



Animal &  
Plant Health  
Agency

# Application of diagnostic tools by Plant health inspectors around the UK

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Animal & Plant Health Agency

# Overview

- Structure of the UK Plant health service
- Activities of the Plant Health & Seeds Inspectorate
- Inspectors role – Select, Detect, Identify, Act.
- Field technologies
- Technology readiness levels
- *Phytophthora ramorum* & *Chalara fraxinea* examples
- Conclusions

# Organisation



**NPPO**

  
 Department  
 for Environment  
 Food & Rural Affairs

**Policy, legislation, coordination**

  Department for Environment Food & Rural Affairs   Forestry Commission	 Llywodraeth Cymru Welsh Government   Cyfoeth Naturiol Cymru Natural Resources Wales	 The Scottish Government Riaghaltas na h-Alba   Forestry Commission	 Northern Ireland Assembly   Department of Agriculture and Rural Development www.dardni.gov.uk
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**Monitoring, surveillance, implementation of controls, testing**

 Animal & Plant Health Agency	 fera The Food and Environment Research Agency	 The Scottish Government   SASA Scottish Agricultural Science and Advisory Service	 afbi Agricultural Food and Insect Biotechnology Institute
 Forest Research Forestry Commission England	 Cyfoeth Naturiol Cymru Natural Resources Wales	 Forest Research Forestry Commission Scotland	 FORESTSERVICE

# Plant Health & Seeds Inspectorate

- 9 regions, 160 staff, 20 major points of entry, fee recovery
  - Look for specific pests, but trained to look for general disease
  - Some specialists - Certification, import & scientific licencing
  - ISO 17020 accredited for: Imports, Plant passporting & Quarantine action
  - Engagement activities
- 
- 100,000 3<sup>rd</sup> country inspections
  - 15,000 Phytosanitary certificates issued
  - 8,000 Inland inspection
  - 900 Europhyt notifications
  - 800 Plant passporting clients

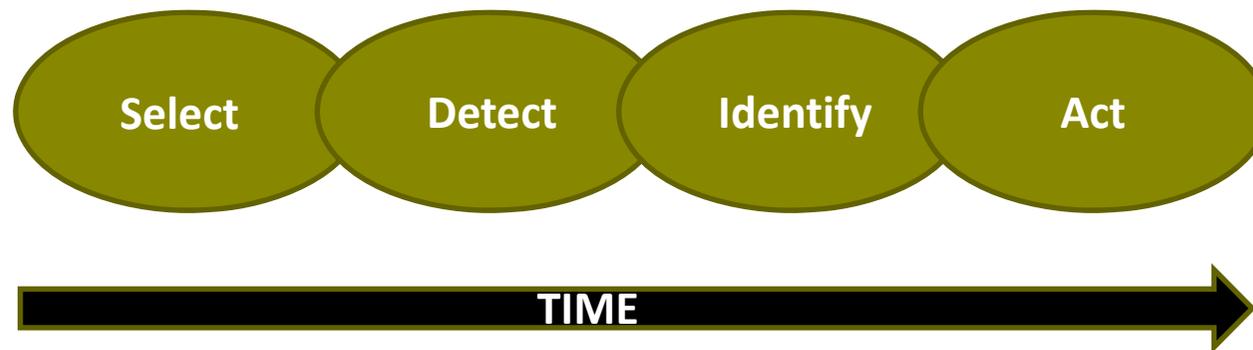


1. Name of official authority RICHARD TAVATOS, NCAM (NATIONAL CENTRAL SCIENCE AND ANALYSIS INSTITUTION), UK UNITED KINGDOM	2. PHYTOSANITARY CERTIFICATE No. EG/UK/GB/01 2008/0017
3. Country of origin and address of consignor AGRI LIFE OF PLANT BIOMATRY KOSKETS AGDALIA GEORGIA	4. Plant Product ORIGINAL
5. Intended means of transport AIR	6. Plant Product Origin Plant Product Origin of AGDALIA GEORGIA
7. Intended point of entry TRINITY INTERNATIONAL AIRPORT	8. Name of consignee UNITED KINGDOM
9. Descriptive name, number and description of consignment items of product (number and name of plants)	9. Quantity indicated 1 X 20 KG BAG 1 X 20 KG BAG
10. This is to certify that the plants or plant products described above have been inspected according to applicable provisions and are considered to be free from quarantine pests, and provided they have other specific pests and that they are considered to comply with the control provisions applicable to the consignee country.	
11. WHEAT (Triticum aestivum) SEEDS WHEAT (Triticum aestivum) SEEDS LABELLED WITH NAME OF CONSIGNEE	
12. Issued at 13. Date of issue 14. Signature 15. Name of official authority 16. Name of consignee	17. Date of issue 18. Signature 19. Name of official authority 20. Name of consignee



# Inspector's role

- To inspect a range of plant material in order to detect & identify harmful pests in a variety of situations and then take action



- Try to reduce chain time
- Tools generally focus on Detect & Identify = Diagnosis

# Select

Which sample do I take ?



What facilities available ?



How much time do we have ?



How do we cover the ground ?



When do we sample ?



What will we do with results ?



# Detect

## Targeted vs random

Profiling of trader

Shipping Manifest				
ACME Trading Company				
September 7, 2013				
Address:	Address	Ship To:	Company	
	City, State ZIP Code		Address	
Phone:	+1-555-555-5555		City, State ZIP Code	
Fax:	+1-555-555-5555			
Customer Account:	3421	Attention:	John Doe	
Order Date:	January 24, 2004	Phone:	+1-555-555-5555	
Order Number:	892345			
Product	Description	Weight	Order Quantity	Ship Quantity

Use of drones



Set sampling



Chance encounter



Public tip off



Unexpected collection



Detect

## Traditional tools



Detect

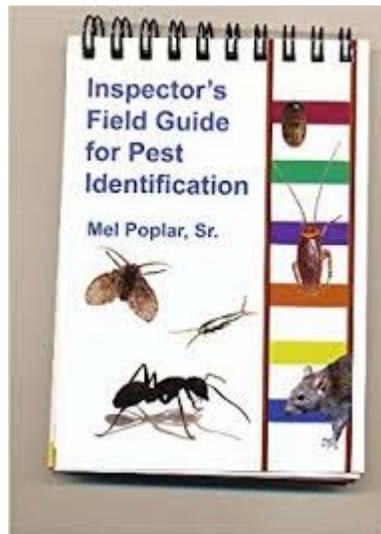
# Traditional tools





Identify

# Improved access to information

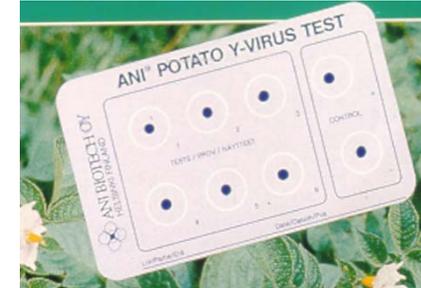
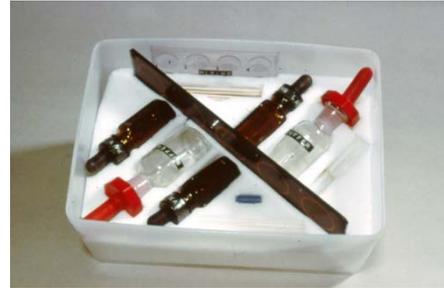


Detect

Identify

- Science partner with Fera since 1980's
- Applying technology at point of inspection
- On-going development through collaboration

## Field technologies



# Some remain experimental



Acoustics

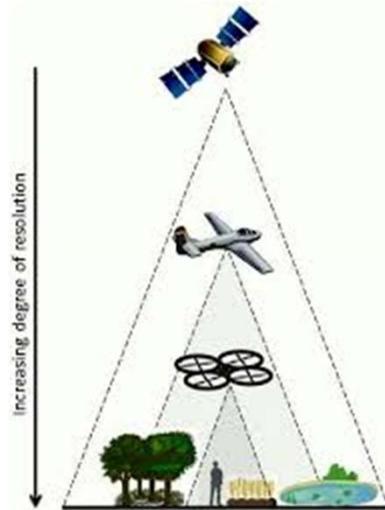


Volatiles

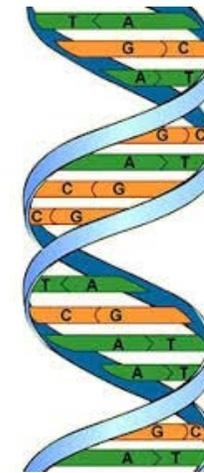
# Others still advancing



Traps



Imaging



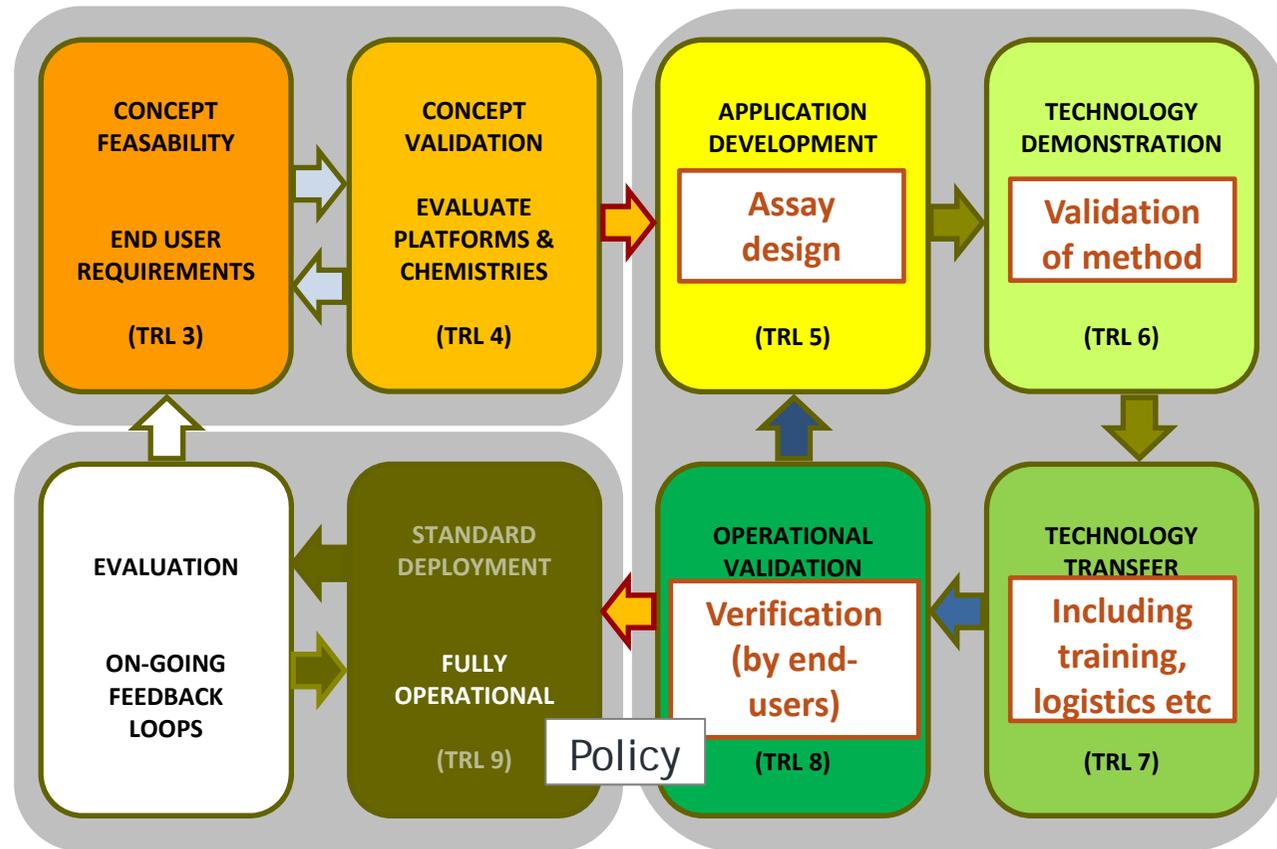
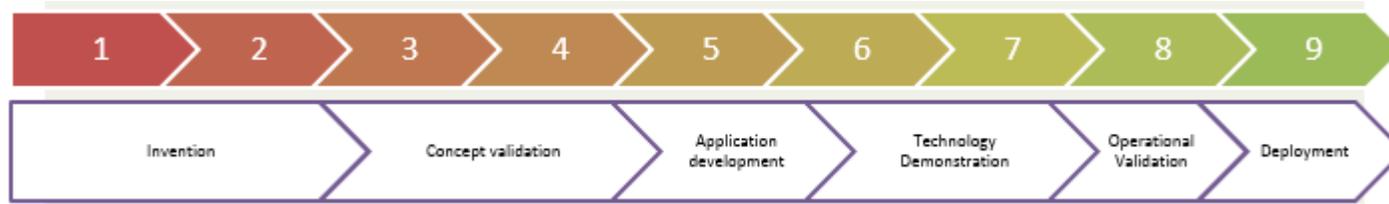
Molecular

- Collaboration & funding has been key, often with SME support

PortCheck



# Technology readiness levels (TRLs)



# Lab to field: *Phytophthora ramorum*

- Oct 2002** Inspectorate provides samples to develop lab protocols
- Jan 2003** LFDs used by inspectors (TRL 9)
- Jan 2004** On-site PCR deployed by lab with inspectors (TRL 6)
- Nov 2004** Assays refined with inspectors (TRL 5)
- May 2006** On-site testing by inspectors alone (TRL 8)
- Aug 2006** Remote lab run by inspectors in Cornwall (TRL 9)
- Nov 2010** Transfer LAMP technology to inspectors (TRL 9)



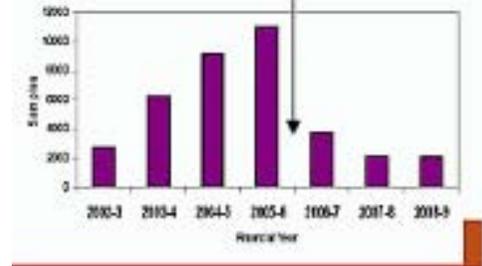
# Benefits from *P. ramorum* tools

## LFD

- 2002: 12,000 lab samples, £ 70 each sent on symptoms
- 30 % *P. ramorum* +ve, other *Phytophthora* sp. or physiological
- 2003: *Phytophthora* sp. LFDs introduced
- 2005: More widely used <3,000 samples yet more sites



§ Post LFD implementation



## PCR - SmartCycler

- 2004: Same day *P. ramorum* confirmation at sites
- Foci detection, better containment / control on public sites
- Enhanced stakeholder engagement



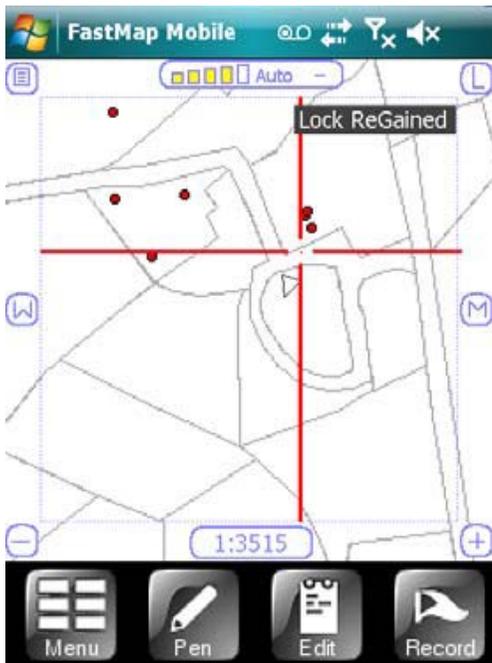
## Surveying & reporting – Trimble device



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CD\_SITE [1411]

FOID		↑
DateStamp	20/11/2012 15:03:44	🕒
QA	7/1.2/1/10.11	↑
EditStatus	NEW	↑
Insp_No		↑
Owner_Type		↓
Unique_ID		↑
Site_Type		↓
Describe_Trees		↓
Lesions	No	↓
Foliar	No	↓

Buttons: Cancel, Repeat, Add, Next

CD\_SITE [1411]

Staining	No	↓
Epicormic	No	↓
Fruiting	No	↓
Dieback	No	↓
symptom_trees	NA	↓
Sample_Taken	No	↓
Observ	No other damage	↓
Comments	TEST	

Buttons: Back, Repeat, Add, Save

CD\_SAMPLE [1412]

FOID		↑
DateStamp	21/11/2012 09:38:26	🕒
QA	7/1.4/1/11.17	↑
EditStatus	NEW	↑
Unique_ID		↑
Insp_No		↑
LR4 No		↑
Comments		↑

Buttons: Cancel, Repeat, Add, Save

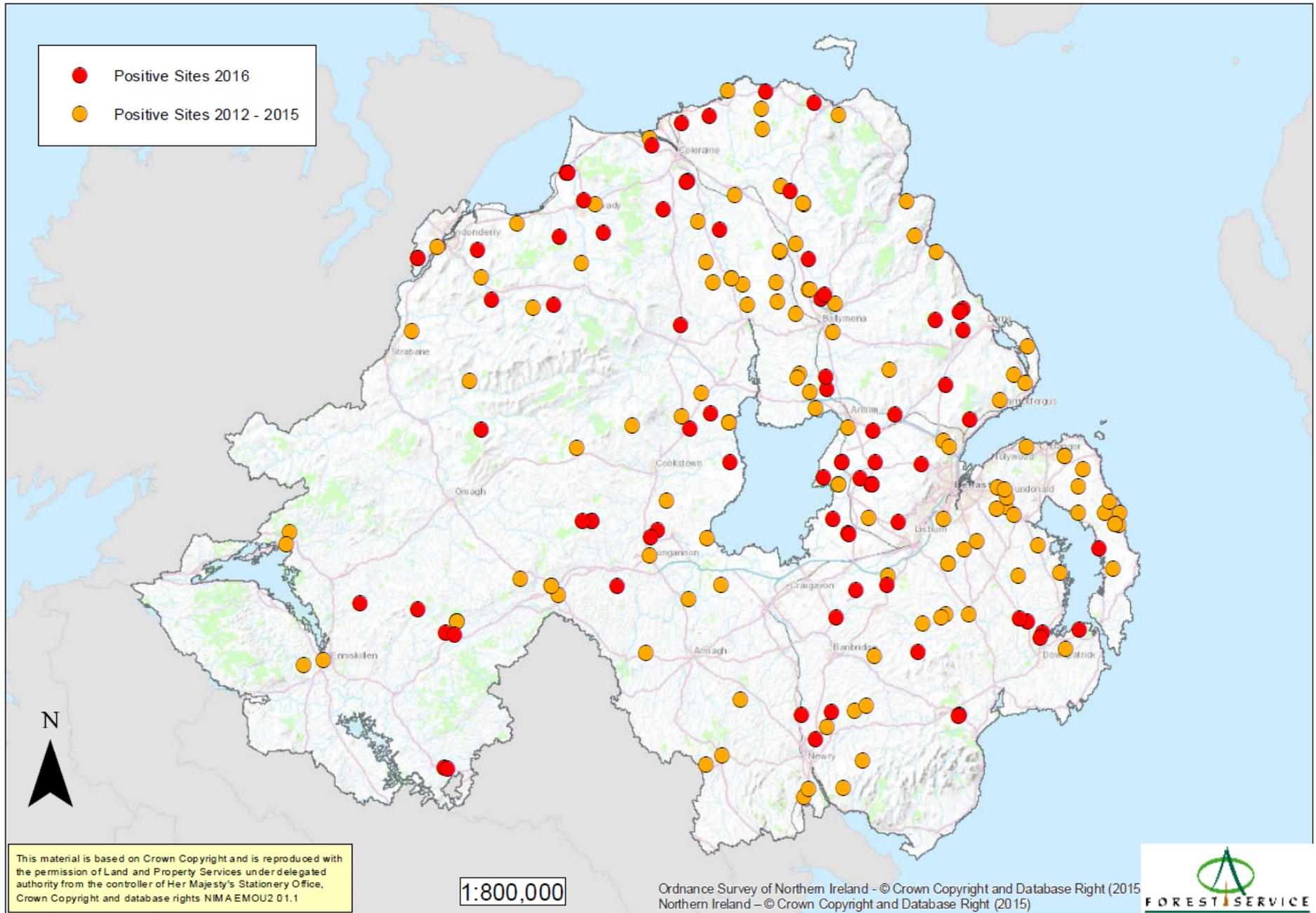


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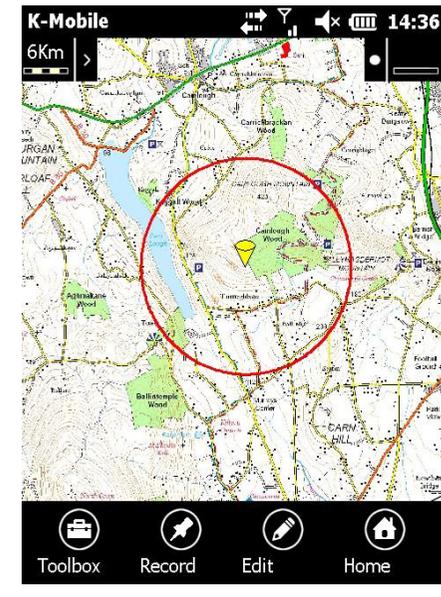
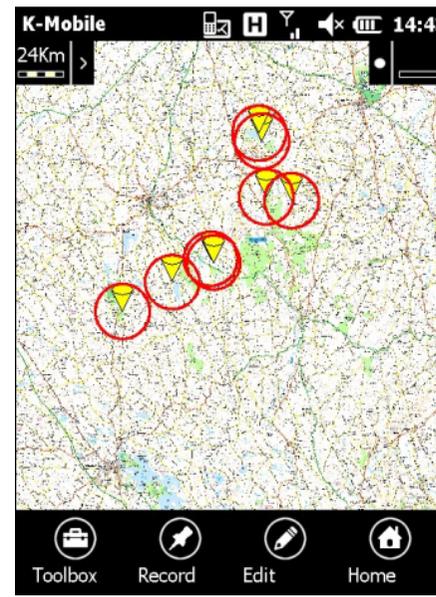
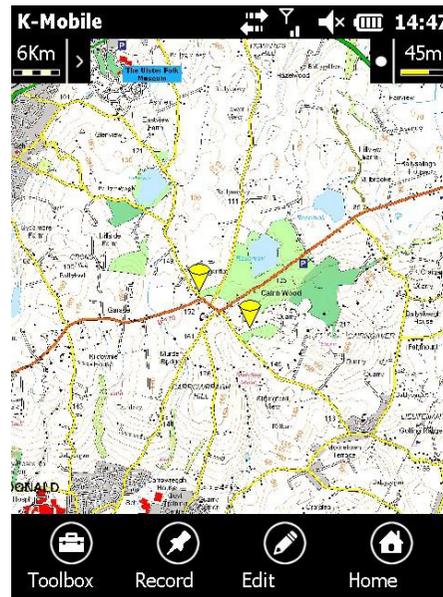
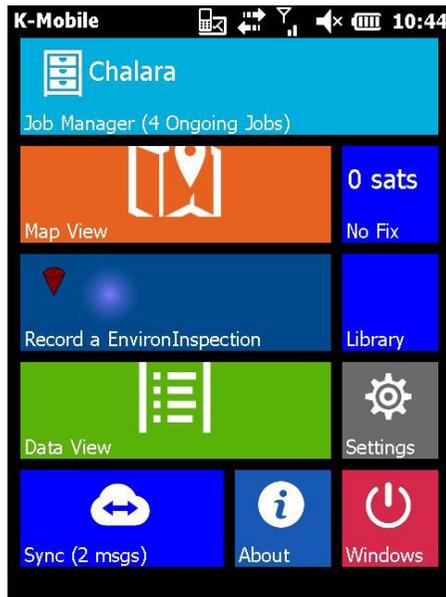
FOR

# Ash Dieback Positive Planted Sites as of December 2016



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# Continuing Systems Development



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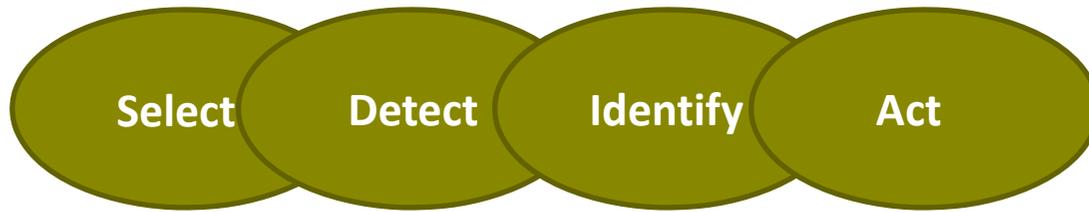
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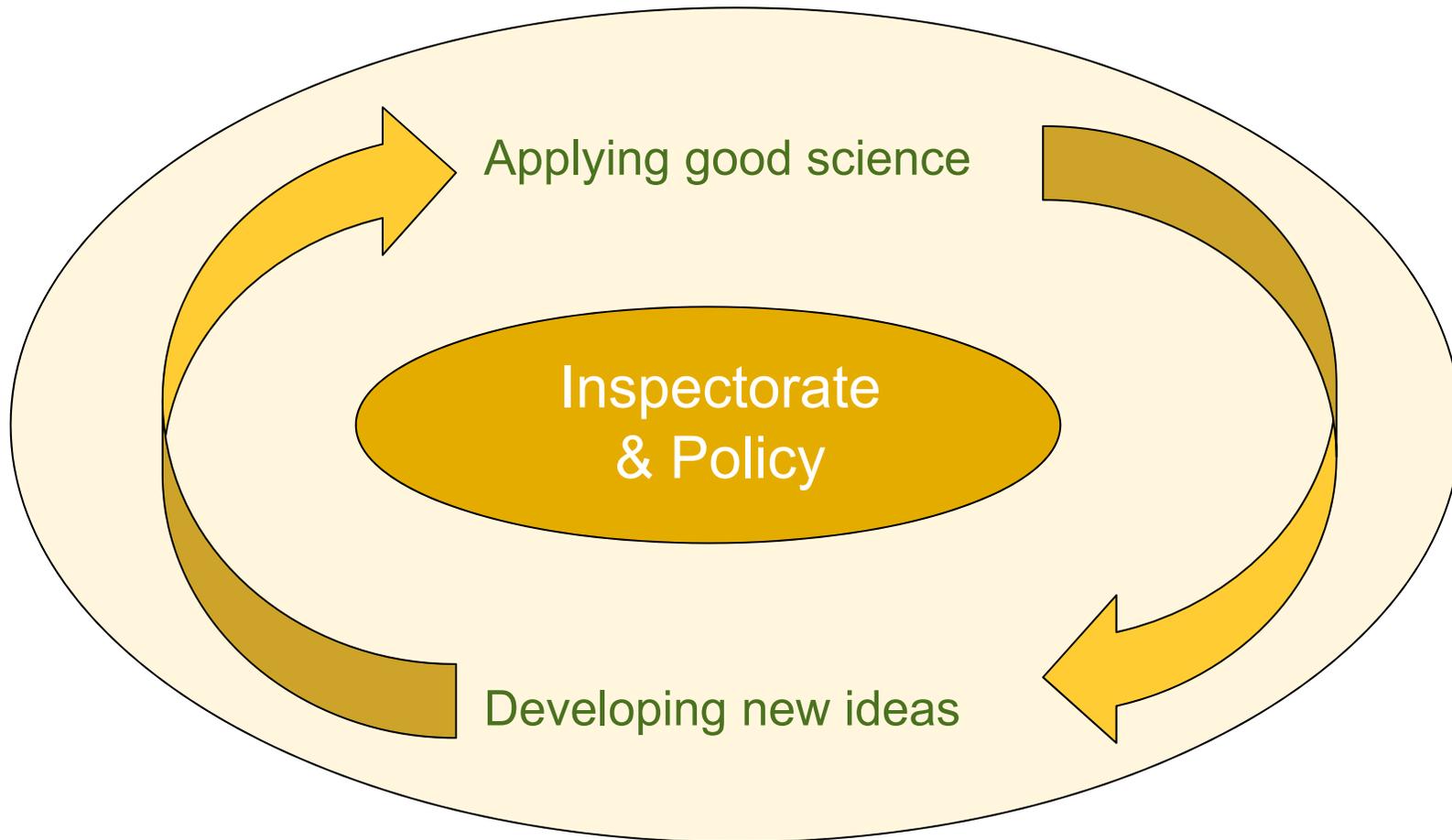
# Issues non-technology effecting TRLs

- Licencing agreements moving from R&D to routine diagnostic
- Licencing non traditional lab areas for work
- Inspector & lab acceptance – changing roles
- Operator training & validation (Training records – ISO)
- Cost of equipment – to purchase & security
- Servicing & decontamination of equipment
- Policy implications non-scientists performing tests, testing unusual samples





- Co-design essential throughout



# New technology (TRL 3-5)

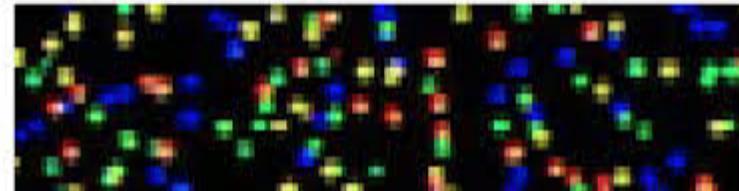


Portable sequencers



New antibody assays

## NGS SEQUENCING



Advanced sequencing



# Acknowledgments

- Neil Boonham & Jenny Tomlinson - Fera Science Ltd
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