Drones for Cranberry Growers and IPM

Taking the next steps to integrating technology on the bogs

Drones are intriguing…

New technology so lots of questions!

- How much do they cost?
- What can they do?
- How can I use them on my bogs?
- Is it worth it to me financially to get one?
- Can I fly them or do I have to hire someone?

Not Toy Drones

- Any drone that should or can be used for agricultural purposes is not a toy!
- There are some recreational drones that can be used for visual inspections, weed identification, sprinkler coverage, etc., available.

Consumer level drones with cameras	DJI Phantom 4	Parrot Bebop 2	Holy Stone	UDI U818A	3D Robotics Solo
					
Cranberry Rating	●●●●●	●●●●	●●●	●●	●●●●
Bottom Line	Best quadcopter on the market right now. Top seller in its category.	Somewhat limited range (~1/2 mile), but bundle packages and vivid image production make it a worthwhile investment for novices.	Good choice for novices. Has ample features and affordable price.	Performs well in most settings.	A stable, well-made drone. Good video. Worth considering if you don't mind the few issues.
Pros	Unmatched performance and overall reliability. Offers numerous high-tech features that separate it from the rest of the pack.	Superb video quality and an accessory package that includes cockpit goggles for a real-flight experience. Easy to fly, and app is easy to program to control distance and height.	Excellent feature set, including Wi-Fi compatible HD camera, hover setting, and reliable flight controller. Easy to navigate in most settings.	High-capacity battery and multi-channel function separate this copter from the rest. You get a lot of features for the price.	User-friendly controls. Flies smoothly and uses GoPro. Durable and easy to use. Owners report no major damage despite crashes.
Cons	Complicated instructions mean a steep learning curve.	Range is not as far as costlier models (about 1/2 mile).	The app occasionally has some issues, and the battery life is poor. Wind may throw it off course.	Doesn't fly well in windy conditions.	Set-up is difficult and time-consuming. Doesn't hold a charge long.
Price	**$899 - $1,200**	**$399 - $599**	**$140 - $230**	**$60 - $120**	**$290 - $490**

Simple visual monitoring

Aerial imaging allows you to inspect large scale patterns in you beds – Like drainage, weed patches, fertilizer issues, etc. These images can be collected easily by most mid- to high-range recreational drones.

Agricultural Drones

Mapping drones

1. Fixed wing or multi-rotor
2. Used for imaging crops
3. Multiple types of cameras available
4. Less expensive than spray drones

Spray drones

1. Multi-rotor only
2. Used for delivering pesticide sprays
3. Only visible camera
4. Most expensive drones

Mapping Drones

What will I need for mapping my bogs?

- Agriculture drones are advanced data-gathering tools for serious professionals.
- Prices for complete, ready-to-fly ag drone systems range from $1,500 to well over $25,000.
- There are two types of **professionals who might want to own an agriculture drone**:
  - **farmers** who want to fly their own imaging missions; and,
  - **agriculture service providers** and others who fly drones *for* farmers.
- **The FAA views *all* agricultural drone activity as *commercial drone operation.***
- **This means <u>the drone operator must have a Remote Pilot Certificate</u> to fly.** This is true, *even if no money changes hands*.
- For the FAA's pilot requirements, check out **FAA Regulations (Part 107).**

Ag Mapping Drones	**senseFly eBee SQ** 	**PrecisionHawk Lancaster 5** 	**DJI Smarter Farming Package** 	**Sentera NDVI Upgrade for DJI Phantom 4 PRO** 	**AGCO Solo** 
Type	Fixed wing	Fixed wing	Multi-rotor	Multi-rotor	Multi-rotor
Camera	5-spectrum sensor. Four spectral bands (red, green, NIR, IR) and visible/RGB).	Multi spectral camera. Carries on-board sensors that measure humidity, temperature, air pressure along with incident light, all in real time.	NIR plus visible/RGB unlike the Sentera NDVI upgrade, this DJI warranty remains valid.	DJI Phantom 4 PRO plus a NIR camera. Two downsides: have to ship your Phantom quad to Sentera to perform the upgrade; and, attaching a second camera voids DJI's warranty.	Includes a GoPro Hero 4 camera for color imaging and a GoPro near-infrared camera for monitoring plant health.
Coverage Control range	500 acres 1.86 mi range	300 acres 1.2 mile range	< 50 acres 3.1 mile range	< 50 acres 3.1 mile range	< 50 acres 2000 ft range
Flight time	55 min	45 min	28 min	28 min	25 min
Price	**$12,000+**	**$25,000+**	**$8,300**	**$2,000+**	**$7,850**

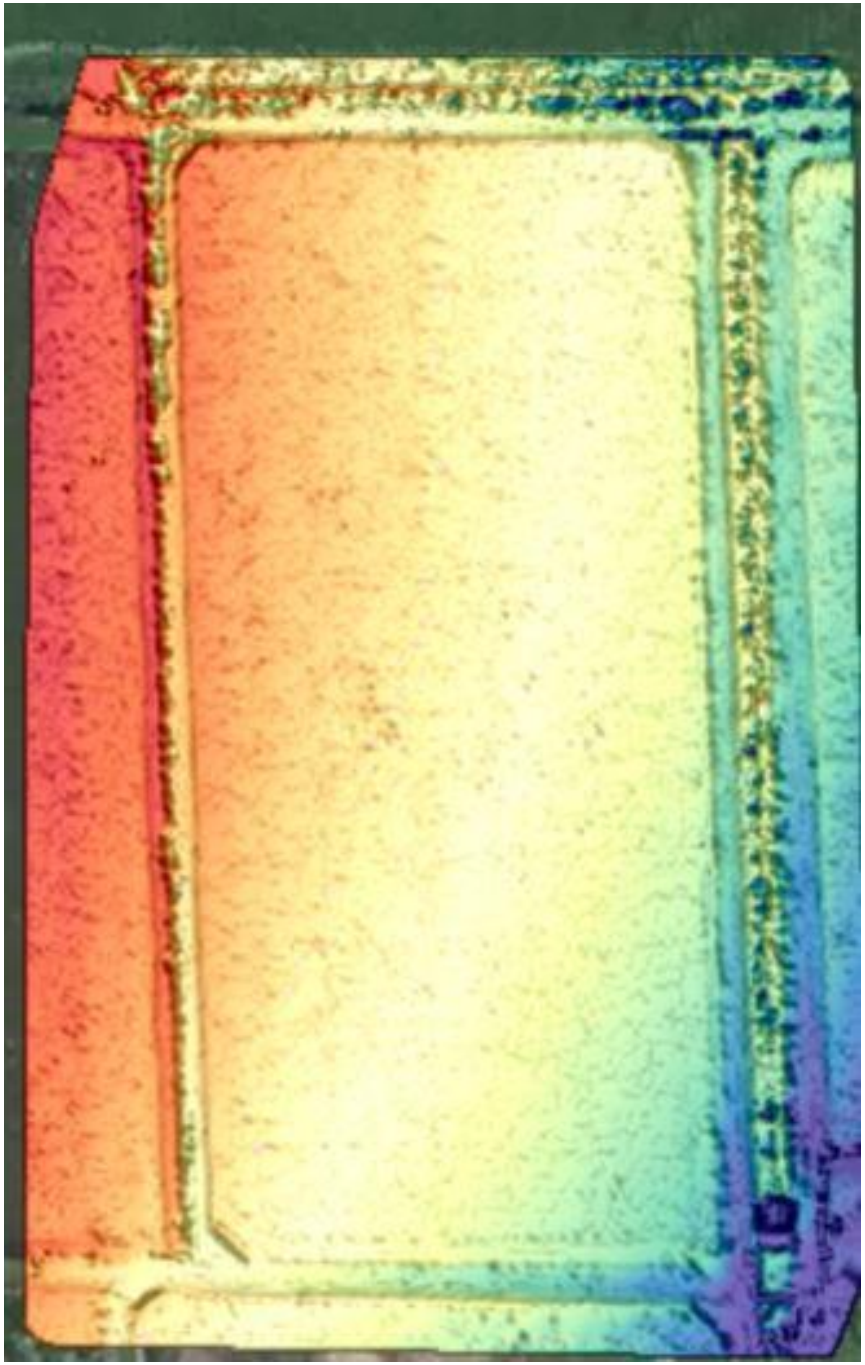
How can drone data assist cranberry growers?

Drones are used to gather a variety of image-based data about the condition of bogs. **Drone data is used to farm more effectively** and efficiently, including:

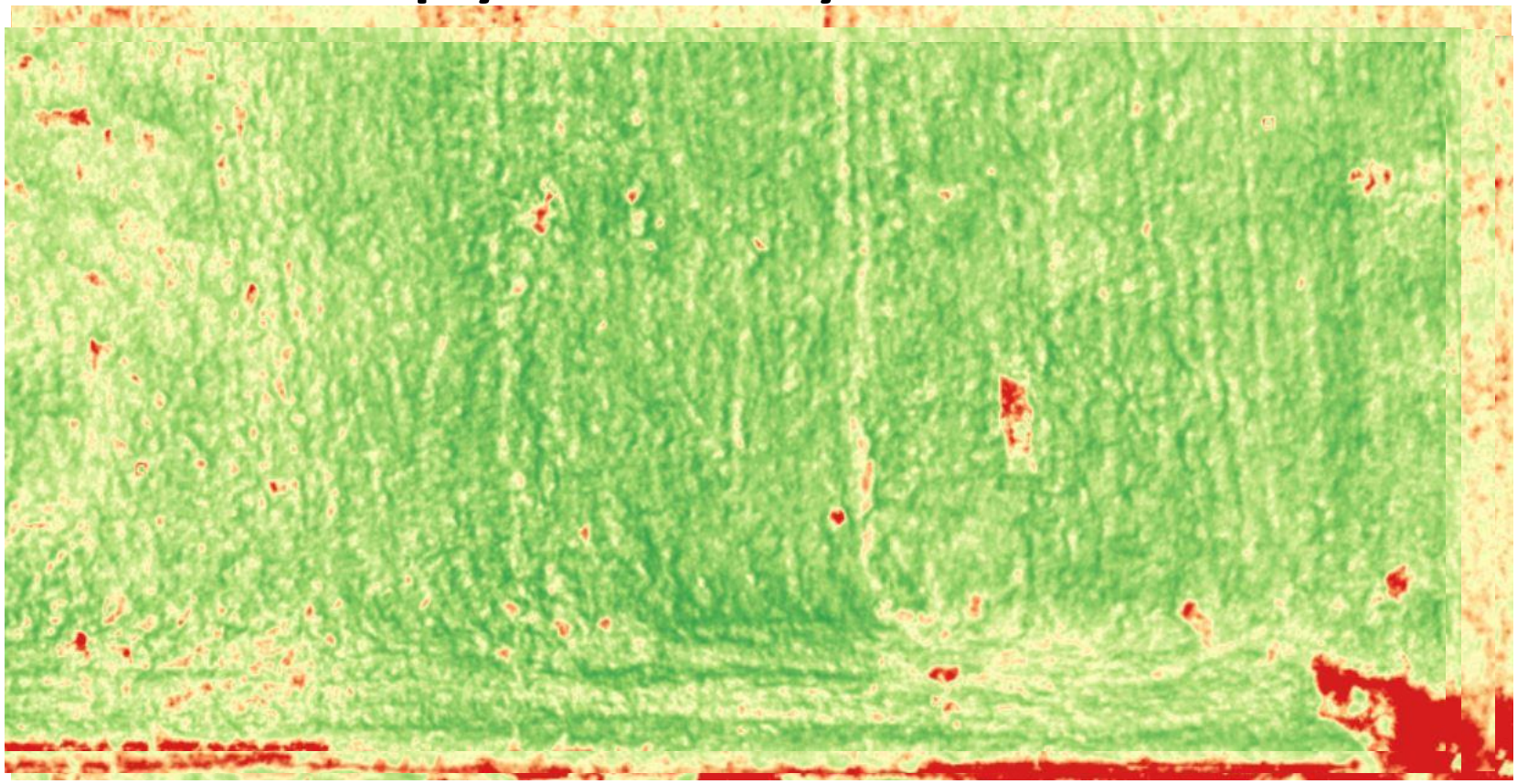
- Identification of crop stresses and yield-limiting issues;
- Irrigation efficiency and water management;
- Early detection of plant diseases and pests;
- Monitor growth rates and predict yield;
- Tracking overall crop health (vigor) through the growing season;
- Detecting the early onset of noxious and invasive weeds;
- Optimizing inputs such as fertilizers; and
- Assessing canopy coverage and bloom count density.

Frost protection uniformity

Elevation mapping



Canopy density over time



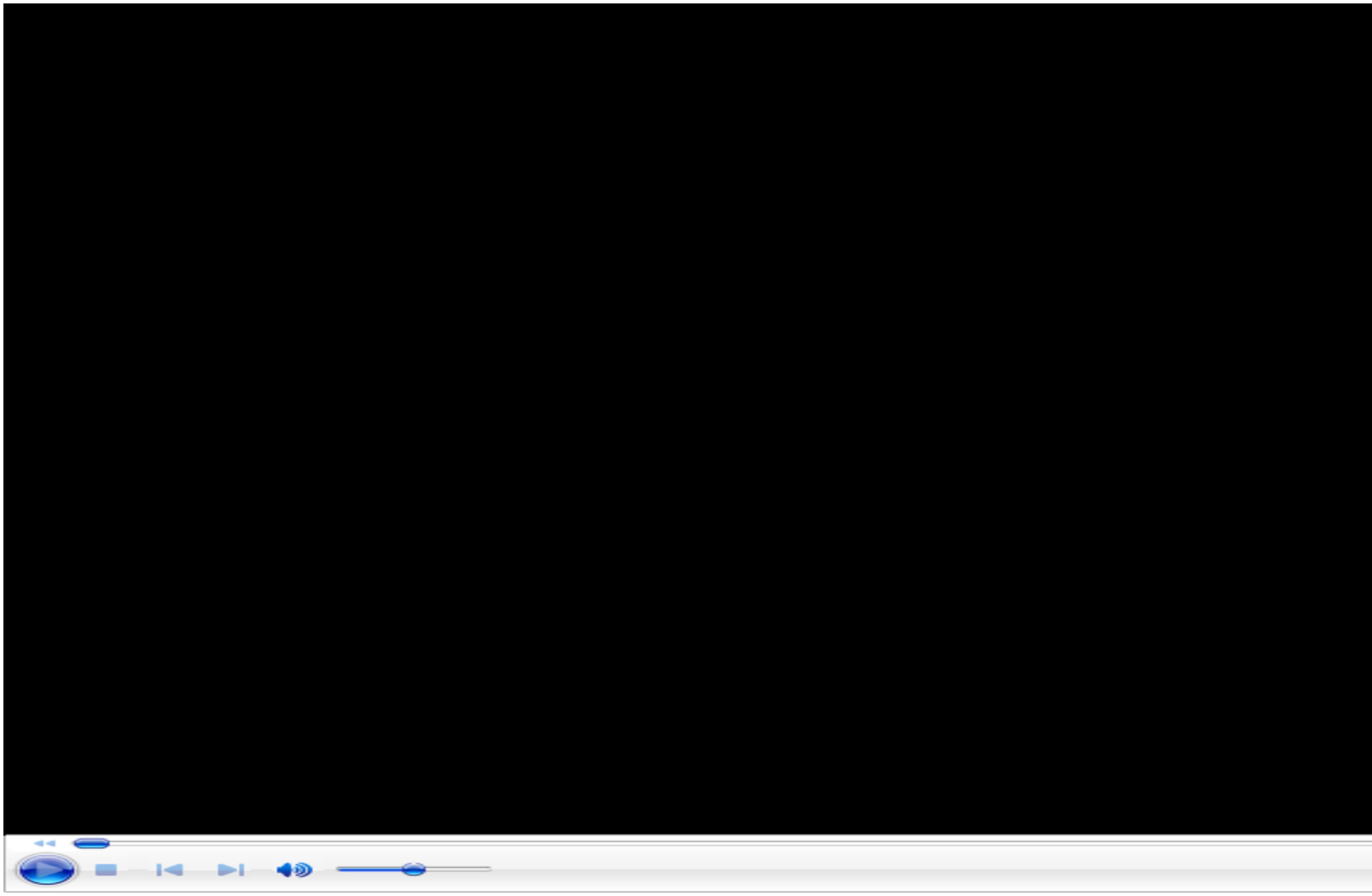
Spray Drones

What can they do?

- Even coverage of sprays – even reaching underside of leaves
- Reduce labor and associated costs
- Typically cover 7-10 acres per hour
- Ability to geotag areas/weeds/patches for specific spot sprays
- Minimizes overspray common in chemigation systems

DJI Agras MG-1s

- $18,000
- Spray 7-10 acres/hr
- Holds 2.6 gallons of liquid pesticide
- 16’ spray width at 10’ flying height
- Empty tank warning and operation resumption
- DJI Agras MG-1s Video

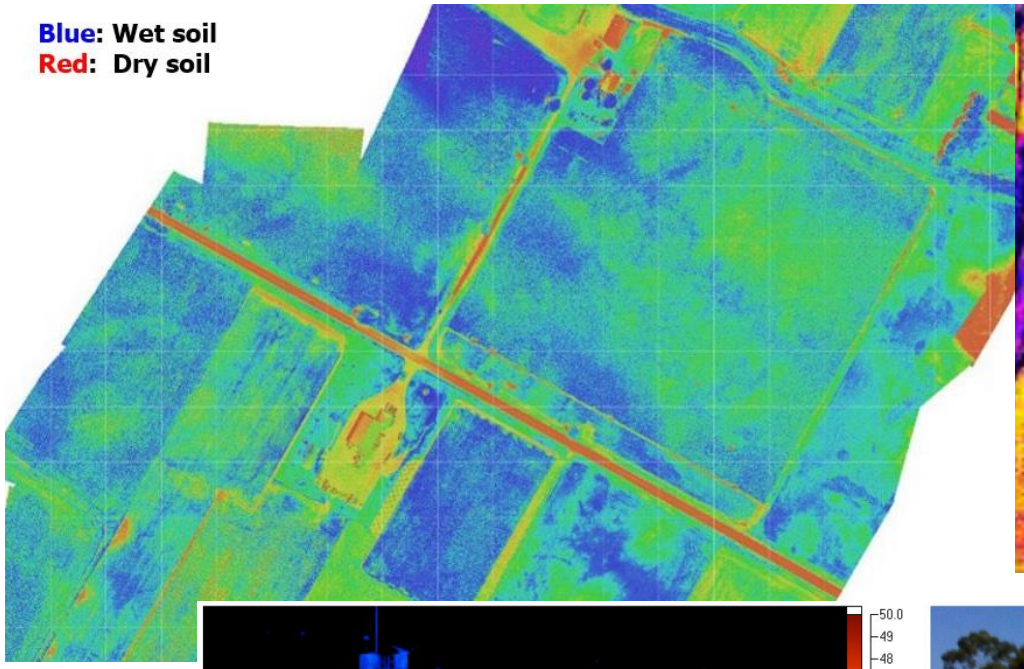


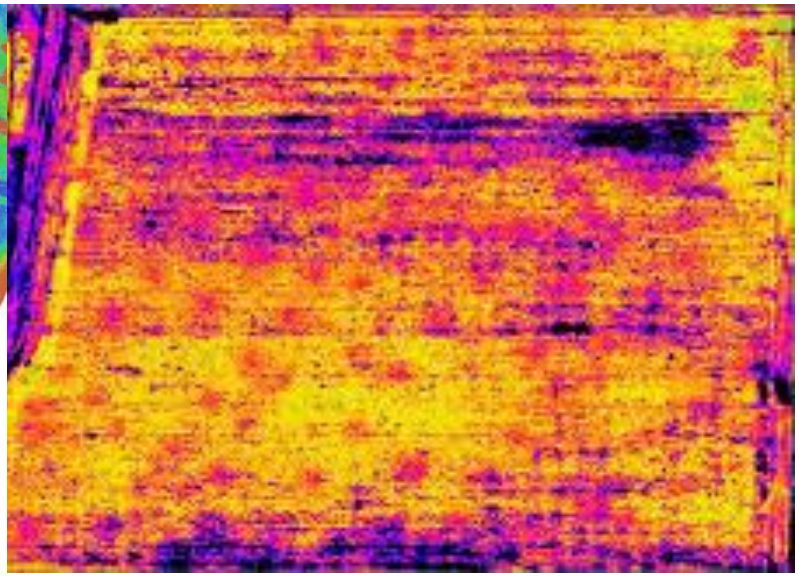
Future direction of drone research

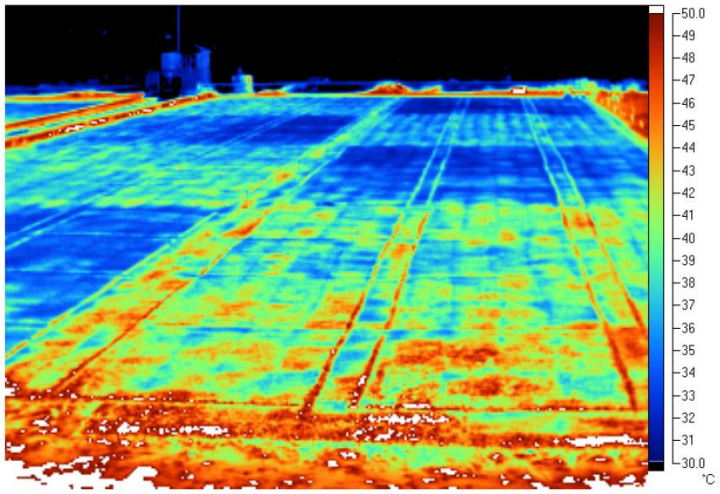
- SPLAT (see next slide)
- Time series analyses
- Yield estimates
- Bloom counts
- Optimizing temperature sensor placement

Splat (mating disruption) - Shawn Steffan, UWisc

Thermal imaging







Do I have to get a license?

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- Course work required to get your Remote Pilot License.

What would you like to see drones do for you as a grower?