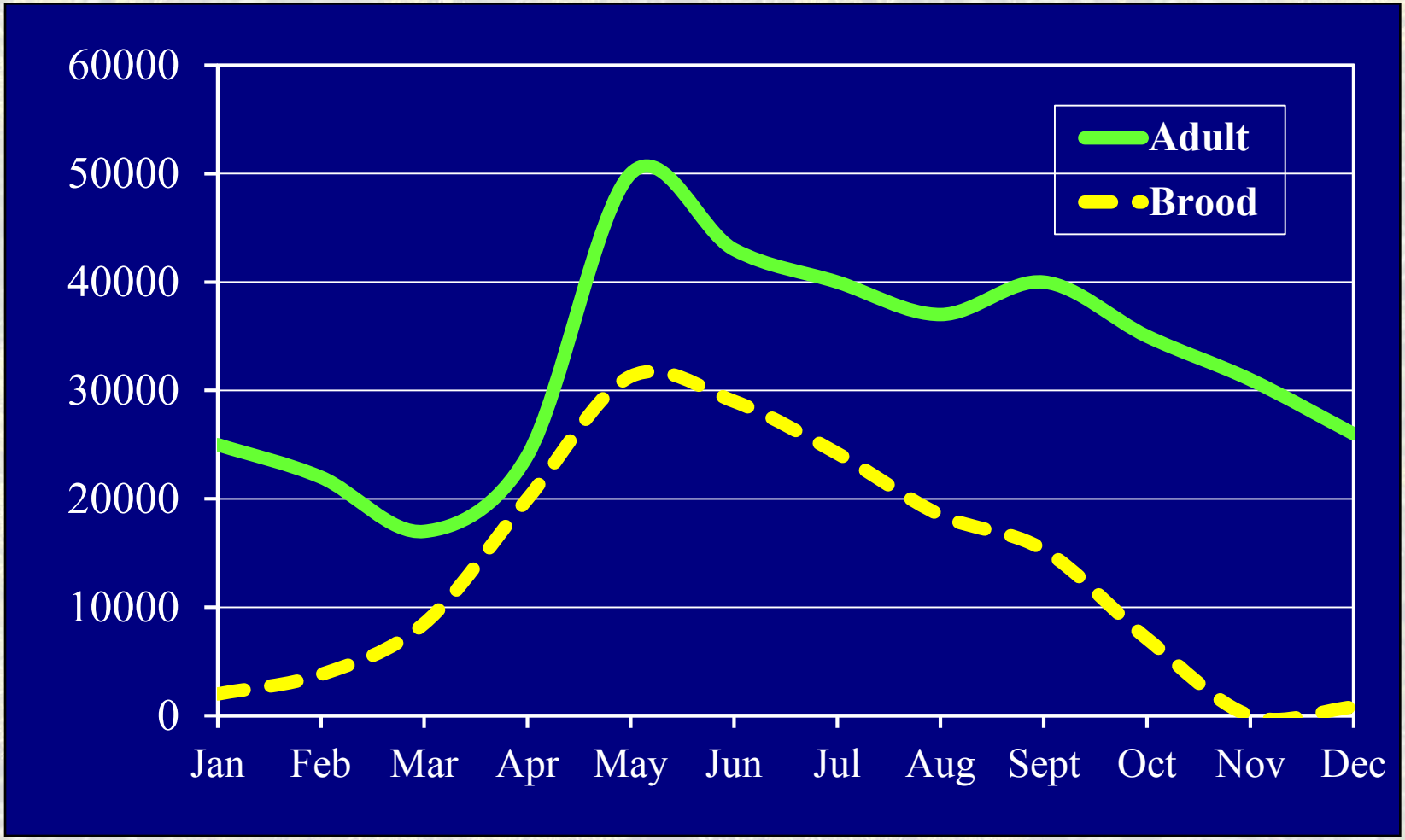
[1]Accumulated value for the average daily temperature minus a minimum base temperature of 50°F from Weather.com.

Key Phenological Events to Track

First bloom: date first flower on the plant opens to reveal pistils and/or stamens.

Full bloom: date 95% of flowers have opened (e.g. 1 out of 20 buds remains closed).

Honey Bee Annual Colony Population in Virginia



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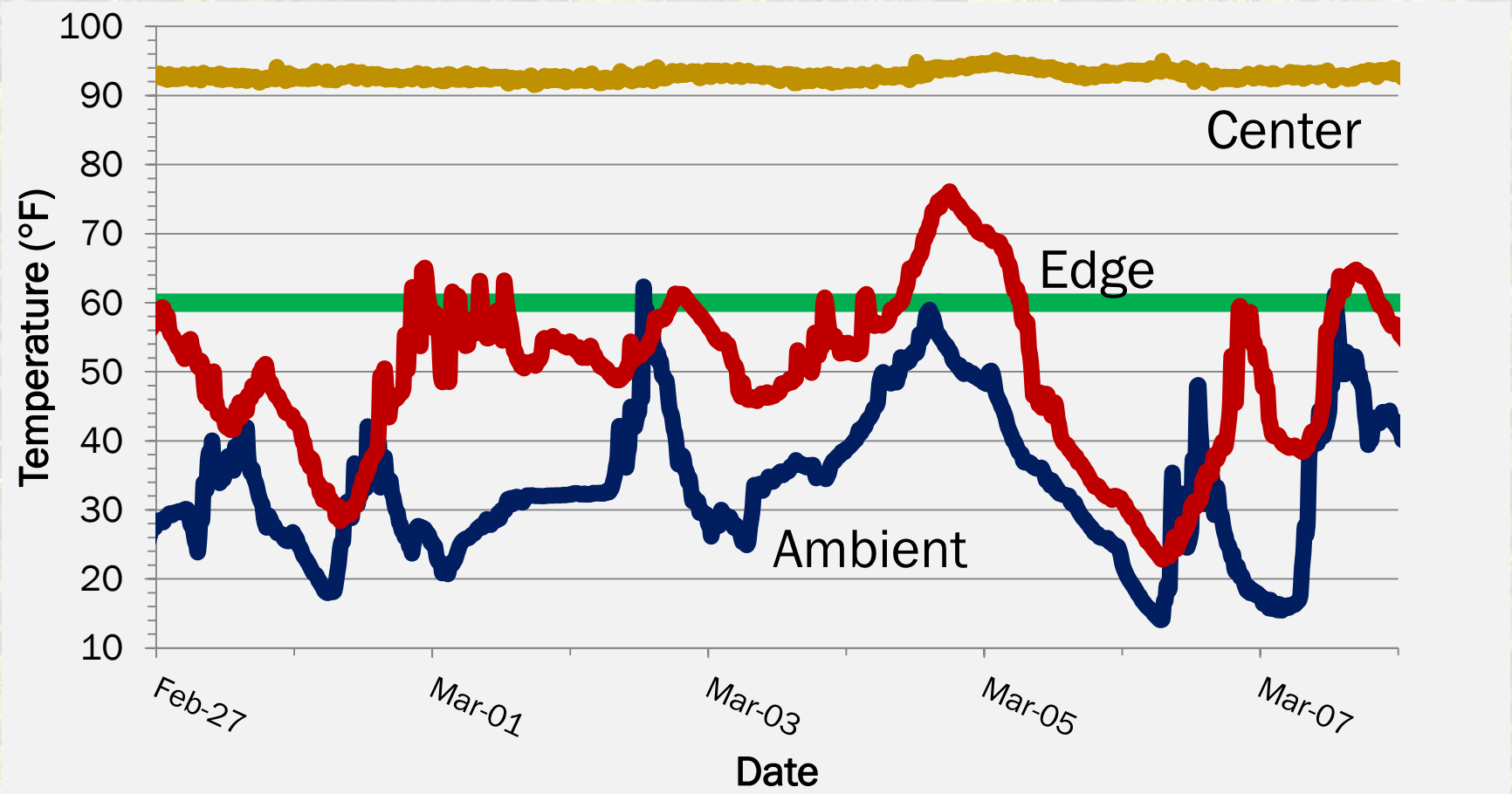

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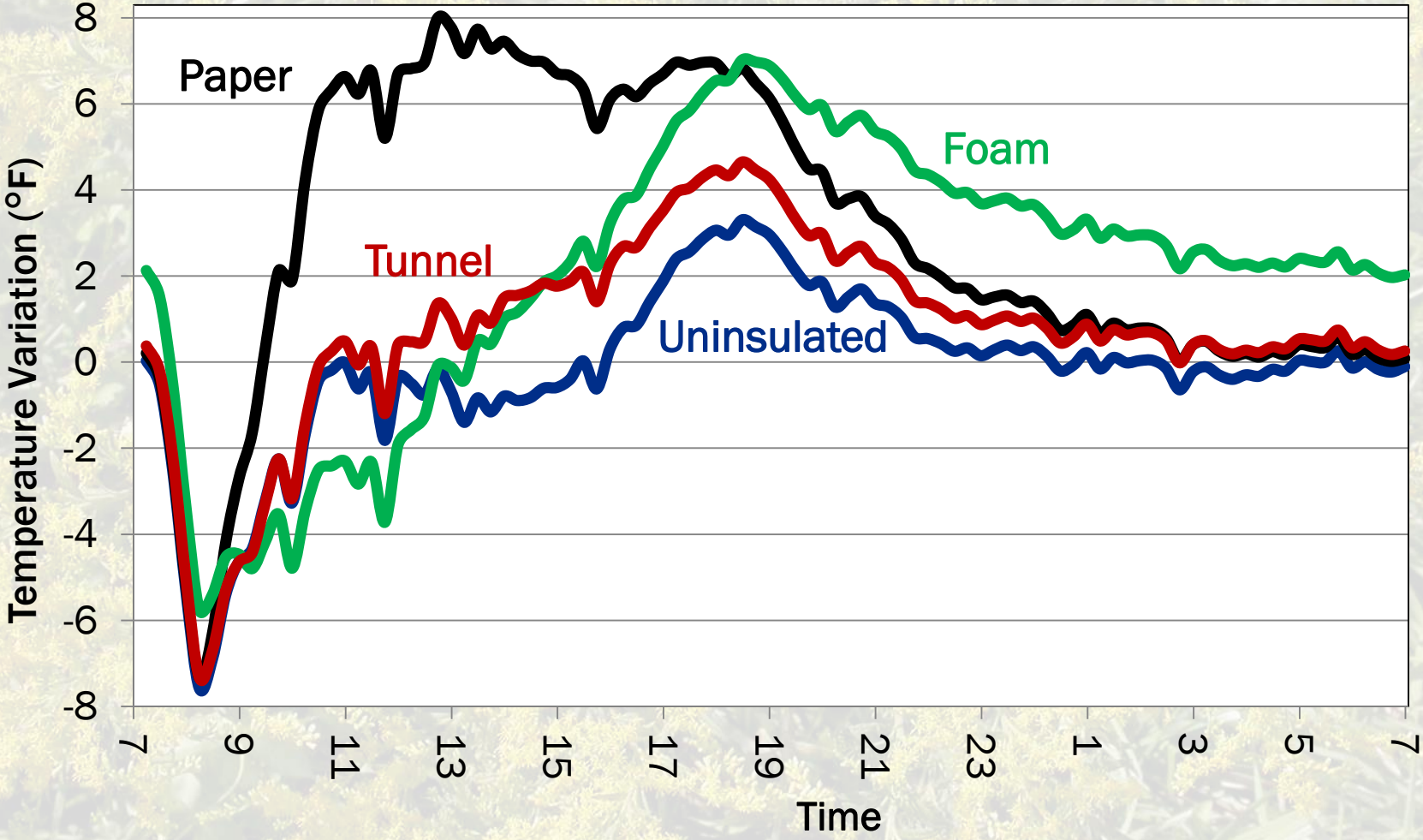
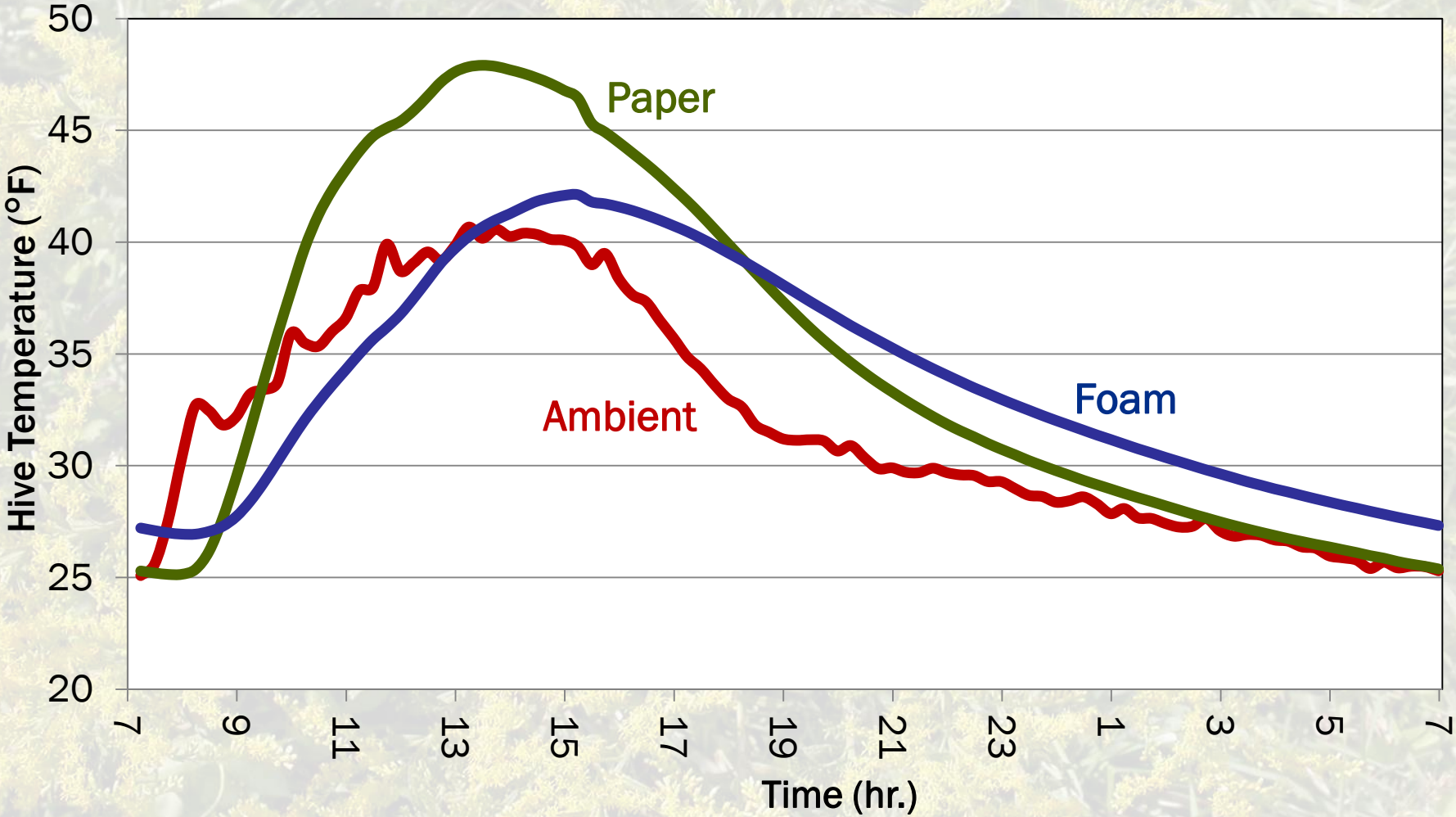
Passive Heat Retention in Bee Hives

Temperature Variation and Retention in Insulated Hives



Glen Allen, VA, January 2016; sunrise ~ 07:19; sunset ~ 17:25

Internal Temperatures in Wrapped Hives



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