

Current impact and future direction of High Throughput Sequencing in plant virus diagnostics: the drivers of COST Action FA1407

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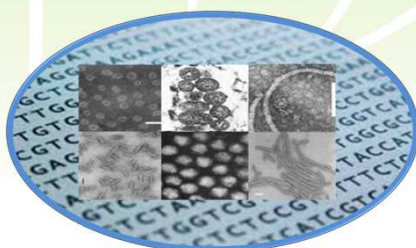
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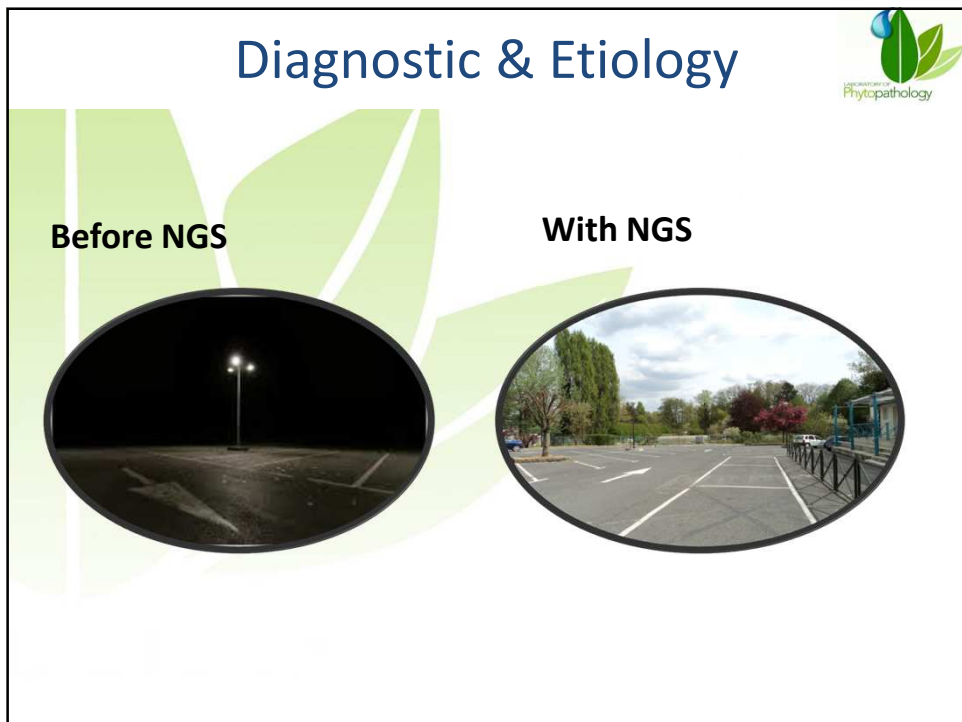
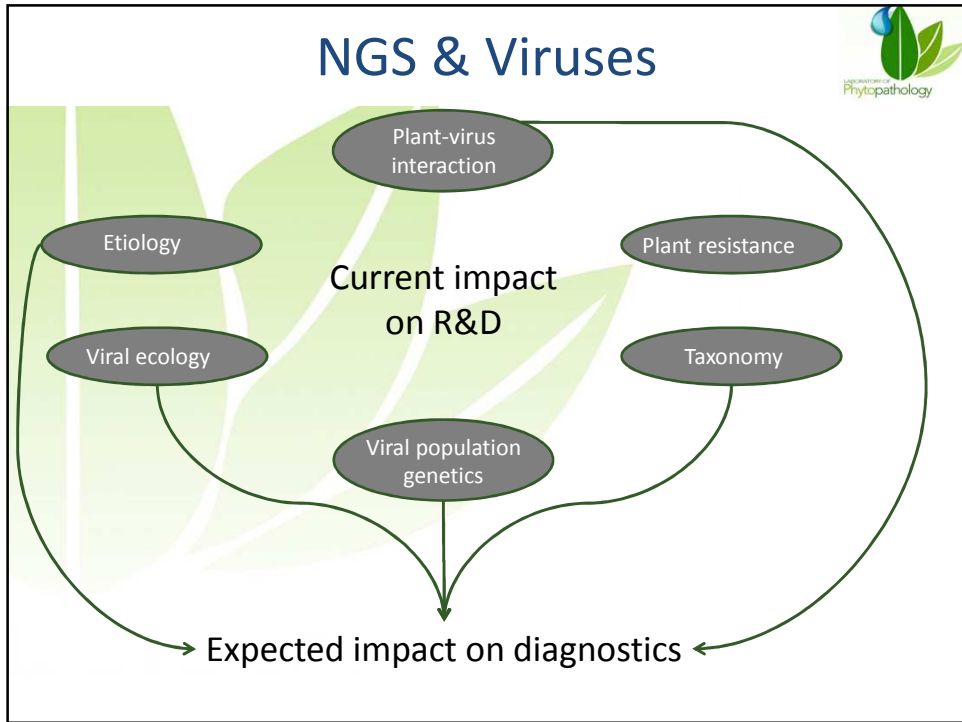



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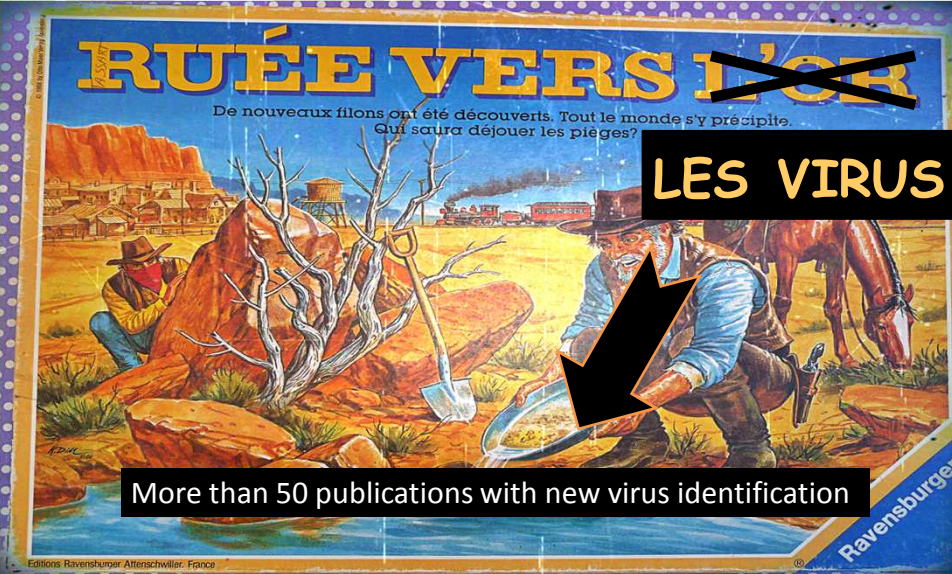


Driving factors





Diagnostic & Etiology 



~~RUÉE VERS L'OR~~


De nouveaux filons ont été découverts. Tout le monde s'y précipite.
Qui saura déjouer les pièges?

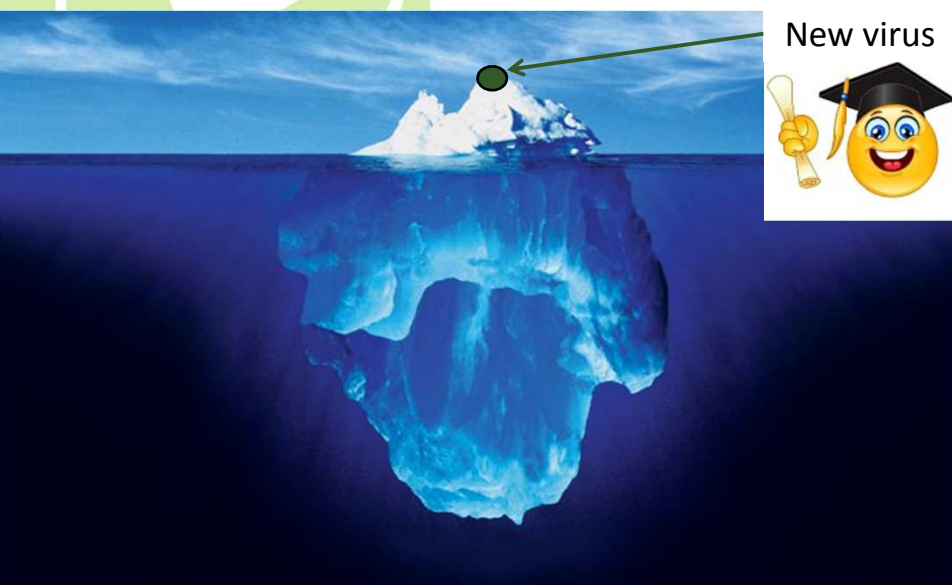
LES VIRUS

More than 50 publications with new virus identification


Ravensburger

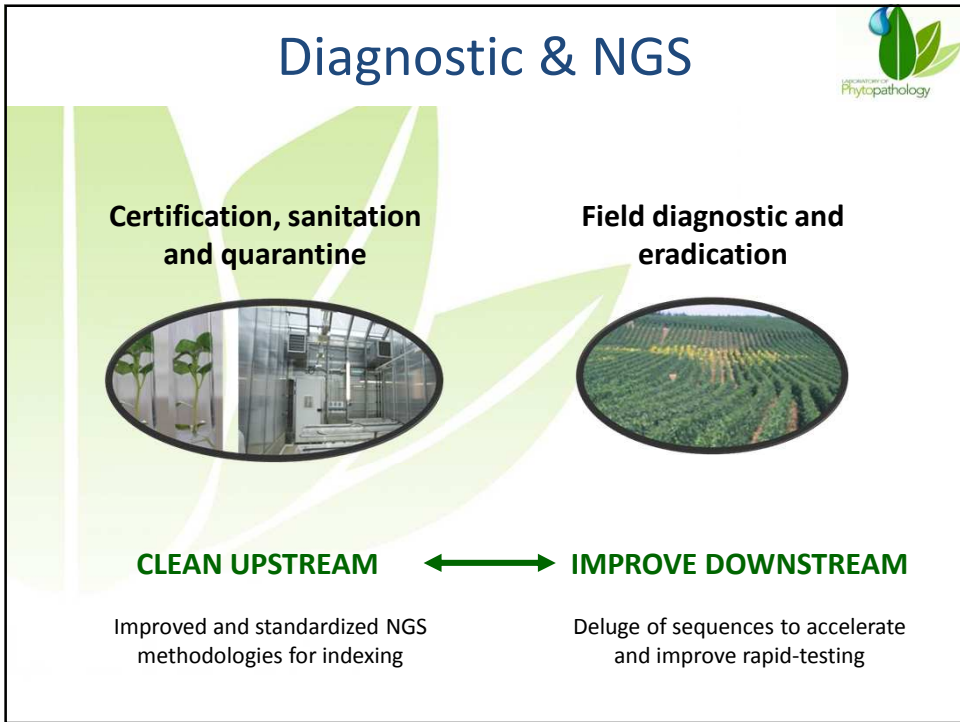
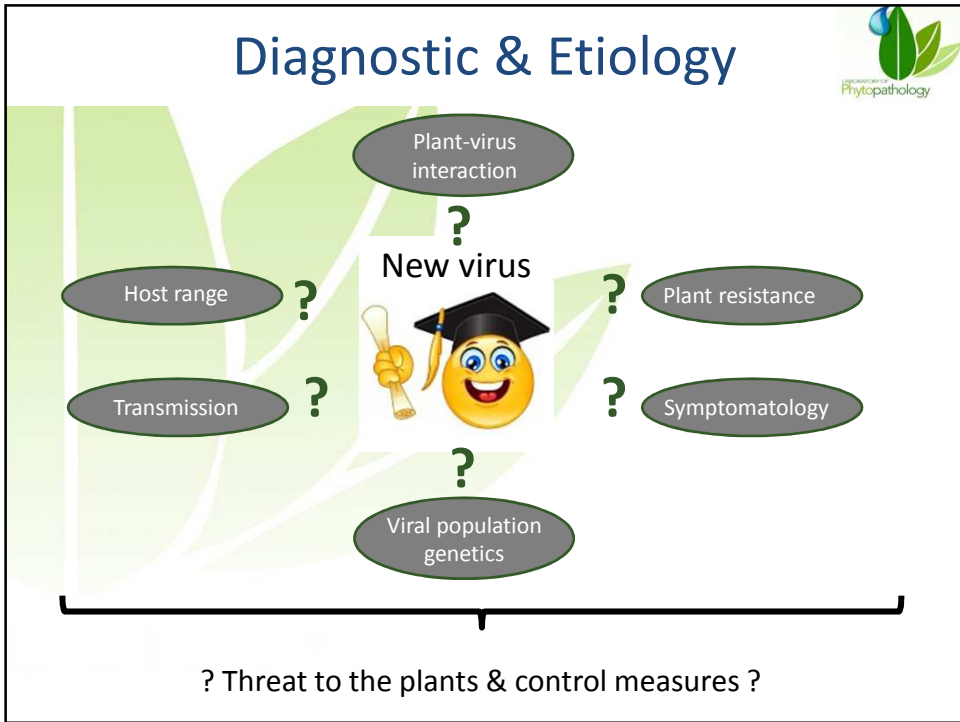
Editions Ravensburger, Altdorf, France

Diagnostic & Etiology 




New virus






Technical Challenges




- 1. Preparation & sequencing strategies ?**
 - Extraction protocol
 - DNA, total RNA, particle isolation, small RNA, dsRNA
- 2. Sensitivity ?**
 - Dependent on sequencing depth
 - Similar to PCR
 - What about a single or a couple of viral reads ?
- 3. Reproducibility and repeatability ?**
 - Intra and inter-laboratory comparison


Technical Challenges



- 4. Contaminations ?**
 - Human & beef contigs -> what about viruses ?
 - Partial or total genome coverage
 - Strict confinement needed !
- 5. Adaptation to host species ?**
 - Virus titre and extraction method

 Practical and technical challenges requiring both fundamental and applied research

Practical impact



Identification of a new virus or a poorly characterized virus by a diagnostician ?

- Halt the distribution of the plant material ?
- Confirmatory assays (Molecular Koch postulate) ?
- Long-term experiment on virus biology ?


➔ Technical framework and decision schemes are needed

Latent (or symbiotic)viruses discovered ?

- Probability of discovering non pathogenic viruses is high
- Re-think trophic relationships ?

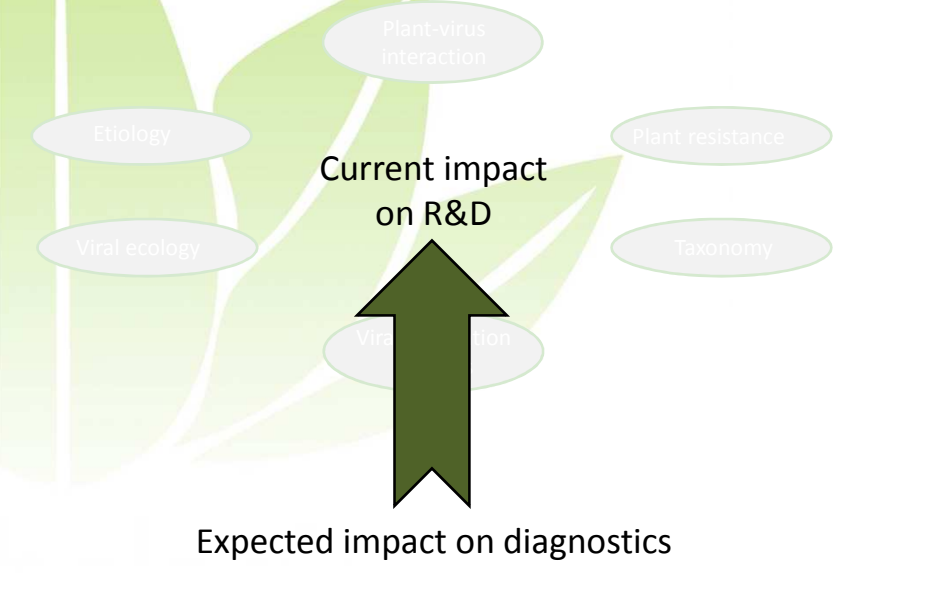
➔ Adaptation of regulatory framework ?

NGS & Viruses



Current impact
on R&D

Expected impact on diagnostics



The diagram illustrates the impact of Next-Generation Sequencing (NGS) on virus research. A large green arrow points upwards from the text 'Expected impact on diagnostics' to the text 'Current impact on R&D'. Surrounding the central text are several research areas in light green ovals: Etiology, Viral ecology, Plant-virus interaction, Plant resistance, and Taxonomy.

COST Action FA1407




DIVAS

Deep
Investigation on
Virus
Associated
Sequences



DIVAS



Applied virologists

Fundamental virologists



Diagnostician

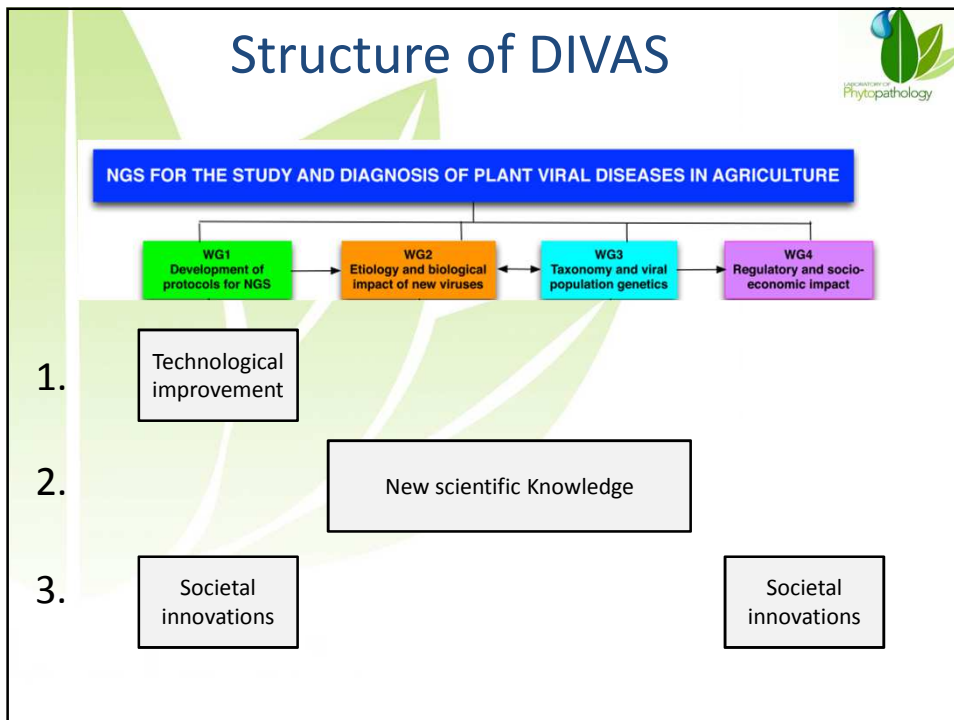
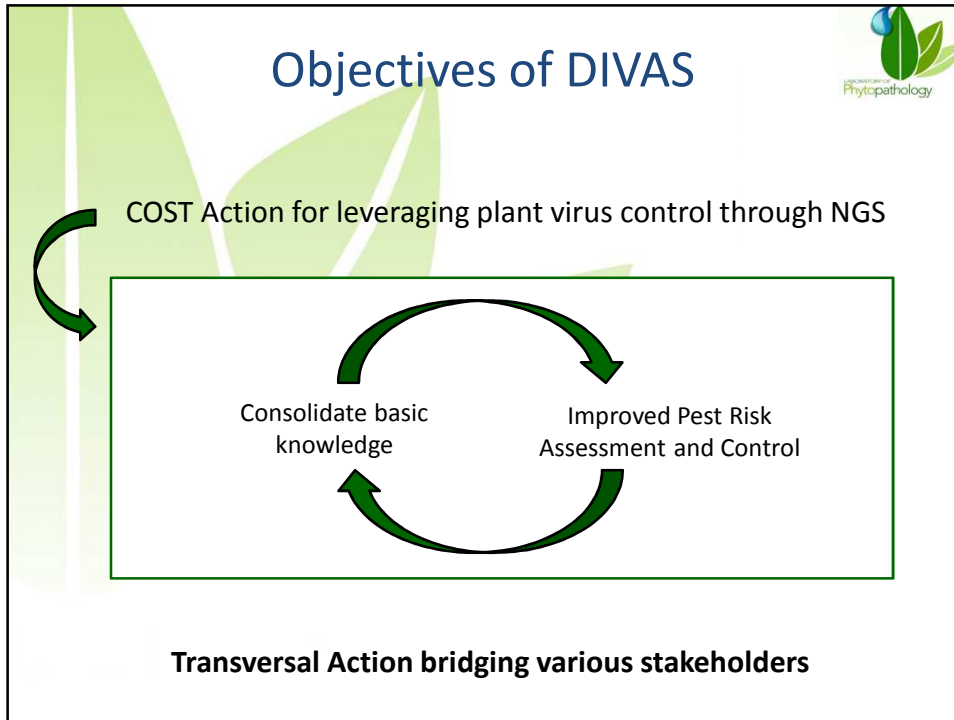
Industries

Coordinate and raise the European capacity to apply NGS technologies for the **study and diagnosis of viral diseases** in vegetatively propagated plants, seeds and seedlings.

Regulatory authorities

NPPO/EPPO





Structure of DIVAS



- ✓ 25 European countries
- ✓ 10 additional countries outside Europe
- ✓ 50 people involved
- ✓ Activities :
 - ❖ Conference
 - ❖ Training schools
 - ❖ Scientific missions

Conclusion



- ✓ Large impact in R&D
- ✓ Impact ongoing in diagnostic
 - ❖ Scientific & regulatory consequences
 - ❖ Feedback loop to fundamental research
- ✓ Long term :
 - ❖ Safer movement and trade
 - ❖ Better understanding of the virus threat and biology (including the Pathovirome)

Thank you for your attention



For more information:

Massart et al., 2014. Virus Research, 188: 90-96



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