



Diagnostics in the Information Age

Mary Burrows, Carla Thomas



Mountains & Minds

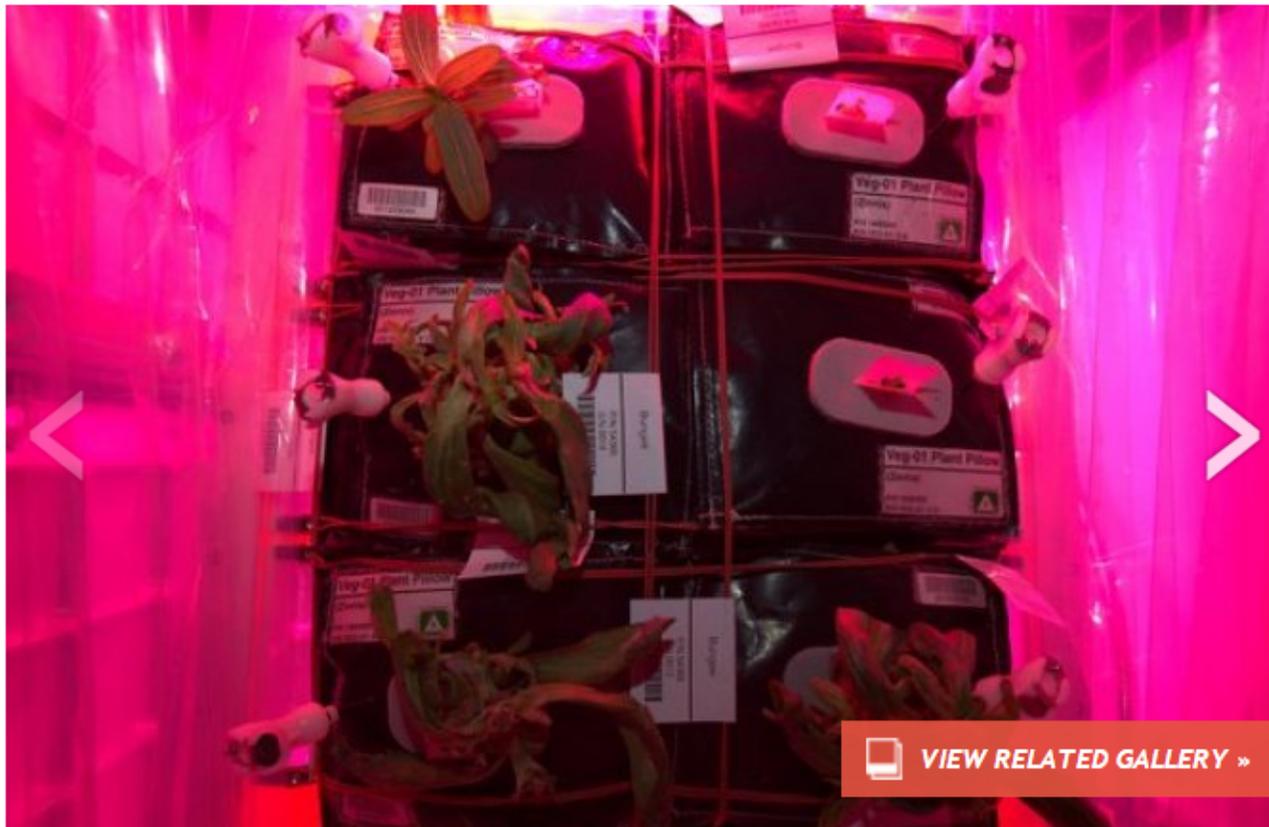
STAR
TREK



USS CHURCHILL, NCC-2713
WWW.STARTREKDESKTOPWALLPAPER.COM
MODEL BY RICKY BRIAN PATRICK MONTANA

Space Fungus! Mold Attacks Space Station Plants

JAN 7, 2016 03:01 PM ET // BY ELIZABETH HOWELL



“Our plants aren’t looking too good,” NASA astronaut Scott Kelly tweeted along with this picture in late December.

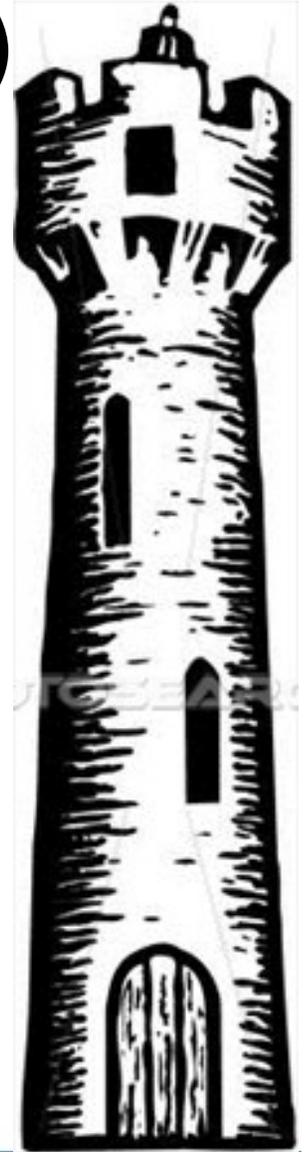
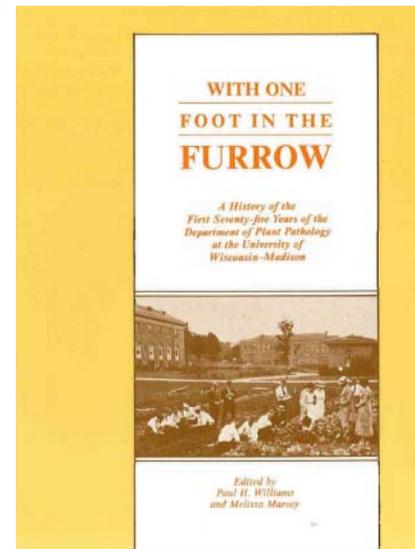
NASA/SCOTT KELLY



Niccolo Machiavelli

The purpose of the book “The Prince” (the purpose of diagnostics?)

"To honor and reward virtù, not to have contempt for poverty.....to constrain citizens to love one another, to live without factions, to esteem less the private than the public good."



“There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.”

NPDN ▾

GPDN ▾

NCPDN ▾

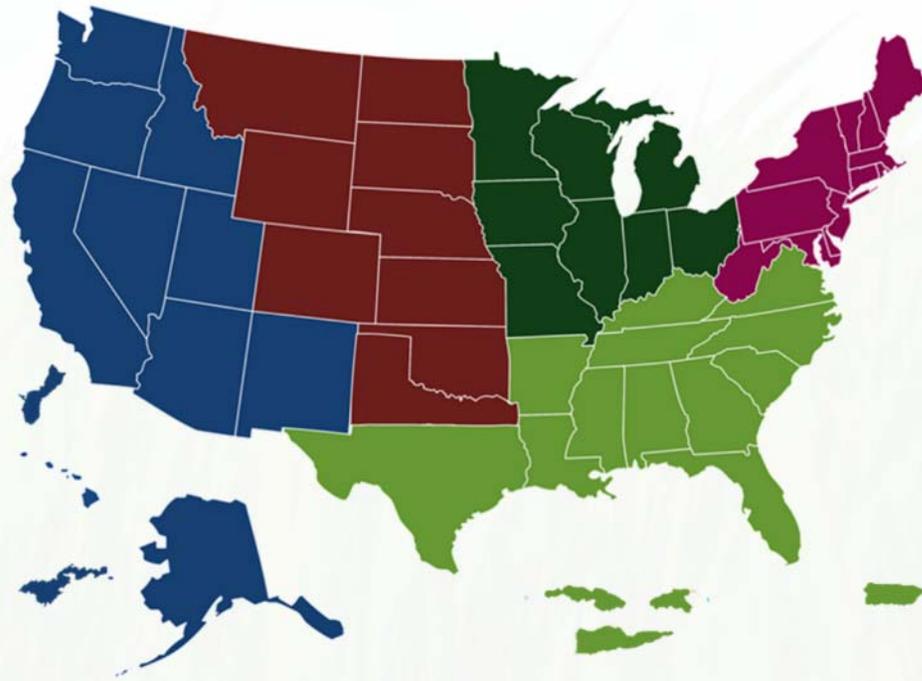
NEPDN ▾

SPDN ▾

WPDN ▾

My Account ▾

The NPDN was established in 2002 in response to the need to enhance agricultural security through protecting health and productivity of plants in agricultural and natural ecosystems in the U.S. With support from the USDA-NIFA and through the collective efforts of many individuals representing Land Grant Universities, federal agencies, state departments of agriculture, and other stakeholders, the NPDN has grown into an internationally respected consortium of plant diagnostic laboratories. The specific purpose of the NPDN is to provide a cohesive, distributed system to quickly detect and identify pests and pathogens of concern. NPDN laboratories immediately report their findings to appropriate responders and decision makers. To accomplish this mission, the NPDN has invested in diagnostic laboratory infrastructure and training, developed an extensive network of first detectors through education and outreach, and enhanced communication among public agencies and stakeholders responsible for responding to and mitigating new outbreaks. We invite you to explore our website to learn more about the NPDN and our programs.



“States quickly founded, like all other things which are born and grow rapidly, cannot have deep roots, so that the first storm destroys them, unless...[the] prince is... able to take immediate steps for maintaining what fortune has thrown into his lap, and lay afterwards those foundations which others make before becoming princes.”



How do we reach our younger stakeholders?



And train graduate students or private industry equivalents?

MONTANA STATE UNIVERSITY
EXTENSION
Schutter Diagnostic Laboratory

Schutter Diagnostic Lab
College & University

Timeline About Photos Reviews More

66 people like this
Gary Adams and 27 other friends

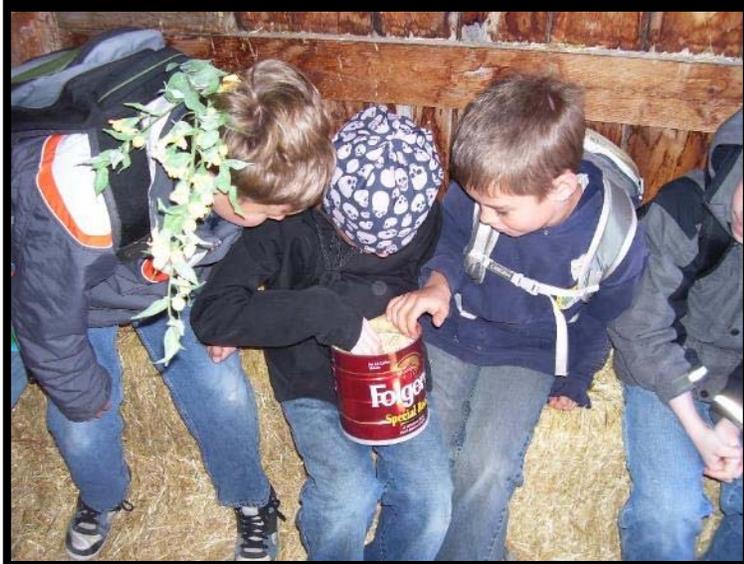
Invite friends to like this Page

ABOUT

Ask for Schutter Diagnostic Lab's address
(406) 994-5150
Ask for Schutter Diagnostic Lab's hours
Ask for Schutter Diagnostic Lab's price range
<http://www.diagnostics.montana.edu/>

Schutter Diagnostic Lab added 2 new photos.
Yesterday at 12:33pm

With this glorious spring-like weather there are lots of plants sprouting around campus. I went outside to remind myself what some common species look like at the rosette stage. The first plant I noticed was field pennycress (*Thlaspi arvense*). Rosette leaves have margins that range from smooth to toothed, and leaves also have a garlic-like odor when bruised. Leaf surfaces are hairless- check this out for yourself with a hand lens or dissecting microscope. Identifying this rosette was easy since the distinctive silicles, or seed pods, were hanging around nearby on last year's plants. They are disc-shaped and indented at the tip. If you need a break from your office take your Weed Seeding ID Guide outside and see what you can find! <http://store.msuxextension.org/.../AgandNaturalReso.../EB0215.pdf>



MSU Extension
Working together to grow a better Montana

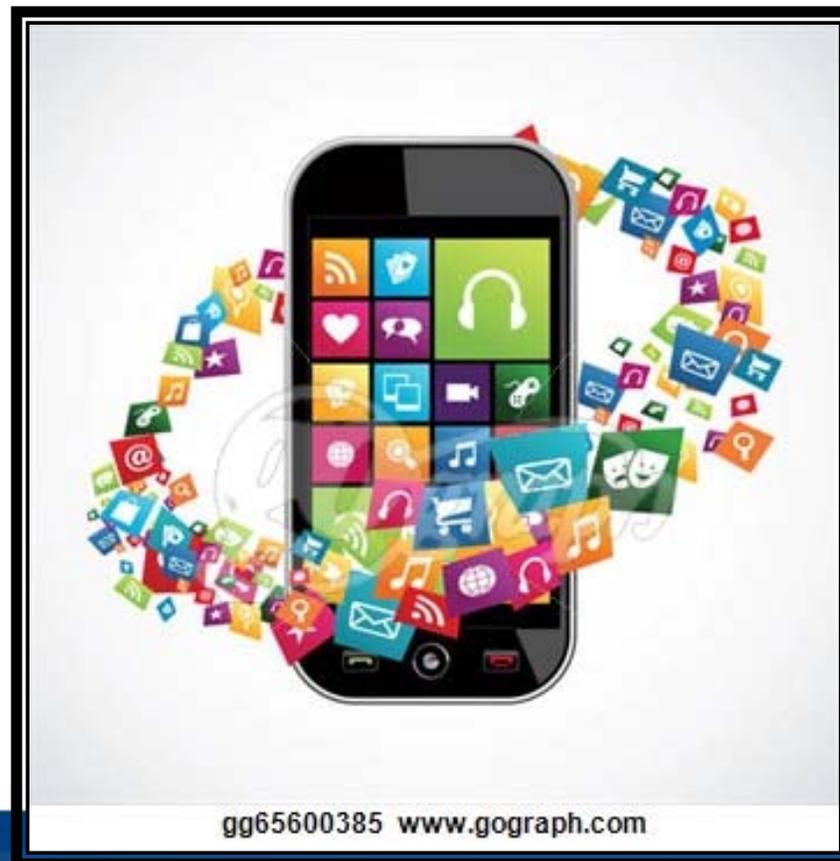
MSU Extension - Working together to grow a better Montana. **EXPLORE**

CHALLENGES

- Digital diagnostics
- Citizen science
- Diagnostic tools, models
- Sustainability

Digital diagnostics

The most powerful tool for diagnostics in the field:



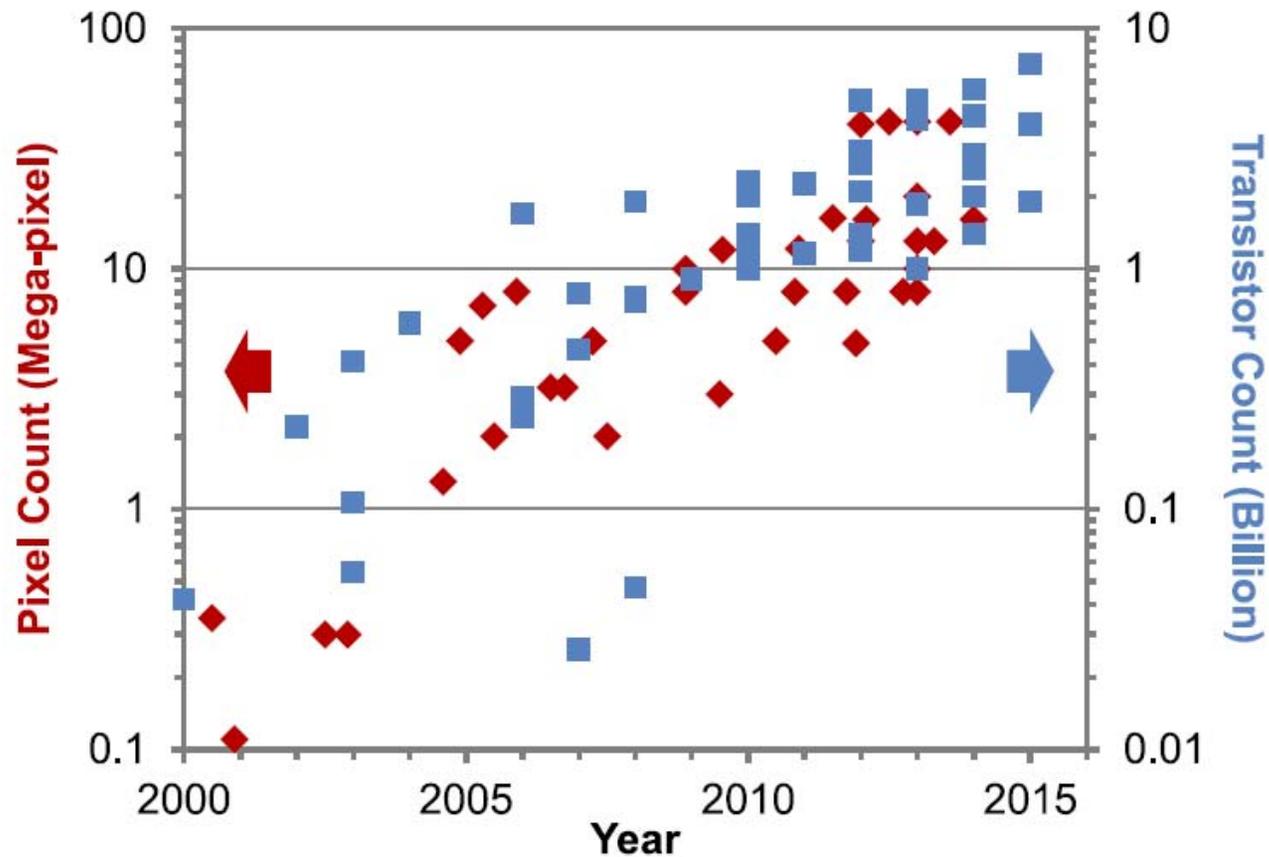


Fig. 1. The mega-pixel count of mobile phone cameras has doubled almost every two years following the Moore’s Law seen in the transistor count in central-processing-units (CPUs) of personal computers [1]—Adapted by permission of The Royal Society of Chemistry.

J. Contreras-Naranjo et al. 2016. IEEE J. Sel. Topics in Quantum Electronics. v. 22.

The good



the bad



he ugly



Challenges

Accuracy

Amount of
information

Expectations

High volume

No 'off' time for
specialists

Availability of
specialists

Opportunities

- Tracking development
- Reaching a new audience
- Direct contact with stakeholders
- Trust
- Providing accurate diagnosis and recommendations that are implemented immediately

“As the doctors say of a wasting disease, to start with it is easy to cure but difficult to diagnose; after a time, unless it has been diagnosed and treated at the outset, it becomes easy to diagnose but difficult to treat”







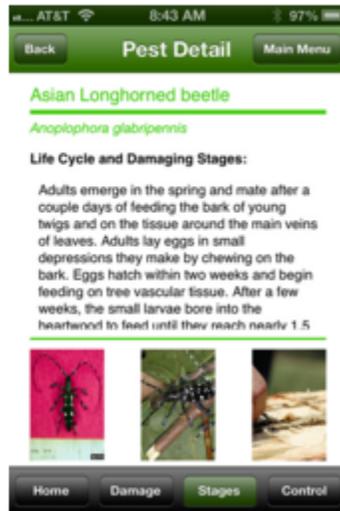
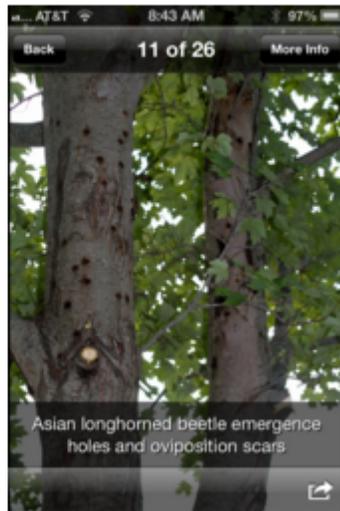


Figure 3

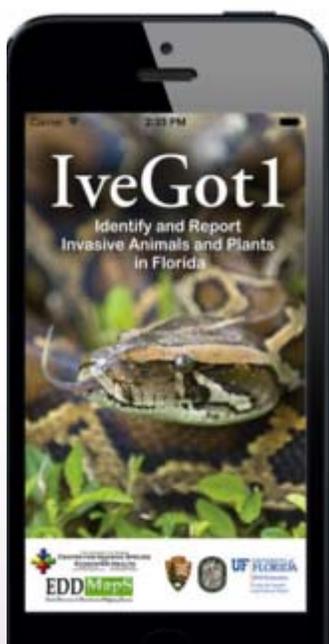
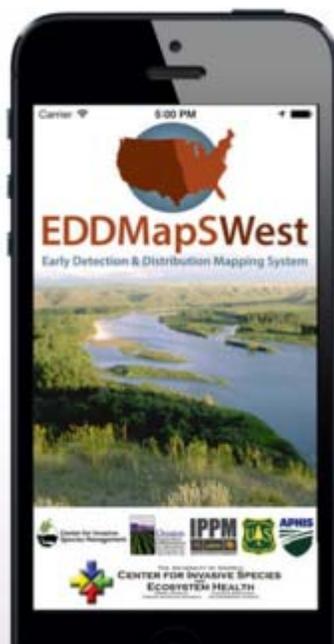
Ugandan farmers wait to be seen by plant doctors at rural plant clinic in Katine market, Soroti. The clinic is staffed by personnel from the NGO, Soroti Catholic Diocese Integrated Development Organization (SOCADIDO), and extension staff from the Ministry of Agriculture. Photo by Rob Harling of the Global Plant Clinic.

Citizen Science

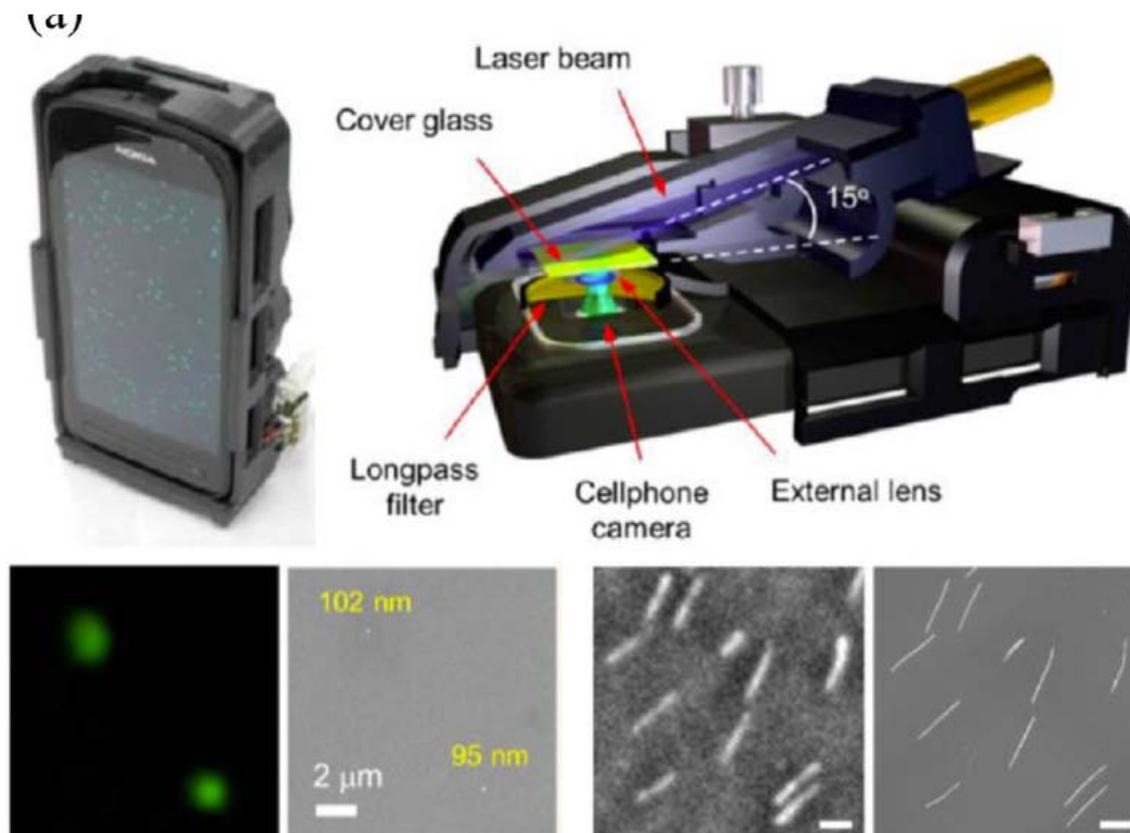




Snapshot



Mobile phone platform for fluorescence imaging of nanoparticles and stretched ssDNA



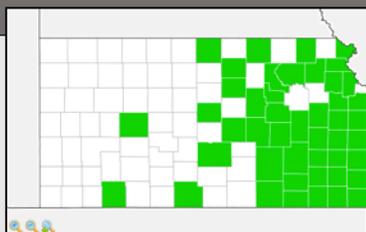


Sugarcane Aphid

Melanaphis sacchari

My Field Guide

(+) Add to My Guide



EDD MapS

*Sign up for a **FREE** account to receive sugarcane aphid alerts and notifications when it has been detected near you!*

Management guide

[Sugarcane Aphid \(Kansas Sorghum\)](#)
[Sugarcane Aphid \(Texas Sorghum\)](#)

Pest Description

These are very pale yellow aphids with short, dark 'tailpipes' (cornicles). They are capable of very high rates of reproduction and produce copious amounts of honeydew. The sugarcane aphids seen in 2013 were gray to tan or light yellow. Unlike other common aphid species that feed on sorghum, sugarcane aphids have dark, paired, tailpipe-like structures, called cornicles, at the rear, and their tarsi (feet) are dark at high magnification. The dark cornicles and tarsi contrast distinctively with the lighter body color of the sugarcane aphid. Go to [Texas A&M Agrilife Extension Publication \(#ENTO-035\)](#) for more information.

Source of information

KSRE (MF742), Texas A&M Agrilife Extension (ENTO-035)

Visit <https://www.myfields.info/sca> to learn more!

Challenges

Rapid increase in use of these platforms

Standardization

Data security

Validation of data

Interdisciplinary and large scale coordination

Formation of accessible data repositories

Opportunities

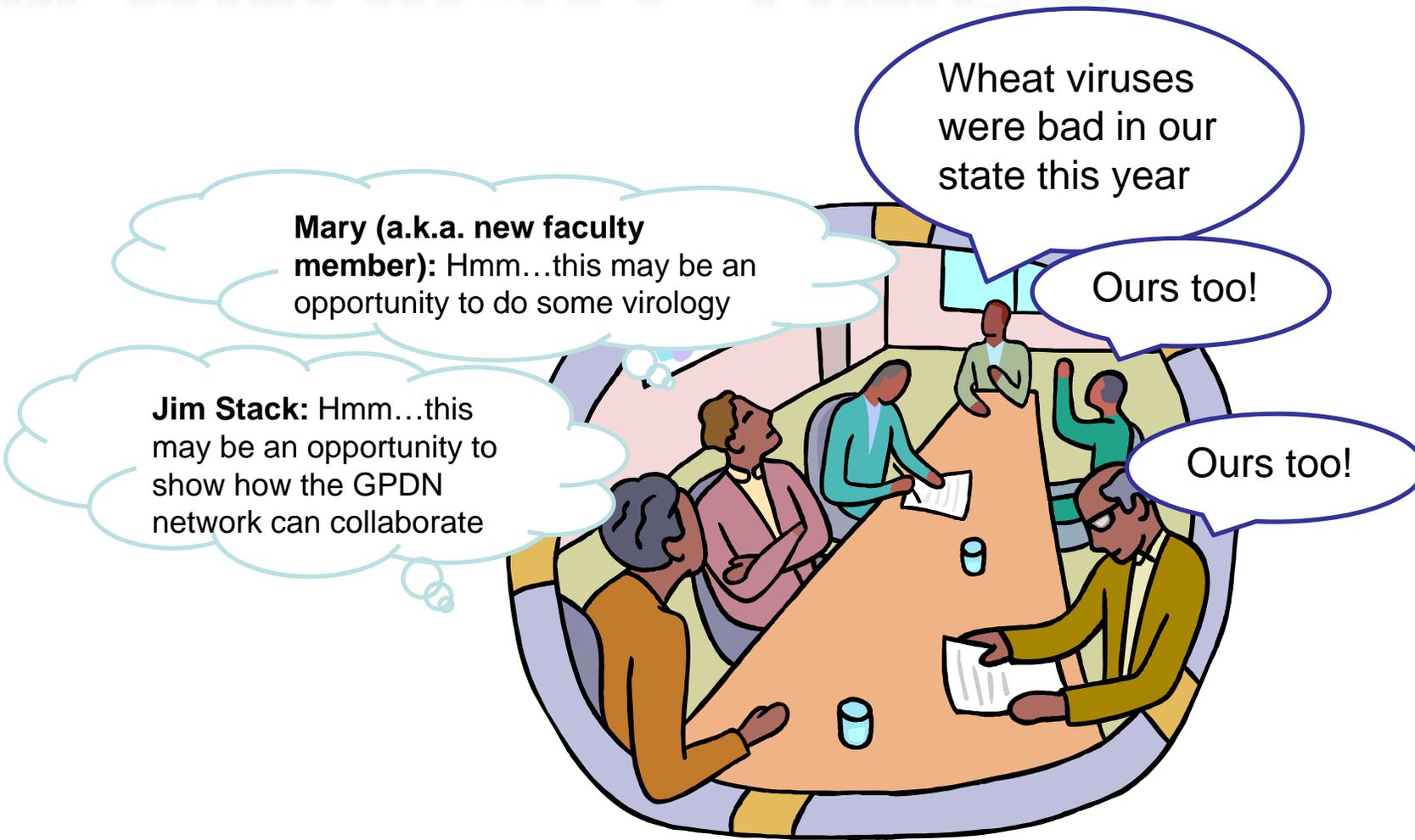
- Metadata for epidemiological analysis
 - Spatial
 - Temporal
- Education of a diverse audience with a stake in the outcome

“Whosoever desires constant success must change his conduct with the times.”

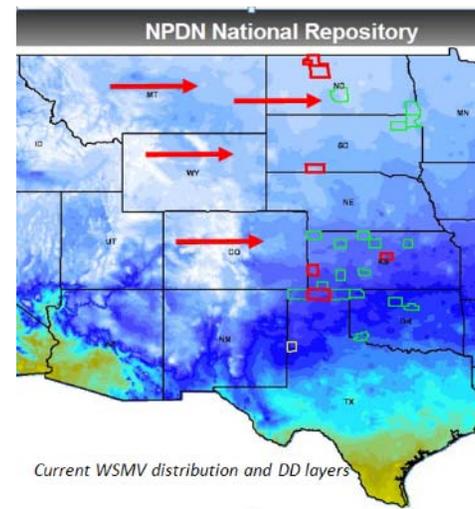
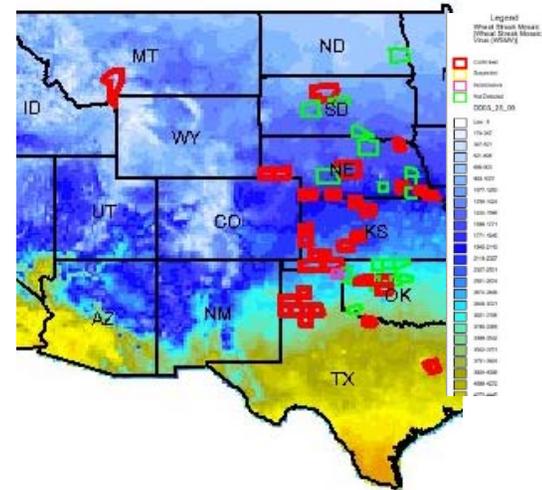


IN ANCIENT TIMES:

2006 NPDN meeting, GPDN state reports



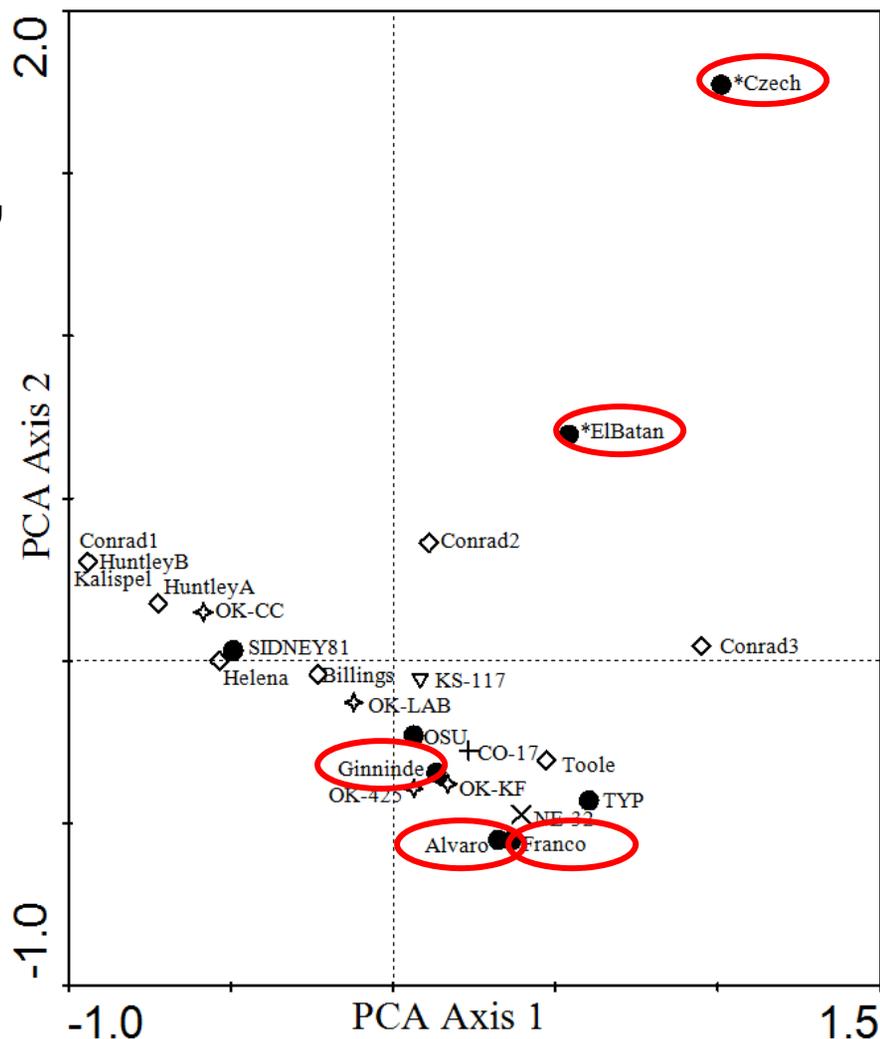
Survey methods: 2008-2010



Current WSMV distribution and DD layers

Forensic plant pathology

WSMV
'ce-back'



Samples

- Montana (◇)
- Kansas (▽)
- Oklahoma (✦)
- Colorado (+)
- Nebraska (X)
- Australia (●)
- Collection strains (●)

Discrimination

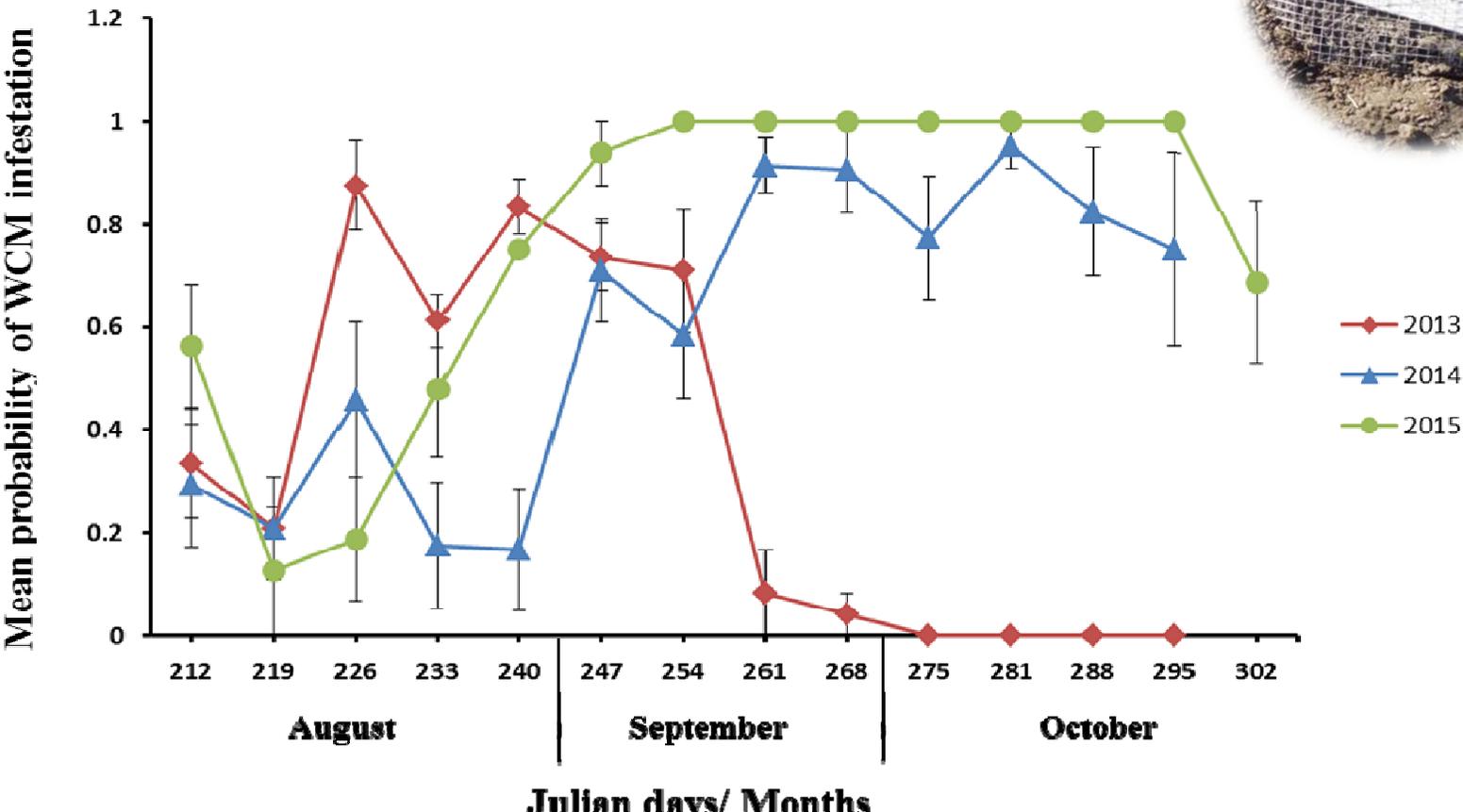
- unique profiles for each strain and most isolates
- some isolates near identical, but from similar area



WCM infestation of volunteer wheat, Bozeman



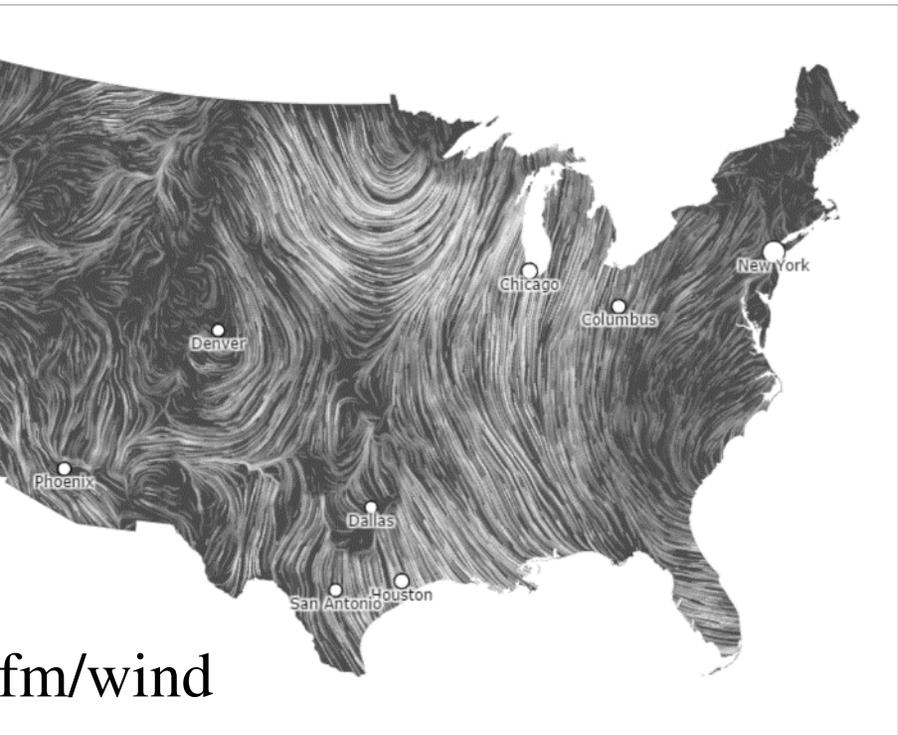
Volunteer wheat



What next?







Sample Entry in Database Report



eria
Date(s): 2016-01-13 to 2016-01-13
Report contains records for that pest code. This report is its own "first submission" and is not final results, not posted to the NPDN National Database.

Sample Date	Sample Date	State
4	2015-07-06	PA
4	2016-01-14	WV
4	2016-01-14	WV
4	2016-01-13	SC
4	2016-01-13	SC
4	2016-01-06	SC
3	2016-01-07	FL
3	2016-01-11	NJ
3	2016-01-12	TN
3	2016-01-05	TX
3	2016-01-13	OK
3	2014-12-12	PA
3	2016-01-13	AR

NPDN Pest/Host Index Report



This report represents confirmed pests/pathogens and the hosts they have been found on. While every effort has been made to provide an accurate report, these results are not guaranteed to be complete and accurate. Please [contact us](#) if you have any questions or concerns regarding the data.

Genus **Species** **Display Options**
 Pest: Sclerotinia minor Common Name
 Host: Select Genus Species Common Name

Search Criteria

Pest: Sclerotinia minor

Pest Name
Sclerotinia minor (Sclerotinia minor)

4601 (OK)	Sixspir
4801 (PA)	Leaf Sp
0812 (AR)	Needle

© 2004-2016 Purdue University. All Rights Reserved. Software Build: Revision 1.0

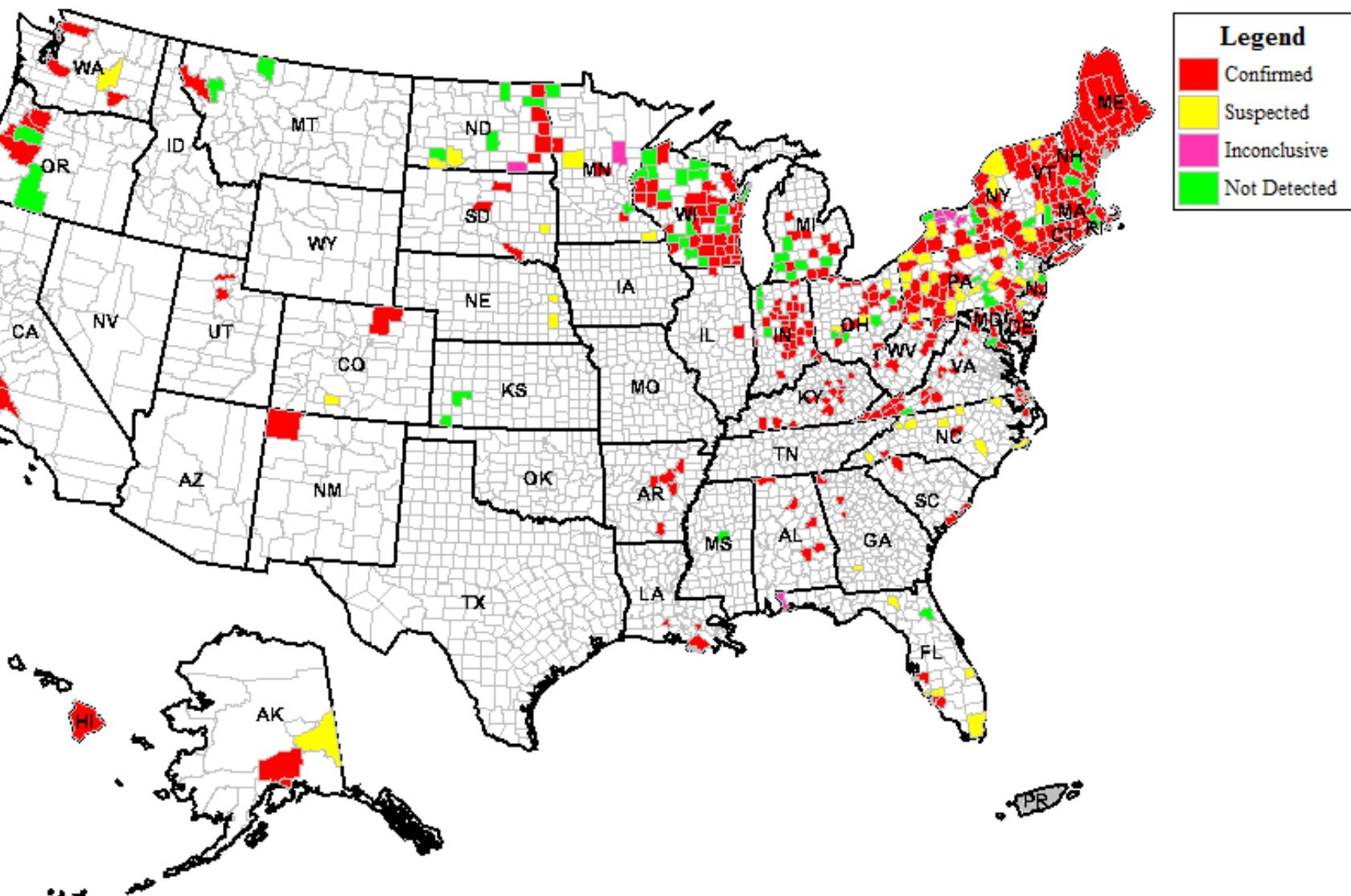
NPDN Summary Data Reports

Date of Search: 02/29/2016 04:24:41 pm EST
Number of Records: 112,025
Report Type: Pest Category
Sorted by: Pest Category
Search Criteria
Sample Dates: 2015-01-01 to 2015-12-31

Lab Sample Data Summary Report

Pest Category	Confirmed	Suspected	Inconclusive	Not Detected	Total
Abiotics	1,798	7,055	1,580	216	10,649
Arthropods	15,619	2,175	815	2,101	20,710
Nematode	12,133	1,076	235	6,485	19,929
Other	10,494	767	1,292	2,034	14,587
Pathogen	25,679	6,433	2,603	10,323	45,038
Plants/Woods	657	348	91	16	1,112

Criteria
Phytophthora infestans



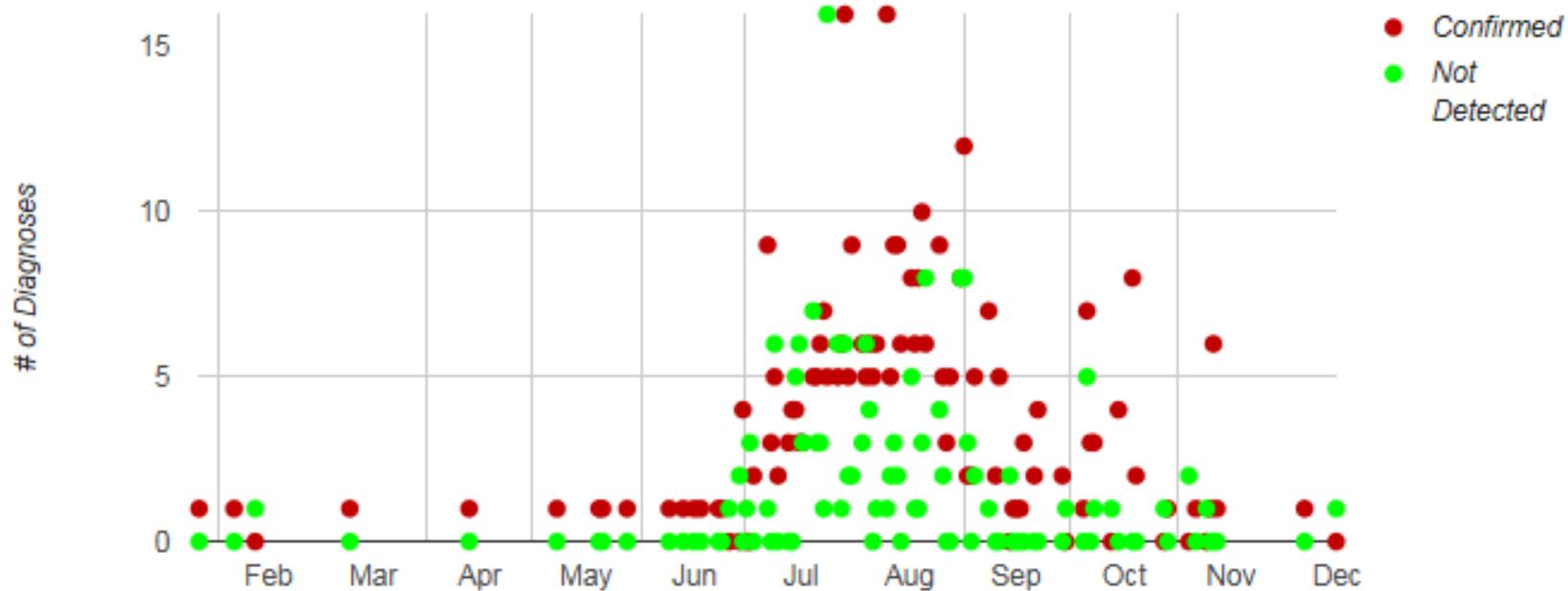
NPDN Scatter Graph

Start Dates: to

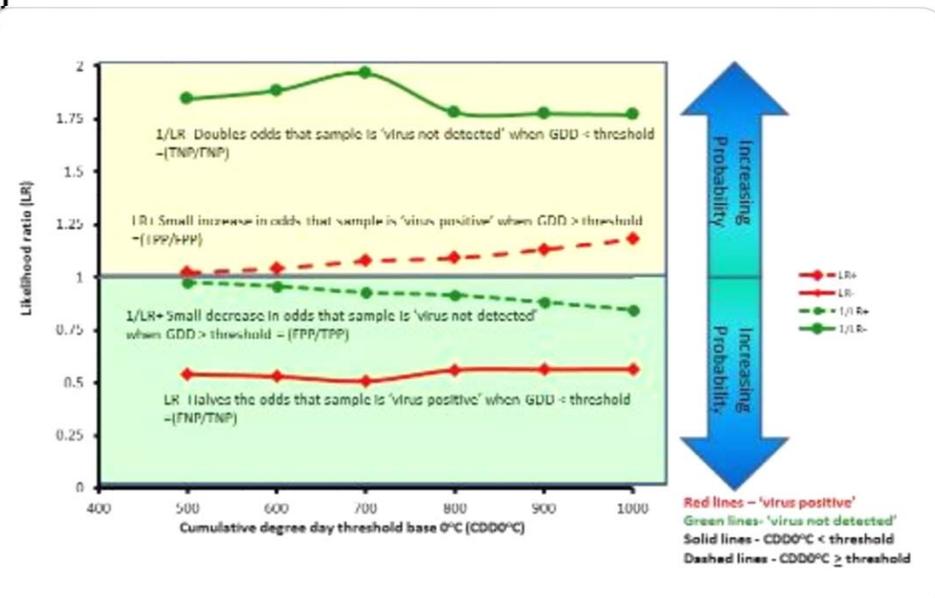
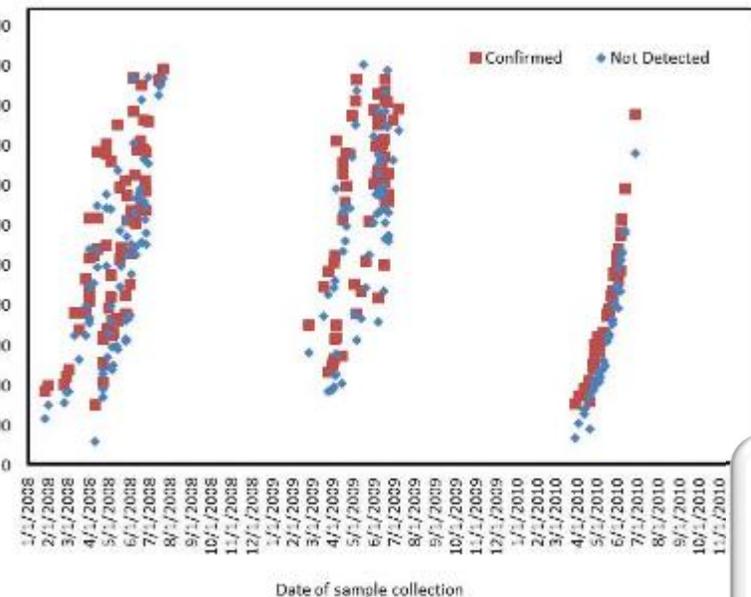
Confidence*: Confirmed Suspected Not Detected Inconclusive

Note*: Change colors by clicking on text boxes above or enter hex values directly!

NPDN Scatter Graph for *Phytophthora infestans*



Disease prediction



Arrows, M., C. Thomas, N. McRoberts, R. Stock, L. Coop, J. Stack. 2016. Coordination Diagnostic Efforts in the Great Plains: Wheat Virus Survey and Modelling of Disease Onset. Plant Dis. (in press, Feature Article, First Look).

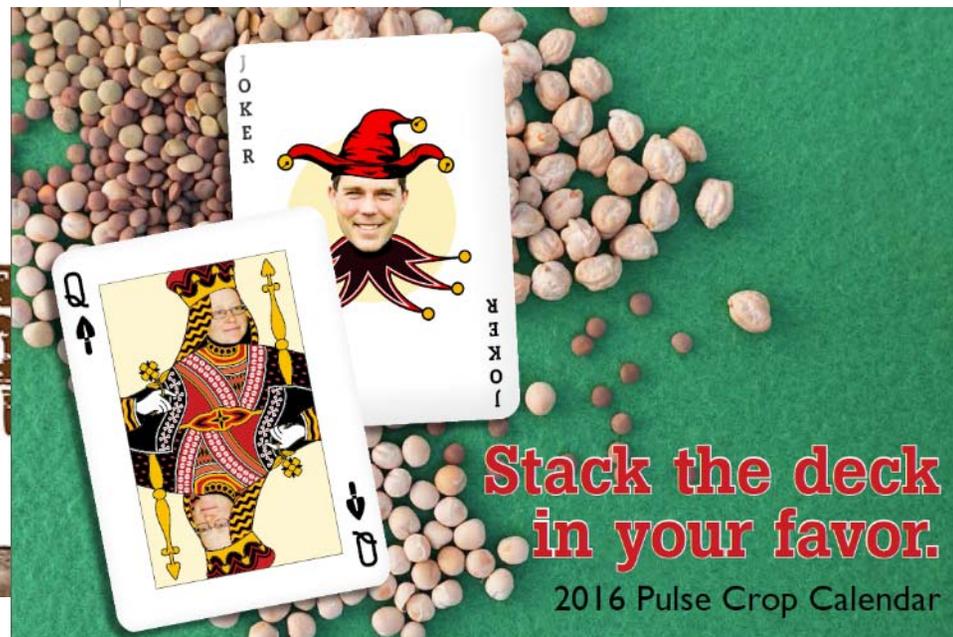
“One change always leaves
the way open for the
establishment of others.
Politics have no relation to
morals.”

“Never was anything great
achieved without danger.”



“I’m not interested in preserving the status quo; I want to overthrow it.”

http://msuaf.org/give-schutter_lab



The ends always justify the means”



Farmers

they have biological weapons

IFA



NPDN
National Plant Diagnostic Network

GPDN

