



# ***NextGen NPDN: A National Network with Global Implications***



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## **Previously.....**

- **1<sup>st</sup> NPDN National Meeting - Florida**
  - **What you do is important – it matters**
  - **Plant Systems support humans in many ways**
- **3<sup>rd</sup> NPDN National Meeting – California**
  - **Plant systems will play central role in meeting the needs of a growing global population**
  - **Plant health is prerequisite to human health and wellbeing**



## Food security from Plants

**Just 5 plant species provide 63% of the calories consumed by humans (2014)**

**Plant health is essential to food security.**

*We eat plants and we feed plants to the animals that we eat!*

Food security is not about keeping people alive...

It should NOT be about the maximum  
number of people we can keep alive

It should be about the maximum  
number of people we can keep healthy

...it's about keeping people healthy.

Food security is NOT just providing calories  
( *kcal/capita/day* )

**Food security is about plants!  
What you do is important!**

**culturally relevant  
food to everyone.**

**We need to protect plant systems – all of  
them!**

## Plant Health and Plant Ecosystems Assessment

We cannot predict the future, but  
**we can prepare for it.**

During that same time period, the world will add 2-3 billion more people...

...who will depend upon plant systems for their health and wellbeing.

Scientists have responsibility to imagine the future and pave the way for it.

## **NPDN in transition**

- **What is the future that we imagine for plant diagnosticians? - For NPDN?**
- **How should we pave the way for that future?**
- **We are translating research into practice**


**Wow – what a difference a few years make?**

**Amazing advances in the research and practice of plant diagnostics!**

- NPDN MISSION STATEMENT**

We've created an incredible enterprise to support plant health and secondarily to facilitate trade.

*The National Plant Diagnostic Network is a premier diagnostic network to quickly detect*



**What are the trends that will inform our thinking?**

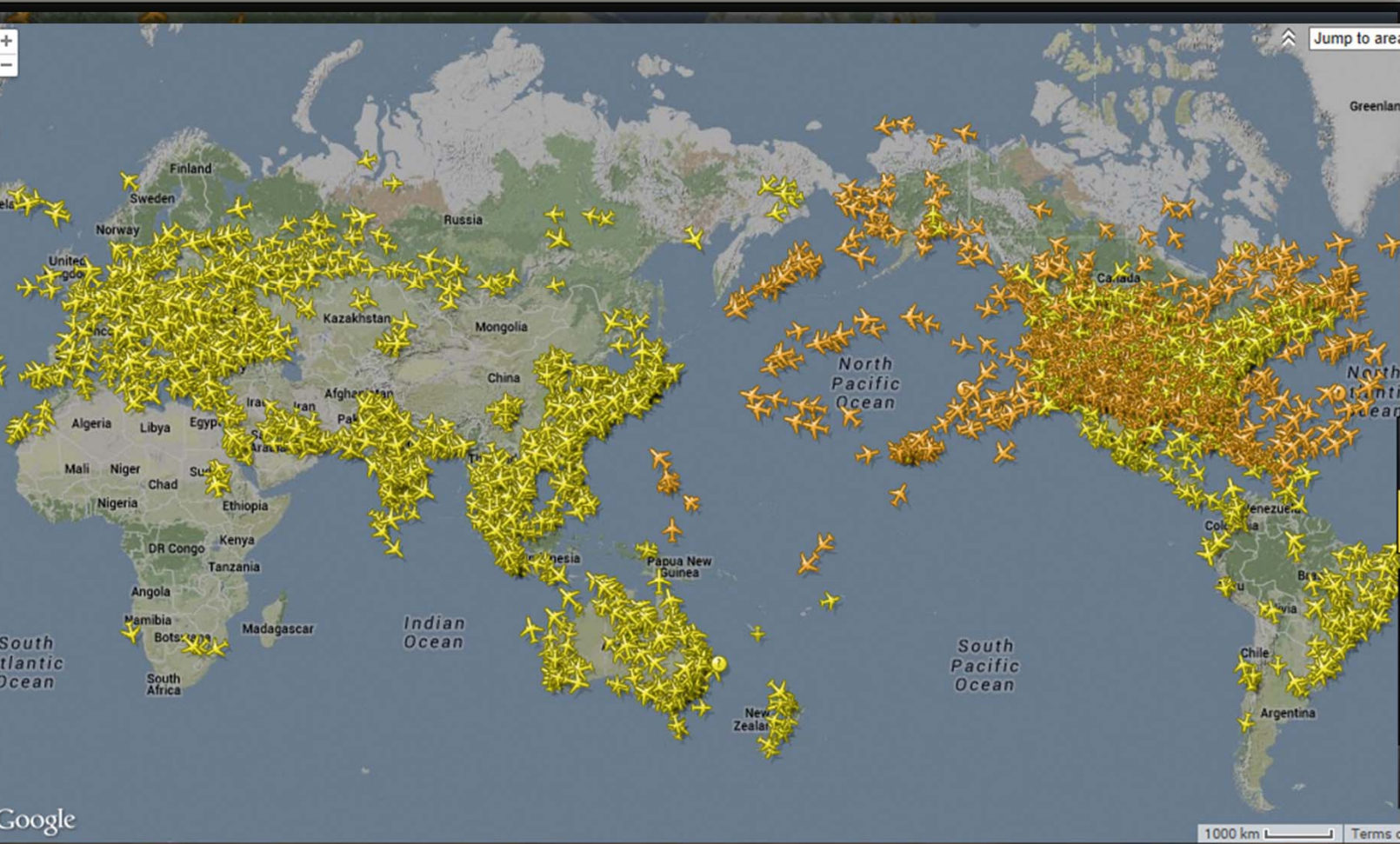
*information.*



What is the future that we imagine for NPDN?



## Trends in trade & travel



ends in trade & travel

*Moving a cargo container contains a sample of organisms at each location*  
**Charles Perrings (Invasive Species Economist)**

**Consequently:** the plant pathogens and pests of most countries are now connected to the plant systems of most other countries by trade and travel networks!



## Trends in policy

- Transition from random inspection to risk-based inspection
  - Looking for known from known locations
  - Unknowns may be the biggest threat
- World exports are growing {developing countries 31% higher than developed}
- Areas of freedom
  - Should NPDN play in this space?
  - NPDN Database as a geo-referenced resource?

## Trends in policy

- Food security through trade and aid
  - Trade undermines plant health
  - Food aid is bigger risk than trade (Perrings)

*We need science-informed policy*

*We need to get the scientific communities on the same page.*

## Trends in medical diagnostics

- ...four key questions in considering the use of molecular diagnostics...
  - **Does the genomic application provide correct information?** – analytic validity of the test
  - **Is there a significant association between the results of the genomic application and the clinical phenotype?**

## Trends in medical diagnostics

- ...four key questions in molecular diagnostics...
  - **Does the genomic application provide clinically significant information?** – measure of clinical utility – does information from application lead

*Should NPDN monitor the performance of its protocols and technologies?*

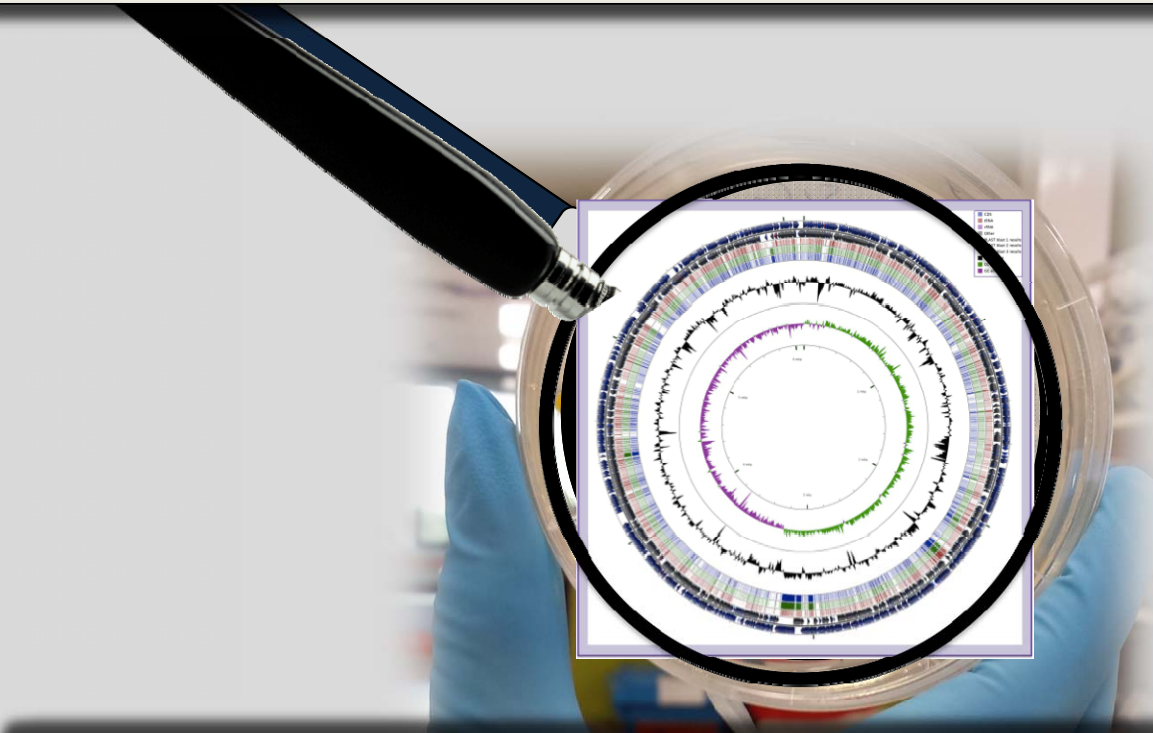
the results of a test and a condition affecting health?

## Trends in medical diagnostics

- *...concepts related to the evaluation of medical technology...*
  - **Efficacy – Will it work?**
  - **Effectiveness – Does it work in practice?**
  - **Efficiency – Is it worth it?**

*Do we ask these questions about our diagnostics?*

## Trends in technology and diagnostics



- From colony morphology and biochemical tests to whole genome sequencing

**From fungal structures to DNA sequence**



**However, we are experiencing a global decline in the taxon specialists that provide the biological anchor for that sequence.**

**Will we loose our frame of reference?**





Genomics & bioinformatics are providing tremendous insights into biological systems challenging long-held beliefs about:

**To derive the greatest benefit,  
we must generate the knowledge base necessary to  
make sense of sequence**

Genomics & bioinformatics are powerful tools for developing diagnostics, however...

**Genome-based diagnostics unlinked to biology and ecology will result in huge errors of biosecurity consequence**



## **trends in technology**

**Sequencing has become routine in plant diagnostics**

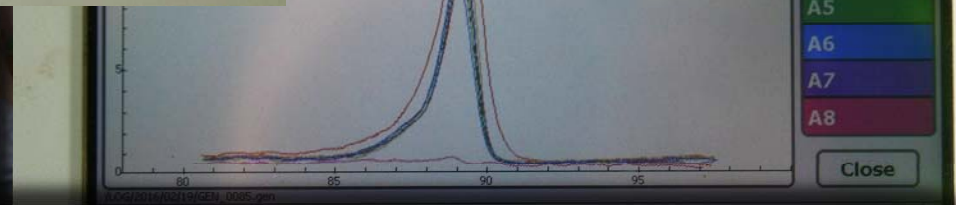
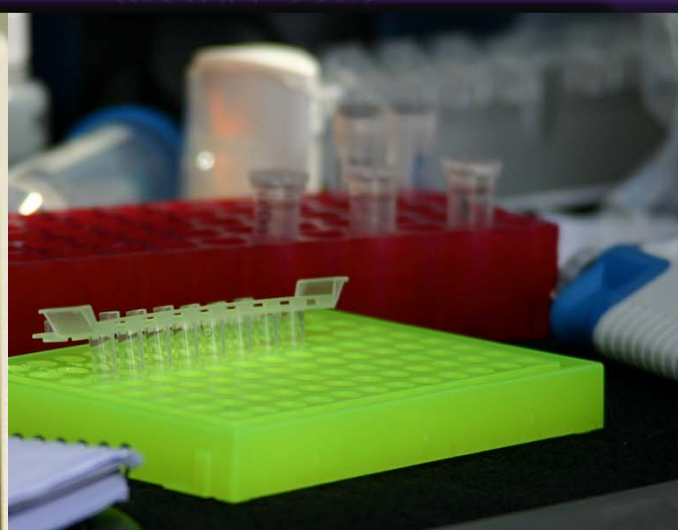
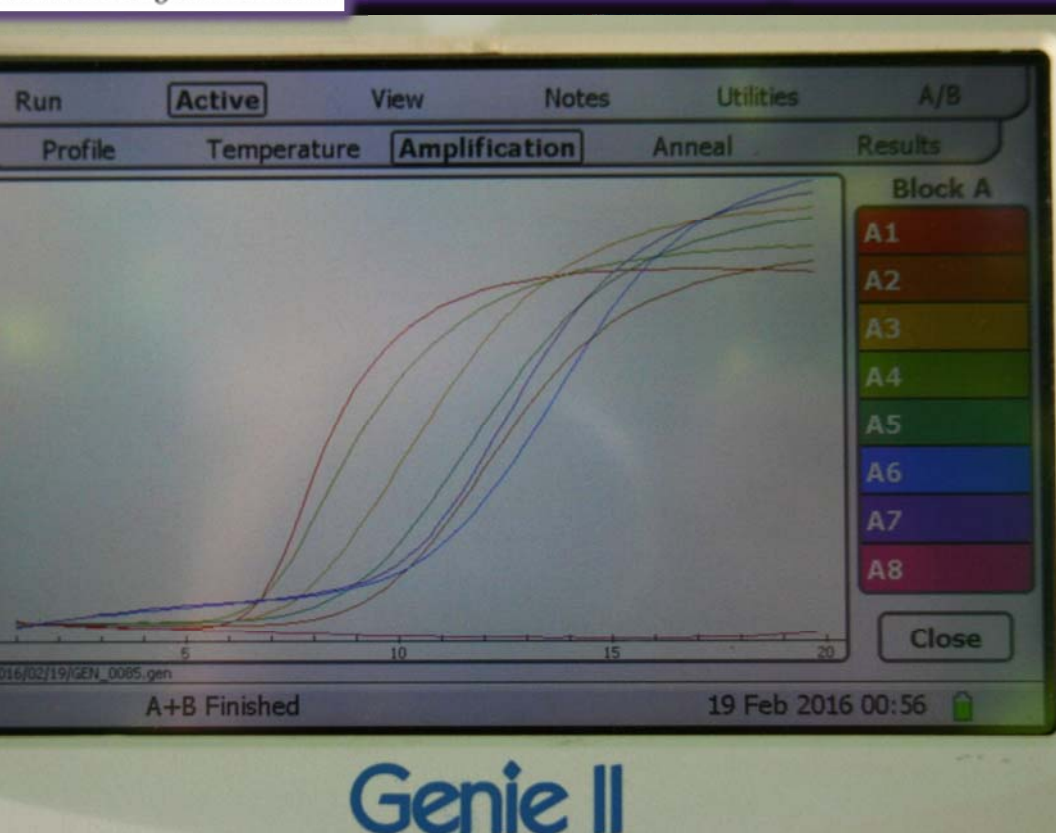
- **Partial gene sequencing**
- **Whole genome sequencing**

***In fact, it's moving to the field***

**New sequencing platforms are developing**

**Metagenomic sequencing increasing**

**Bioinformatic analysis tools are improving**



**LAMP and RPA isothermal technologies in use**

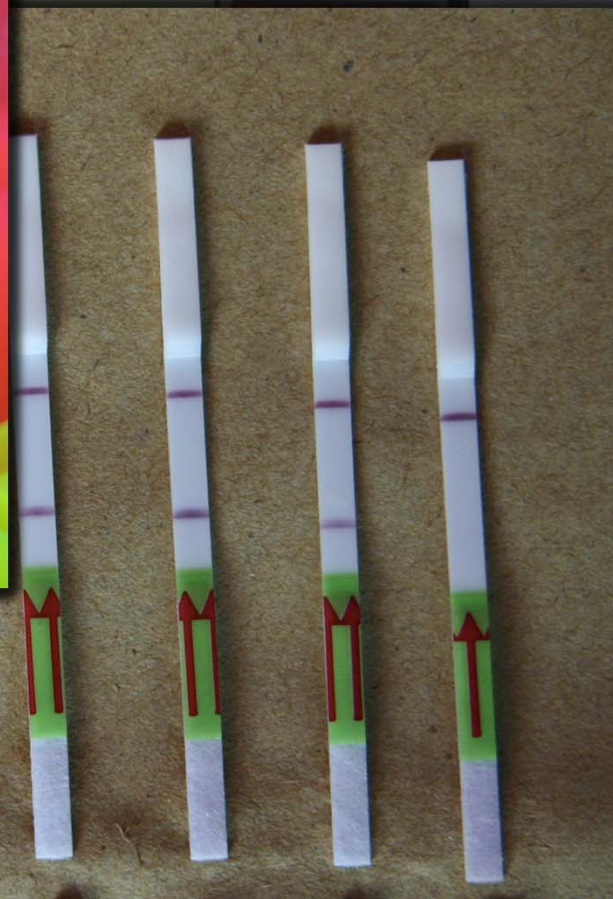
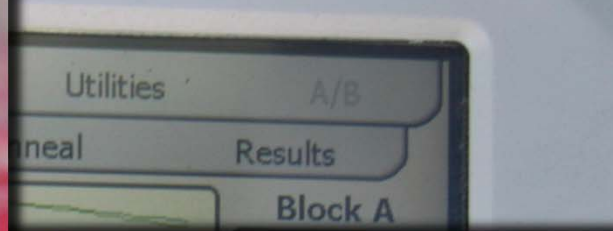
Field-Deployable Detection and Diagnostics - *Rathayibacter toxicus*

## ***Biosecurity Staff Technology Training***

***They like it!***







The FERA SMART spore trap combines:

- Programmed air sampling
- Automated loop-mediated isothermal amplification

**smart, sophisticated, in-field pathogen detection with wireless communication.**

- Transmits diagnostic and weather data to a central facility – or wherever needed.

Collaboration between OptiGene Ltd, Fera, The University of Hertfordshire, Bayer Crop Science and Frontier Agriculture.

The FERA SMART spore trap combines:

- automated loop-mediated isothermal amplification (LAMP) analysis

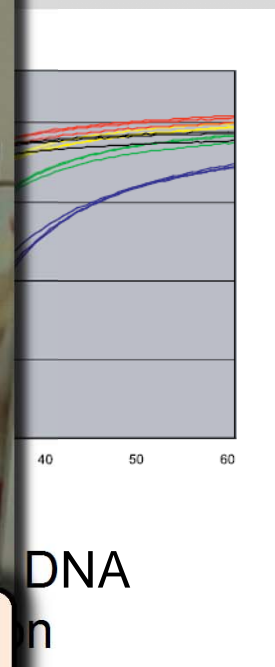
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## Moving advanced diagnostics to the field



**Imagine all that in a drone!**

**LAMP isothermal technologies in use**

**Thumb-drive sequencing – not ready for prime time, but getting closer (Nature 2015).**



**Portable, field-deployable version soon to follow(?)(!)**



## NextGen NPDN: challenges

*Will NPDN remain relevant in this point-of-care diagnostics era?*

*Is that the value that NPDN offers – rapid AND accurate? Experience!*

*And our connection to the research upon which diagnostics are based.*

## Trends in industry

- Whole production to market support
  - Big data – whole system services

*What is our vision – our plan?*

- Specialty consultant groups
  - Complete service providers

*Will NPDN be bypassed in the future?*

## Opportunities

- Should NPDN extend its diagnostic reach to the field – embrace point-of-care diagnostics?

*Change is hard...  
it is hardest on those least prepared.*

- NPDN should not just partner with the research community, it should embed itself in the diagnostics research community.

## Opportunities: NPDN Global Engagement

*APHIS PPQ is expanding off-shore inspections...*



*Global Partners Program*

*...should NPDN partner with the diagnostic labs in those countries?*

- Visiting diagnostician/scientist program

## Opportunities: NPDN Global Engagement



*Global Network of  
Plant Diagnostic Networks*

**What you do is important!**

## Plants...

- *Generate the oxygen we breathe*
- *Food that we consume directly*

**Plant systems will face increasing pressures over the coming decades...**

**...from emerging and recurring pathogens and pests.**

## NextGen NPDN

We cannot predict the future, but  
**we can prepare for it.**

**You are this generations experts in the practice of  
plant diagnostics.**



## NextGen NPDN

- 
- *Imagine the future...*
  - *Make it happen.*





*Thank you & Have a nice day!*

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