Farm Foundation is an accelerator of practical solutions for agriculture. Our mission is to build trust and understanding at the intersections of agriculture and society. We accomplish this by leveraging non-partisan objective dialogue, information and training, catalyzing solutions and creating multi-stakeholder collaboration. Our vision is to build a future for farmers, our communities and our world.

Since 1933, we have connected leaders across agricultural sectors—farming, business, academia, organizations and government.

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Cornell Initiative for Digital Agriculture (CIDA)

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Advancing Digital Agriculture and Conservation: A Virtual, Multi-Day Policy Workshop

• During the webinar, participant audio will be muted.
• Participants can submit questions by clicking on the Q & A button at the bottom of their screens.
• When submitting questions, please include your name and company so questions may be contextually understood.
• Due to time limits, the moderator may not be able to ask all questions submitted.
• Following the close of the webinar, we will hold a 30 minute “coffee break” over Zoom for those interested. The link will be posted in the chat.
• This webinar is being recorded and will be posted on our website at farmfoundation.org.
• If there are any connectivity issues during the webinar, we ask that you stay on the webinar as those generally rectify themselves after a few moments.

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Workshop Objectives

• Advance policy dialogue to realize the potential of data applied to the challenges of conservation in agriculture
• Strengthen the science-policy interface
Advancing Digital Agriculture and Conservation: A Virtual, Multi-Day Policy Workshop

Steven Wolf
Cornell University

Katherine Baylis
University of Illinois

Jonathan Coppess
University of Illinois
Moderator

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Cornell Initiative for Digital Agriculture

digitalagriculture.cornell.edu

- Over 100 faculty from 5 colleges
- Annual Digital Agriculture Hackathon
- Research Innovation Fund
- Curriculum
- External partnerships

#digitalagworkshop
Digitalag.Illinois.edu

• Illinois Center for Digital Ag
• The Gardner Agriculture Policy Program
• CEOS

Farmdoc.Illinois.edu/policy

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Session Two: Conservation Implementation and Policy Perspectives

Panelists

Steve Hagen
Co-Founder, COO and Senior Scientist, Dagan, Inc.

Sarah Beebout
National Program Leader-Sustainable Intensification, USDA Agricultural Research Service, Office of National Programs

Alyssa Charney
Legislative Assistant for Sen. Bob Casey, D-PA

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Steve Hagen
Co-Founder, Chief Operating Officer, and Senior Scientist
Dagan, Inc.

With nearly 25 years’ experience in environmental research and data mining techniques, Steve Hagen brings tremendous expertise to Dagan’s development of new and critical technology. Hagen marries his technical strengths in extraction of land surface information and interpretation of large geospatial datasets (particularly remote sensing data) with his strengths in leadership and critical thinking to head Dagan’s research team in the development of effective technology that improves environmental outcomes in agriculture and forestry.

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Advancing Digital Agriculture and Conservation – May 2020

• Established in 2018, as a spin-out from Applied Geosolutions
• Williams Salas, Stephen Hagen, and Ian Cooke - Founders
• Located outside of Boston in Durham, NH
• Seed investment from Neglected Climate Opportunities in 2019

• Working to be the leader in providing soil health and sustainable agriculture data insights to farmers and organizations that work with farmers
Integrated technology to understand conservation and crop resilience

Operational Tillage Information System (OPTIS)

- Uses publicly-available remote sensing data to map & monitor adoption of tillage practices and cover crops
- OpTIS data are “longitudinal”, making multi-year products possible (e.g. include crop rotation overlays, etc.)

Biogeochemical Model (DNDC)

- Process-based model that uses ag management, weather, and soil type as input and, by modeling soil microbial processes, vegetation growth, C and N cycles, produces estimates of soil organic carbon, greenhouse gas emissions, and other attributes;

Data are freely available at ctic.org/OpTIS
Remote sensing-based tools provide unique information...

We analyzed the use of conservation practices and associated outcomes across the Corn Belt for 2005 to 2018

- Which areas use conservation management?
- How has the use of the practices changed over the years?
- What are the soil health outcomes associated with the use of conservation practices?
Remote sensing-based tools provide unique information...

Data are freely available at ctic.org/OpTIS
Remote sensing-based tools provide unique information...

Initial indications that conservation practices can mitigate farmland susceptibility to flooding

Prevented Planting was common in 2019 due to flooding in the spring

Which fields were prevented from planting? Historically, how have these fields used conservation practices?

In all three regions, historical use of conservation practices was more frequent on those fields that successfully planted in 2019.

<table>
<thead>
<tr>
<th>Location</th>
<th>Planting Status</th>
<th>No-till SD.</th>
<th>Conservation tillage SD.</th>
<th>Winter green cover SD.</th>
<th>Mean elevation SD.</th>
<th>Area acres</th>
<th>Number of segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood county, OH</td>
<td>Successful</td>
<td>1.71</td>
<td>1.7</td>
<td>5</td>
<td>2.75</td>
<td>0.67</td>
<td>211</td>
</tr>
<tr>
<td></td>
<td>Prevented</td>
<td>1.31</td>
<td>1.31</td>
<td>4.87</td>
<td>2.12</td>
<td>0.55</td>
<td>205</td>
</tr>
<tr>
<td>Hutchinson county, SD</td>
<td>Successful</td>
<td>0.63</td>
<td>1.27</td>
<td>3.58</td>
<td>2.91</td>
<td>0.82</td>
<td>434</td>
</tr>
<tr>
<td></td>
<td>Prevented</td>
<td>0.33</td>
<td>0.73</td>
<td>2.96</td>
<td>2.48</td>
<td>0.78</td>
<td>430</td>
</tr>
<tr>
<td>Lincoln county, MO</td>
<td>Successful</td>
<td>1.48</td>
<td>1.8</td>
<td>5.76</td>
<td>3.19</td>
<td>2.86</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>Prevented</td>
<td>1</td>
<td>0.77</td>
<td>4.4</td>
<td>1.96</td>
<td>0.1</td>
<td>134</td>
</tr>
</tbody>
</table>

Table. Area and number of fields with planting classes in three regions of interest; Wood, OH, Hutchinson, SD, and Lincoln, MO.
• Employ new tools to (1) reduce transaction costs associated with Ecosystem Service Markets and (2) generate innovative insights for ag finance and land value

• Recognize the role that on-farm observations and measurements (i.e. farmer data) play as the foundation to these new technologies

• Create a data warehouse where producer privacy is protected, and field-level information is accessible by approved researchers working to strengthen our understanding of conservation practices and risk
Sarah Beebout is the National Program Leader for Sustainable Intensification as USDA's Agricultural Research Service. Prior to her role at USDA, Beebout worked for nearly fifteen years at the International Rice Research Institute where she spent much of her time in the Philippines studying soil chemistry. Beebout has a PhD in Soil Science from Cornell University, a MS in Soil Chemistry from Texas A&M University and a BS in Chemistry from Wheaton College.
Twin Brook Creamery keeps water clean for baby salmon

Lynden, WA

All photos from USDA: https://www.flickr.com/photos/usdagov/
Sustainable agriculture: Now is the time for big data

Goals announced by USDA in Feb 2020:

- Increase agricultural productivity by 40%
- Decrease environmental footprint by 50%
  - Food loss and waste
  - Carbon sequestration and greenhouse gas emission
  - Water quality
  - Renewable energy

Private sector momentum for promoting sustainable practices:

- Field to Market
  https://fieldtomarket.org/
- Indigo Ag
  https://www.indigoag.com/about
- Ecosystem Services Market Consortium
  https://ecosystemservicesmarket.org/
- Others highlighted in this seminar series
Three ways that big data enables sustainable ag:

1. **Planning**: Where will we get the most benefit from improved practices?
2. **Implementation**: Sensors and fences
3. **Value addition**: Making sustainability profitable
Agricultural Conservation Planning Framework (ACPF)

- ArcGIS tool box combines multiple data sets: digital elevation model (DEM), USGS HUC12 watershed boundaries, USDA land use and crop rotations (NASS Cropland Data Layer), soils data from NRCS gSSURGO

- Designed to answer these questions for a watershed:
  - Which fields are most prone to contribute runoff to streams?
  - Where could field-scale and edge-of-field conservation practices be effective?
  - What are the opportunities for riparian management? (including specific recommendation for buffer width)

[https://acpf4watersheds.org/](https://acpf4watersheds.org/)

Status: in use
Implementation example #1: Crops

Sensors and drones for monitoring crop growth:

- Sensors for soil moisture, pest pressure, leaf color
- Enable real-time precision management of fertilizers, irrigation and pest management

http://precisionsustainableag.org/

Status: in development
Implementation example #2: Livestock

Virtual fencing

- Livestock wear GPS-guided collars and receive mild electric shock if they stray across a virtual fence line programmed by farmer
- Potential to enable precision livestock management
  - Exclusion from riparian areas
  - Exclusion from rangeland areas with toxic plants
  - Rotational grazing

https://www.farmprogress.com/livestock/cattle-be-confined-virtual-fence

Status: Futuristic
Value addition example

Payments for ecosystem services

- In addition to profit from production, farmers get paid for providing environmental services:
  - Carbon sequestration
  - Water quality
  - Biodiversity and habitat

- Requires big data for:
  - Defining baseline
  - Verifying agricultural practices
  - Modeling to quantify ecosystem services

https://www.oem.usda.gov/

Status: In development
Three ways that big data enables sustainable ag:

1. **Planning:** Where will we get the most benefit from improved practices?
   - Example: Agricultural Conservation Planning Framework (ACPF)

2. **Implementation:** Sensors and fences
   - Example: Sensors for monitoring crop growth
   - Example: Virtual fencing

3. **Value addition:** Making sustainability profitable
   - Example: Payments for ecosystem services
How research uses big data

Partnerships for Data Innovation (PDI)

- Databases:
  - AgCROS: One-stop shop for agricultural research data
- Decision support informatics platform
- High-performance computing
- Artificial intelligence tools

Example of a PDI project:
Fertilizer Recommendations Support Tool (FRST)

Collaboration between ARS and many university extension partners

- Develop searchable tool for soil test calibration data for the geographical area of interest (general user)
- Provide database and search tools for in-depth analysis and modeling of soil test calibration and correlation data (researchers)

## Understanding USDA agency roles and resources related to big data for sustainable agriculture

<table>
<thead>
<tr>
<th>Agency</th>
<th>Role</th>
<th>Resources available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Research Service (ARS)</td>
<td>Research</td>
<td>Data (all types; method development)</td>
</tr>
<tr>
<td>Economic Research Service (ERS)</td>
<td>Research</td>
<td>Data (questionnaire survey)</td>
</tr>
<tr>
<td>National Agricultural Statistics Service (NASS)</td>
<td>Nationwide data collection</td>
<td>Data (questionnaire survey and remote sensing)</td>
</tr>
<tr>
<td>National Institute for Food and Agriculture (NIFA)</td>
<td>Funding research</td>
<td>Funding through competitive grants</td>
</tr>
<tr>
<td>Natural Resources Conservation Service (NRCS)</td>
<td>Promoting conservation practices</td>
<td>Data (soil survey) Cost-sharing for producers Research funding</td>
</tr>
</tbody>
</table>

Note: See collaboration forum (Session 2) for links to federal resources
Alyssa Charney covers agriculture, energy, environment, and natural resources issues for U.S. Senator Bob Casey. She previously was a senior policy specialist at the National Sustainable Agriculture Coalition, where she led the coalition’s work on conservation. Charney holds a MS in Agriculture and Food Policy and an MPH from Tufts University, as well as a BA in Environmental Studies from Vassar College.
Conservation Data & Outcomes

WHY does Congress care?

- We have been able to:
  - Justify spending
  - Target to where conservation is most needed
  - Tell our farmers and stakeholders WHAT we’re doing for them
  - Support efforts that further improve programs/practices/outcomes
2018 Farm Bill and Conservation Data

- Ag Data Modernization Act
  - Improving the Effectiveness & Efficiency of the Federal Crop Insurance Program
- Regional Conservation Partnership Program & Outcomes
- Prioritization of most effective practices
- Program Implementation
  - Conservation Assessment & Ranking Tool (CART)
Regional Example
Chesapeake Bay Watershed

- Pennsylvania & nutrient reduction goals = DATA
- How are farmers + conservation improving water quality?
  - Better, more comprehensive data needed
    - To quantify farmers’ conservation efforts
    - To target/ improve conservation outcomes
Barriers & Opportunities

Barriers

- Staffing resources
- Privacy Concerns

Policy Opportunities

- Farmer Driven Conservation Outcomes Act of 2020
- Carbon Markets
Advancing Digital Agriculture and Conservation: A Virtual, Multi-Day Policy Workshop

Session Two: Conservation Implementation and Policy Perspectives

Q&A
Let’s continue the conversation…
advancingdigitalagandconservation.com/collaboration

Collaboration

FORUM
Welcome! Have a look around and join the discussions.

General
Follow
14 2
Share your ideas, research, or thoughts related to advancing digital agriculture and conservation.

Session 1
Follow
3 1
Share ideas, research, thoughts and more!

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Save the date – May 29
Session Three – Mobilizing Data for Conservation: On- and Off-Farm Perspectives
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