Syndromic surveillance for the detection of emerging and re-emerging diseases in cattle

Aurélien Madouasse

July 16, 2015

Emerging and re-emerging diseases in cattle

- Over the past 20 years:
  - Bovine spongiform encephalopathy
  - Foot and mouth disease
  - Bovine neonatal pancytopenia
  - Bluetongue virus
  - Schmallenberg virus

Emerging and re-emerging diseases in cattle

- Over the past 20 years:
  - Bovine spongiform encephalopathy
  - Foot and mouth disease
  - Bovine neonatal pancytopenia
  - Bluetongue virus
  - Schmallenberg virus
- Disease that were unknown or not present in the population

Emerging and re-emerging diseases in cattle

- Over the past 20 years:
  - Bovine spongiform encephalopathy
  - Foot and mouth disease
  - Bovine neonatal pancytopenia
  - Bluetongue virus
  - Schmallenberg virus
- Disease that were unknown or not present in the population

$\Rightarrow$ Relevance of targeted surveillance limited for most diseases:

- Impossible to test for all known and unknown diseases that could emerge

$\Rightarrow$ Syndromic surveillance

Syndromic surveillance

- Aim:
  - Detect potentially unknown health disorders through their consequences
- Detection of an abnormal event:
  - Must be precocious
  - Leads to further investigations allowing the identification of the cause

Syndromic surveillance

- How to?
  - Collect relevant data
  - Construct indicators
  - Look for unusual patterns and deviations
  - Detection of abnormal events leads to further investigations and action

$\Rightarrow$ All this must be performed in close to real-time

Emergence of BTV

- Bluetongue virus
  - Emerged in Northern Europe in 2006
  - Emerged in France in 2006-2007

    (Notification of clinical suspicions was mandatory)
  - Spread in France until 2010
  - Caused reproductive disorders, abortions, mortality, drop in milk production, ...

Emergence of BTV

- Bluetongue virus
  - Emerged in Northern Europe in 2006
  - Emerged in France in 2006-2007

    (Notification of clinical suspicions was mandatory)
  - Spread in France until 2010
  - Caused reproductive disorders, abortions, mortality, drop in milk production, ...
- EMIDA ERA-NET research project on testing indicators constructed from milk production and reproduction in dairy cattle for the detection of such emergences

2007 emergence of BTV

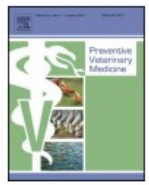
- Milk production data
  - Milk recording
  - Individual cow milk production collected monthly
- Prediction of expected milk production/herd/week
- Detection of clusters of recorded $<$ expected

Preventive Veterinary Medicine 113 (2014) 484–491

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed



Use of monthly collected milk yields for the detection of the emergence of the 2007 French BTV epizootic

Aurélien Madouasse[a,b,*], Alexis Marceau[a,b], Anne Lehébel[a,b], Henriëtte Brouwer-Middelesch[c], Gerdien van Schaik[c], Yves Van der Stede[d,e], Christine Fourichon[a,b]

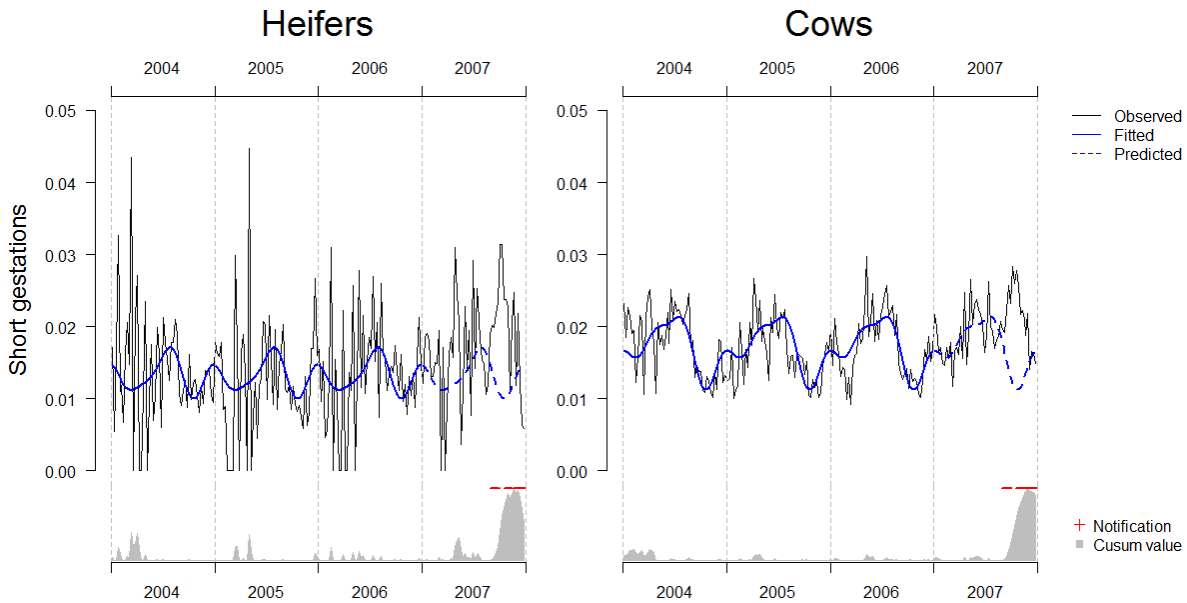
[a] INRA, UMR1300 Biologie, Epidémiologie et Analyse de Risque en santé animale, CS 40706, F-44307 Nantes, France
[b] LUNAM Université, Oniris, Ecole nationale vétérinaire, agroalimentaire et de l'alimentation Nantes Atlantique, UMR BioEpAR, F-44307 Nantes, France
[c] GD Animal Health Service, PO Box 9, 7400AA Deventer, the Netherlands
[d] Unit for Co-ordination of Veterinary Diagnostics, Epidemiology and Risk Analysis (CVD-ERA), Groeselenberg 99, B-1180 Brussels, Belgium
[e] Department of Virology, Parasitology and Immunology, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

2007 emergence of BTV

- Reproductive data
  - Artificial insemination
  - Each artificial insemination recorded
  - Calving dates available
  - 5 indicators tested
  - Best indicator: proportion of cows calving a few days earlier than expected

2007 emergence of BTV

- Reproductive data
  - Artificial insemination
  - Each artificial insemination recorded
  - Calving dates available
  - 5 indicators tested
  - Best indicator: proportion of cows calving a few days earlier than expected



2007 emergence of BTV

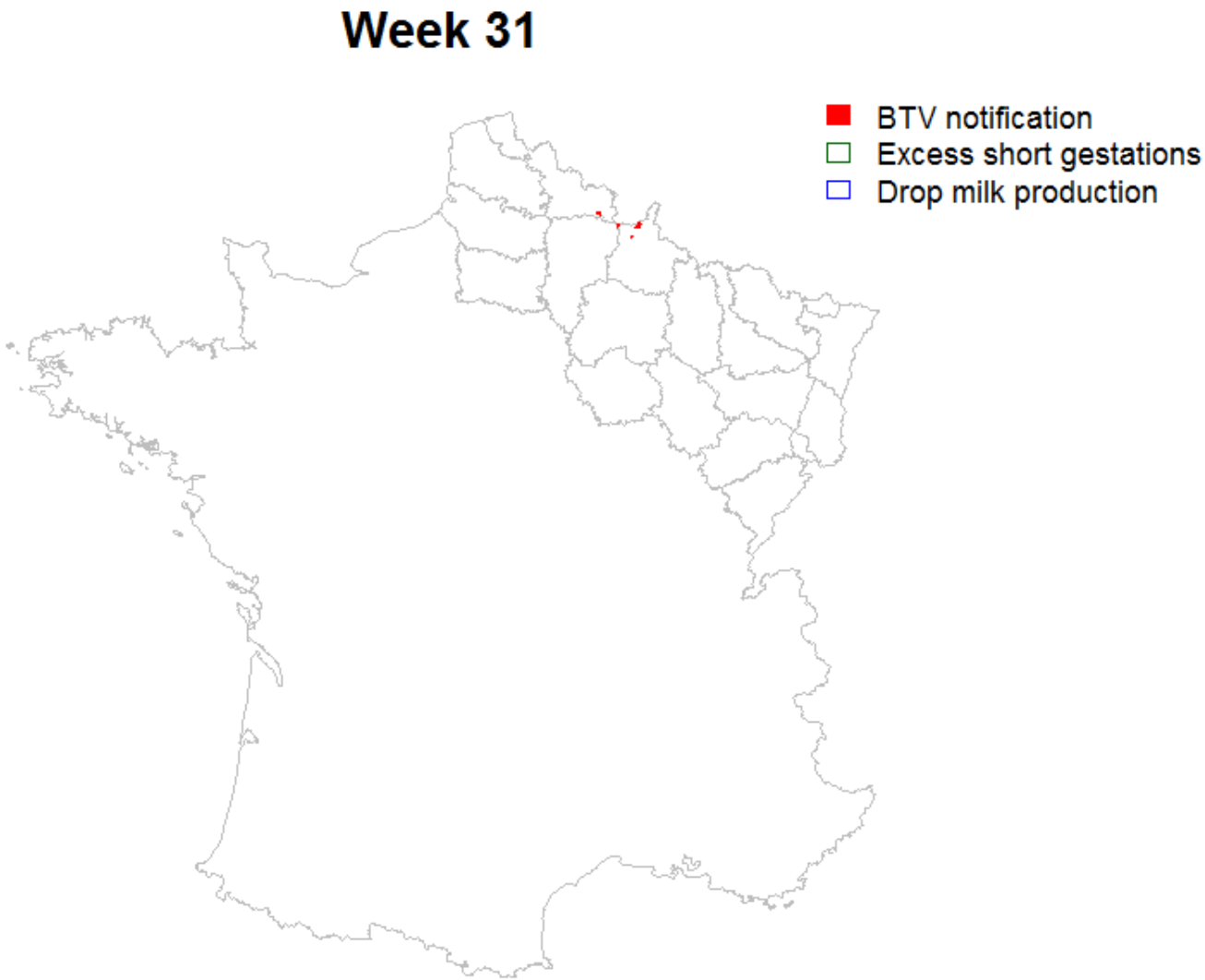
- Reproductive data
  - Artificial insemination
  - Each artificial insemination recorded
  - Calving dates available
  - 5 indicators tested
  - Best indicator: proportion of cows calving a few days earlier than expected

J. Dairy Sci. 97:6135–6150
http://dx.doi.org/10.3168/jds.2013-7346
© American Dairy Science Association®, 2014.

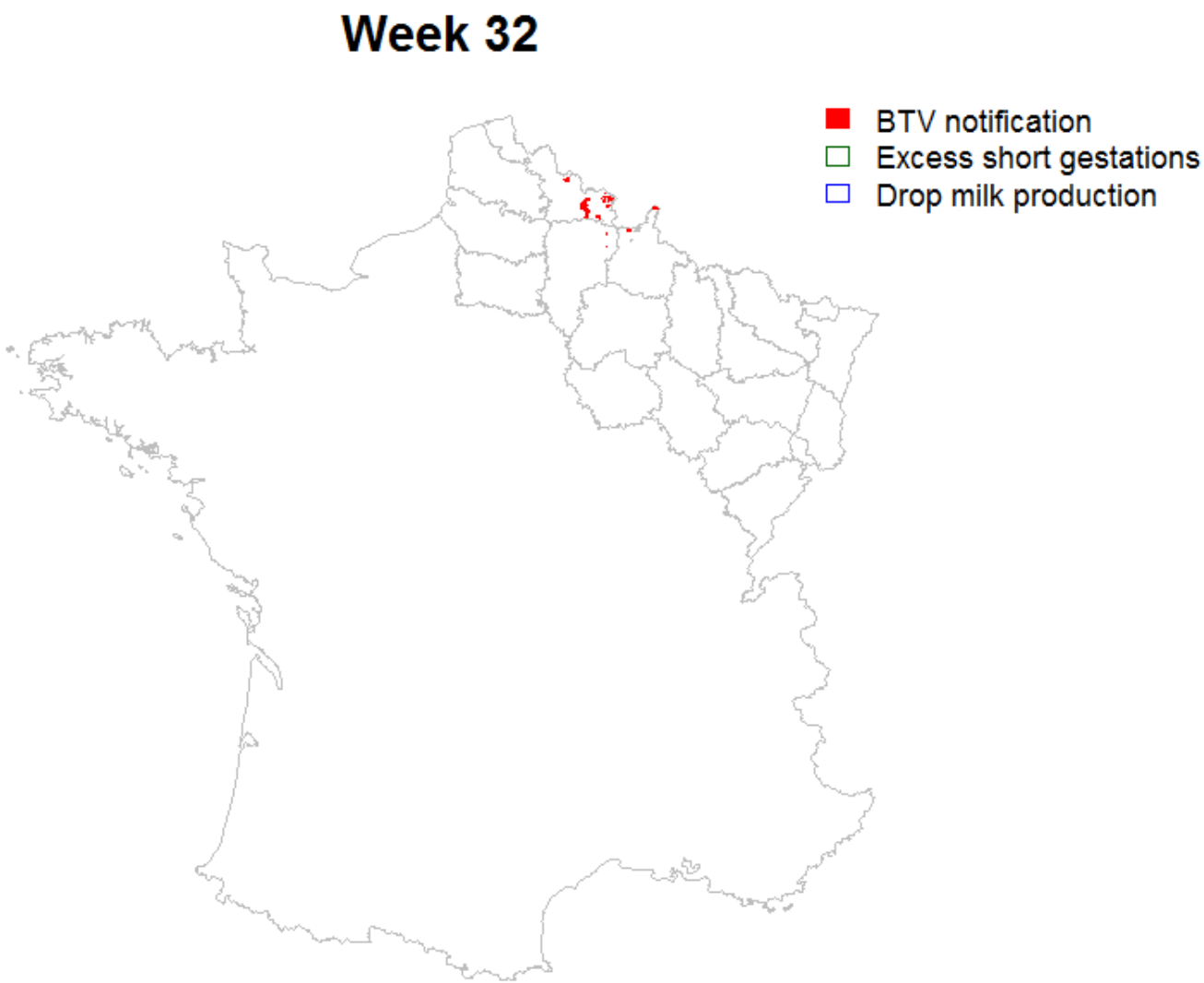
Can routinely recorded reproductive events be used as indicators of disease emergence in dairy cattle? An evaluation of 5 indicators during the emergence of bluetongue virus in France in 2007 and 2008

Alexis Marceau,*†‡ Aurélien Madouasse,*†‡ Anne Lehébel,*†‡ Gerdien van Schaik,§ Anouk Veldhuis,§ Yves Van der Stede,#‖¶ and Christine Fourichon*†‡[1]
*Oniris, UMR1300 Biologie, Epidémiologie et Analyse de Risque en Santé Animale, La Chantrerie, CS 40706, F-44307 Nantes, France
†INRA, UMR1300, F-44307 Nantes, France
‡Université Nantes (LUNAM), Angers, Le Mans, F-44200, Nantes, France
§GD Animal Health, Epidemiology Group, PO Box 9, 7400 AA Deventer, the Netherlands
#Coordination Veterinary Diagnostics–Epidemiology and Risk Assessment (CODA-CERVA), Groeselenberg 99, 1180 Brussels, Belgium
‖Laboratory of Veterinary Immunology, Faculty of Veterinary Medicine, Salisburylaan 133, 9820 Merelbeke, Belgium
¶Laboratory of Veterinary Immunology, Ghent University, Faculty of Veterinary Medicine, Salisburylaan 133, 9820 Merelbeke, Belgium

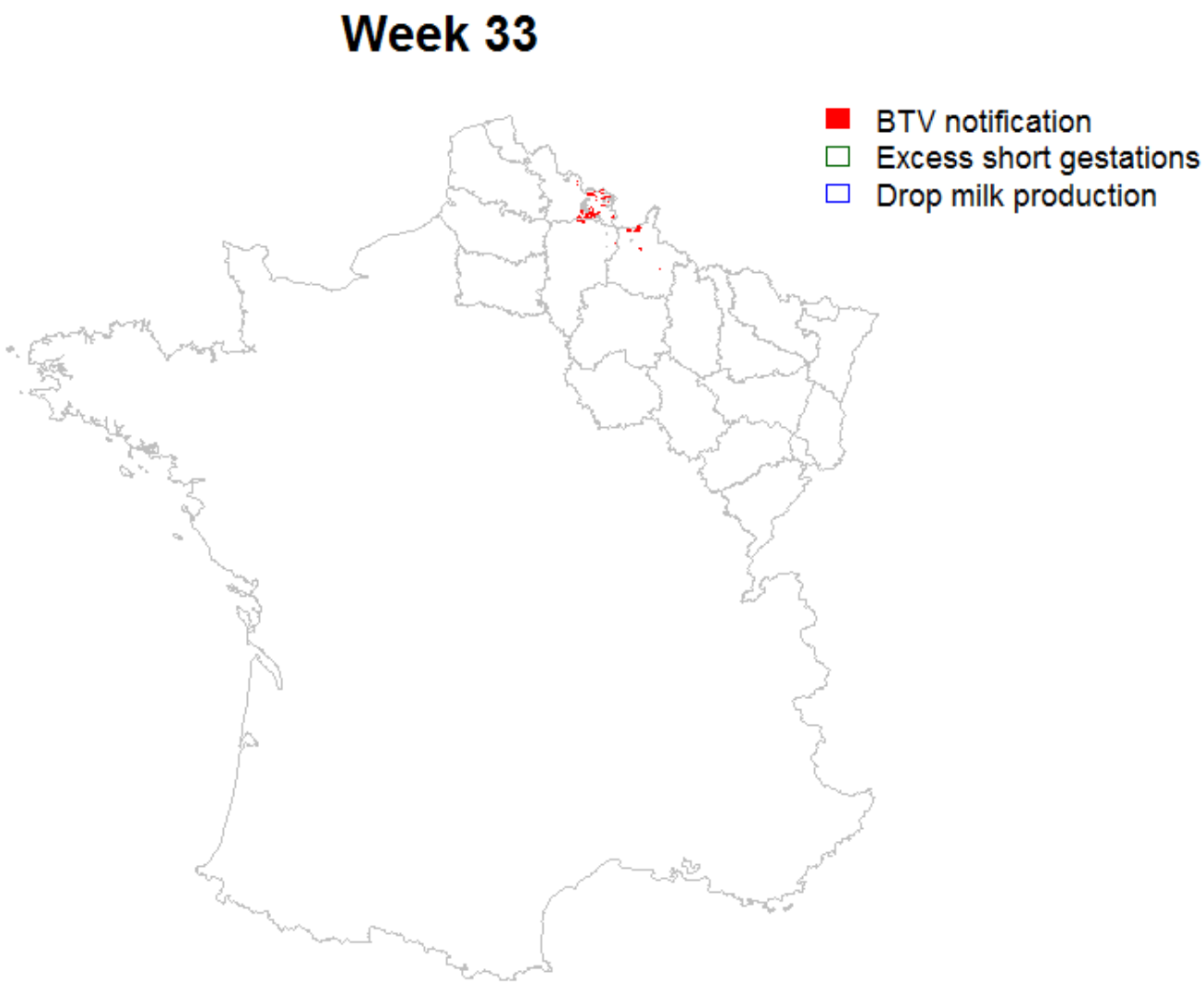
2007 emergence of BTV



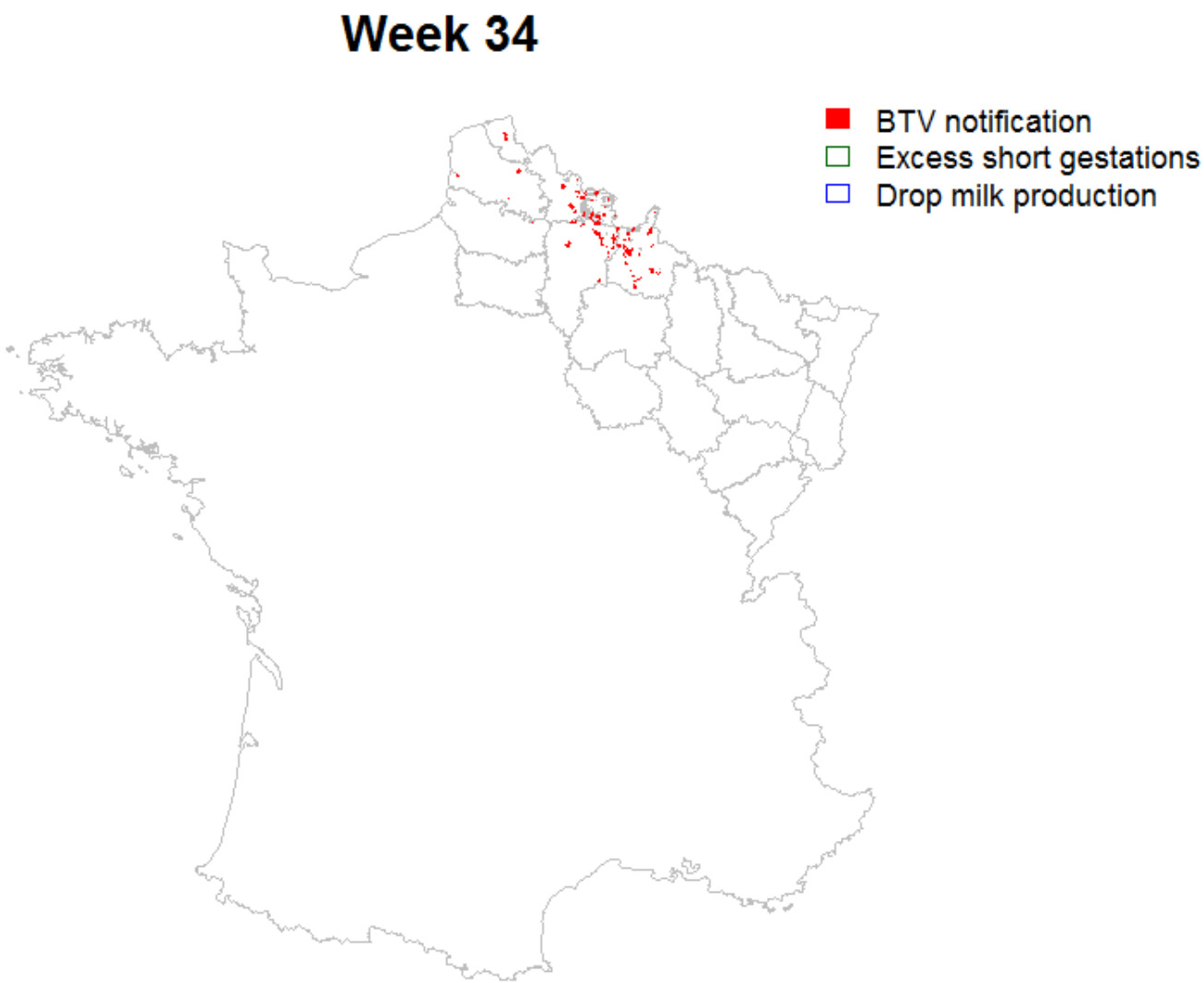
2007 emergence of BTV



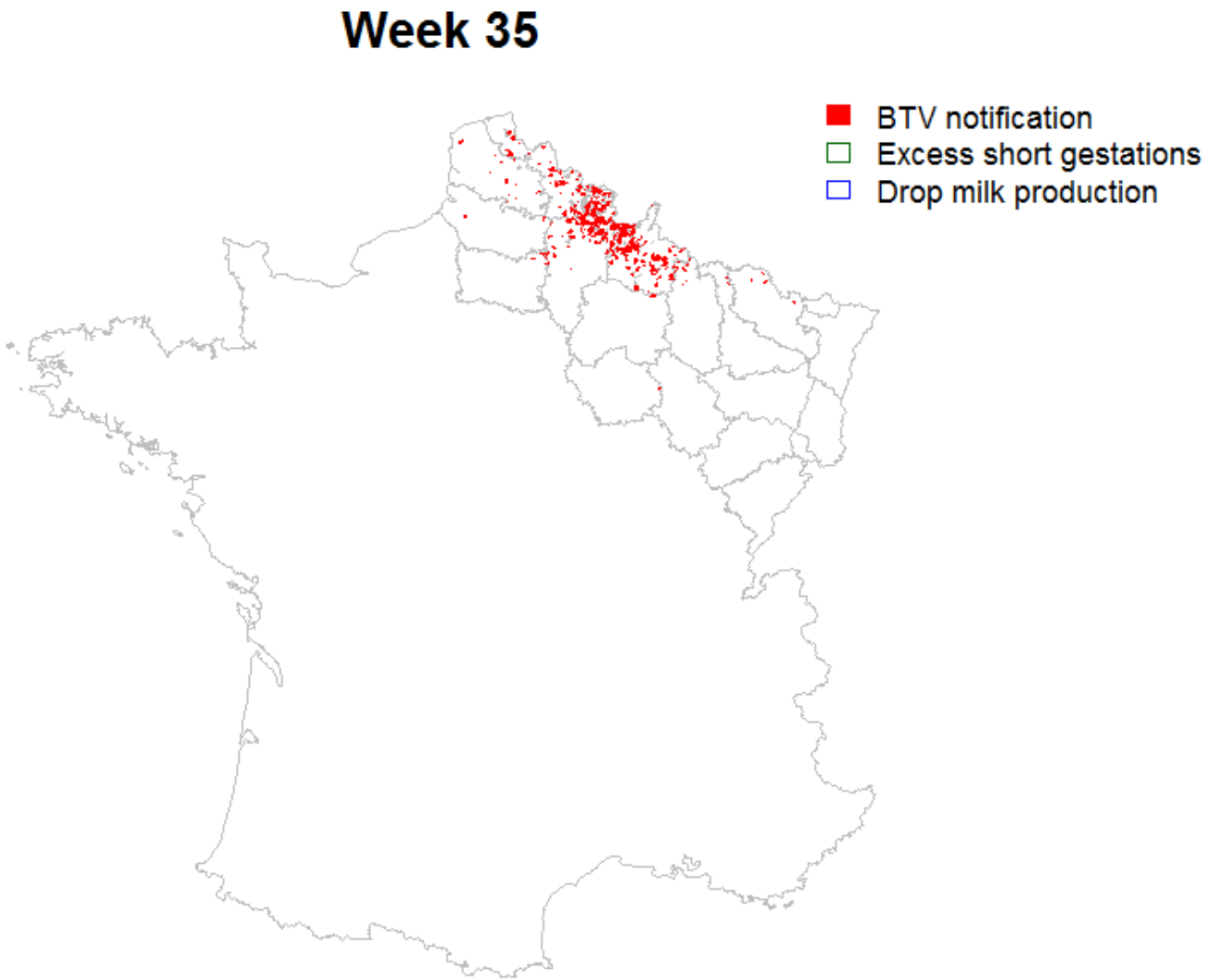
2007 emergence of BTV



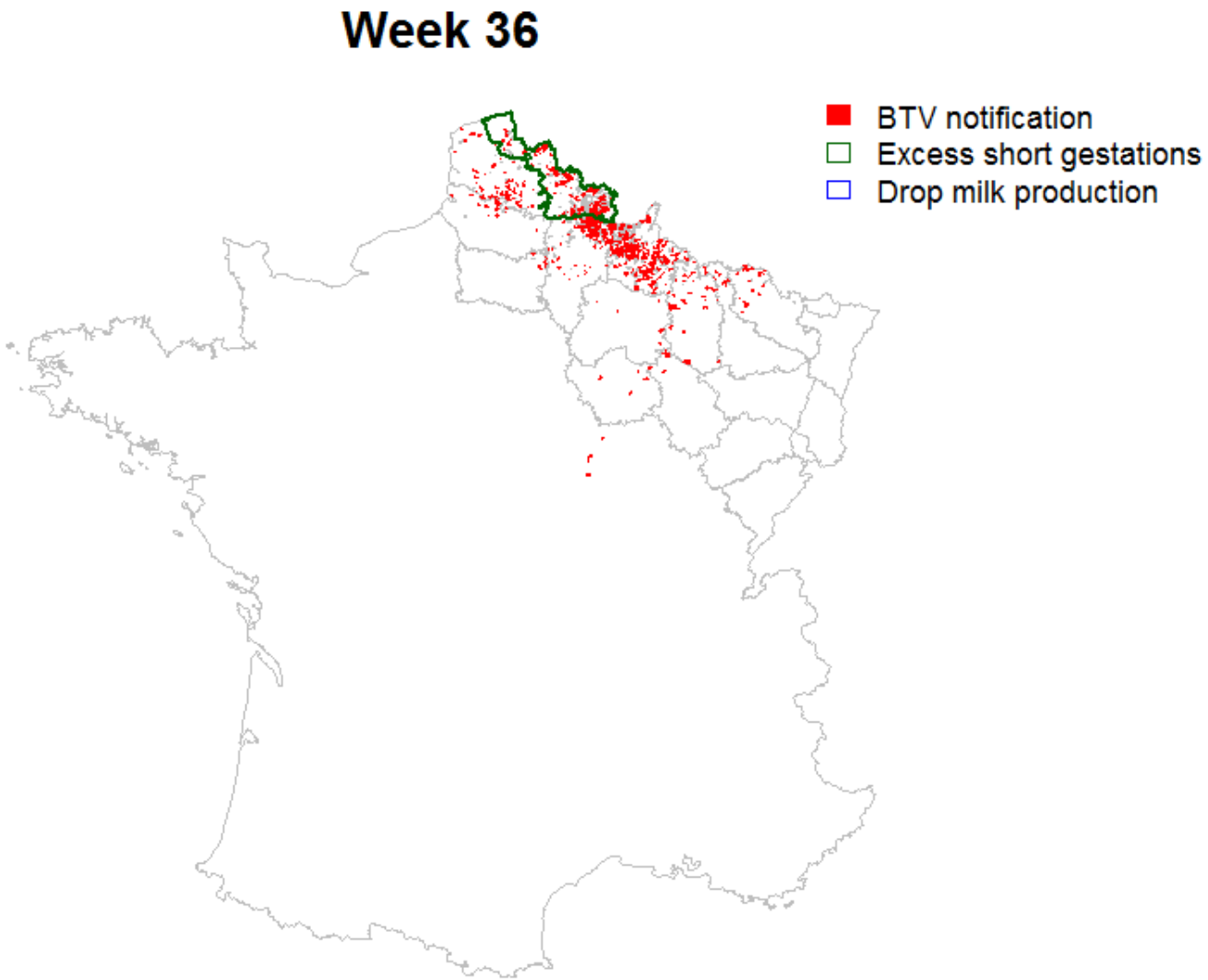
2007 emergence of BTV



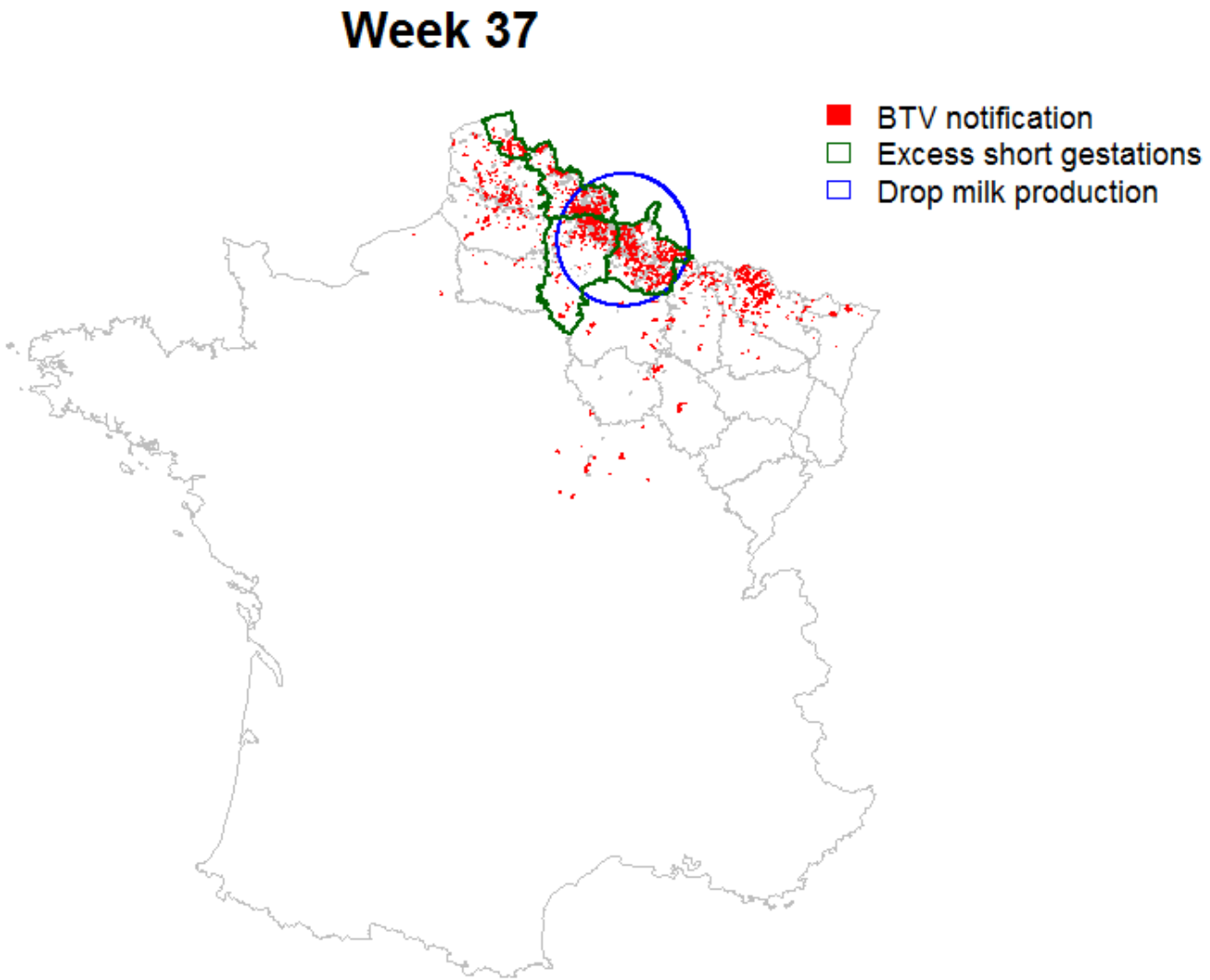
2007 emergence of BTV



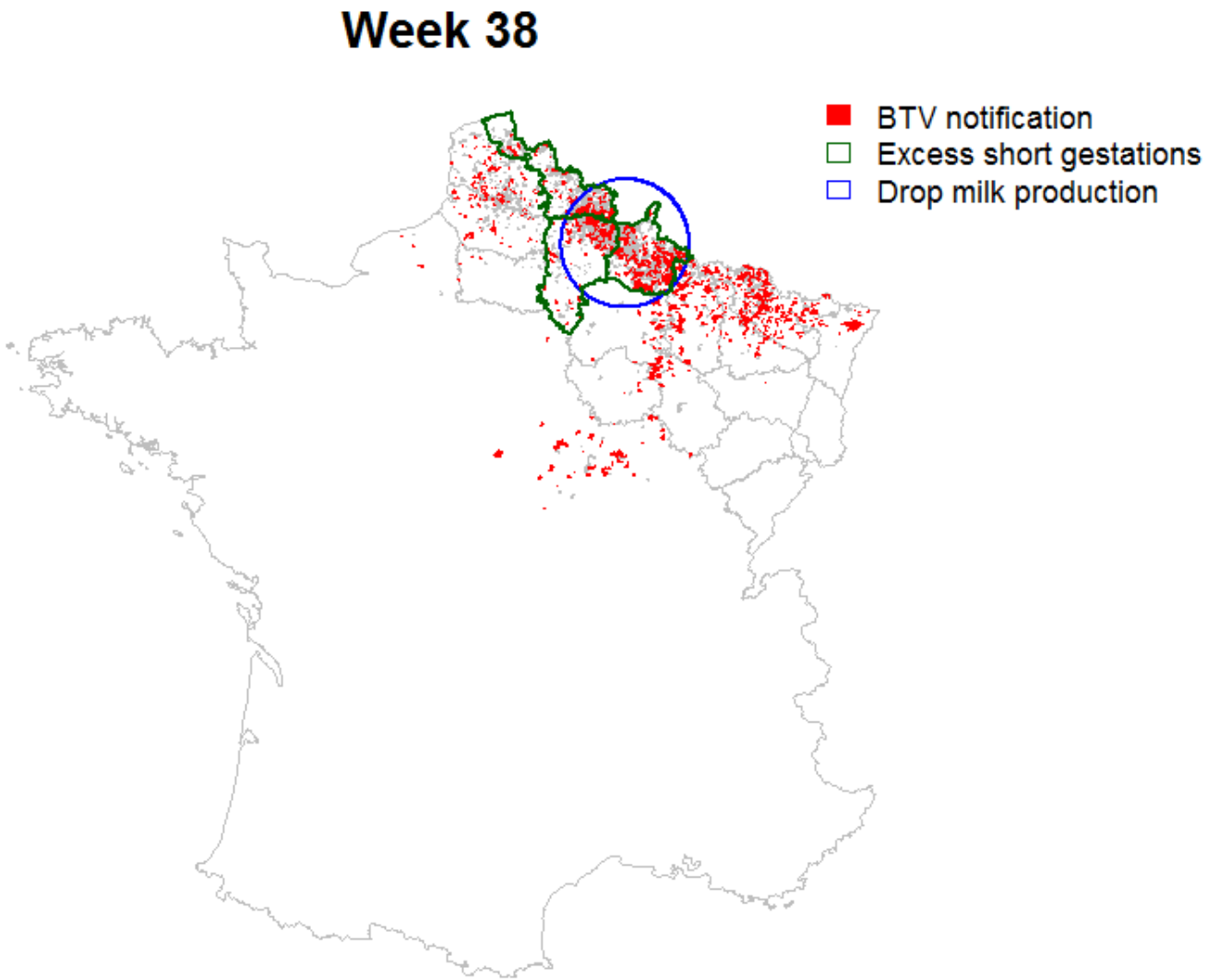
2007 emergence of BTV



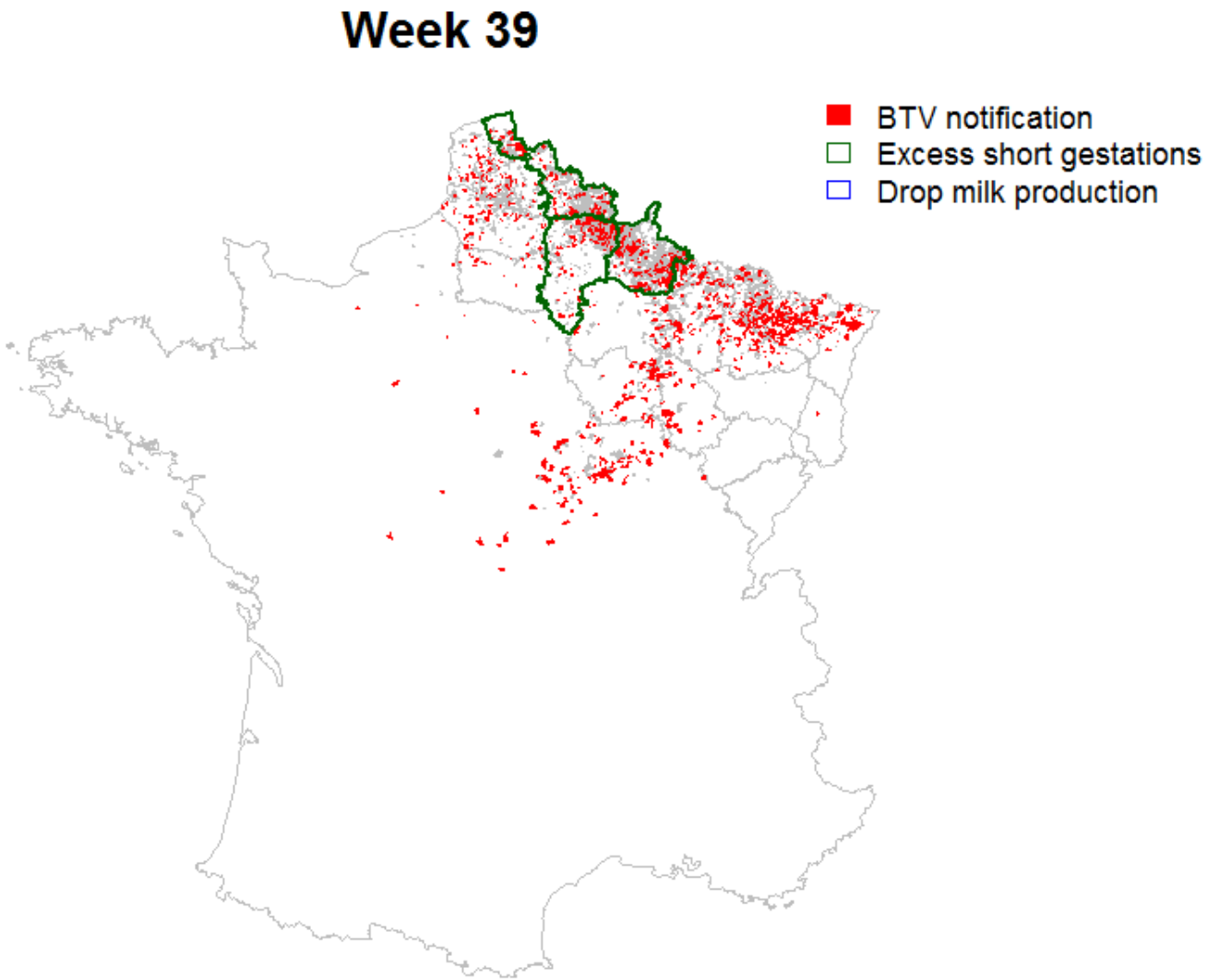
2007 emergence of BTV



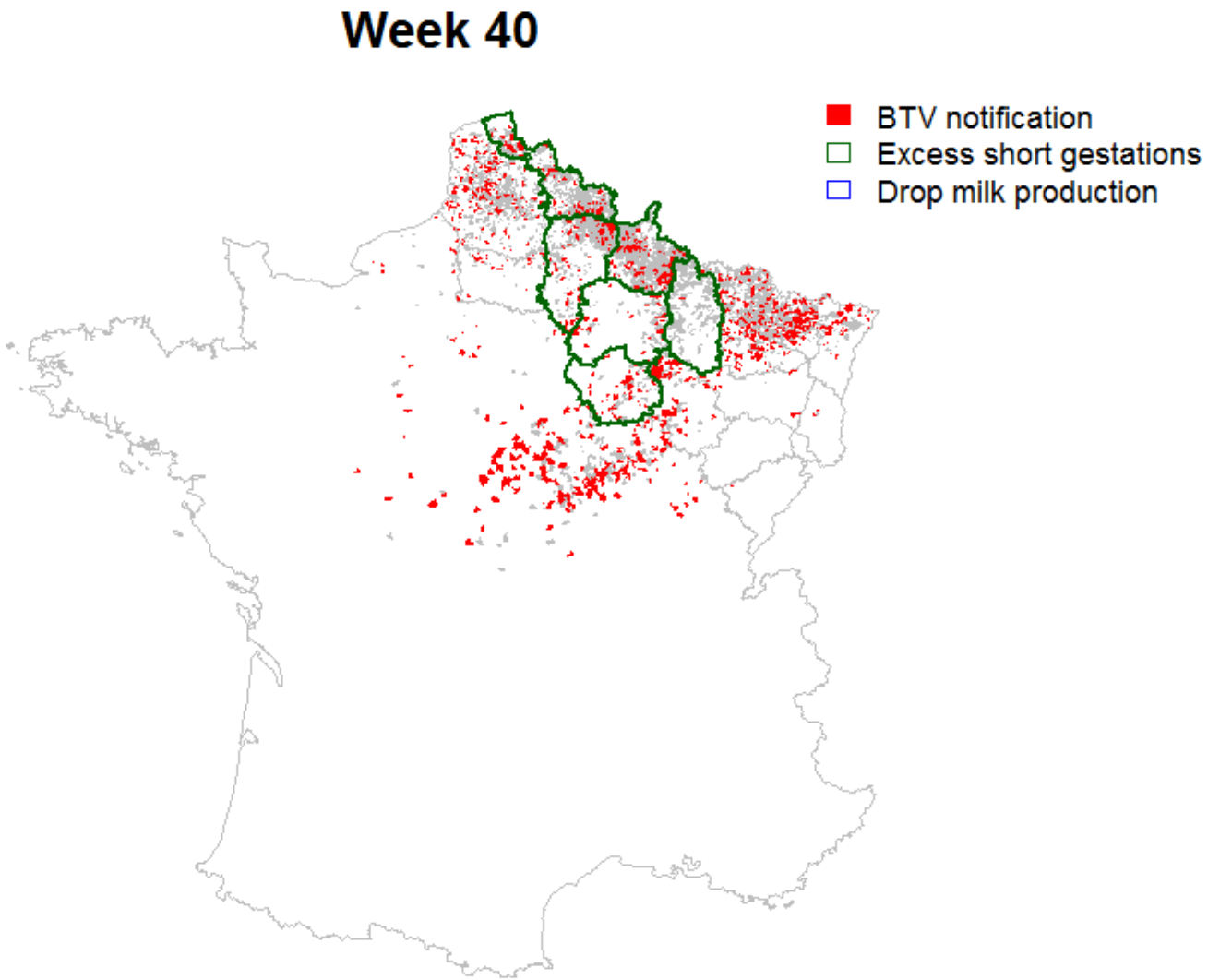
2007 emergence of BTV



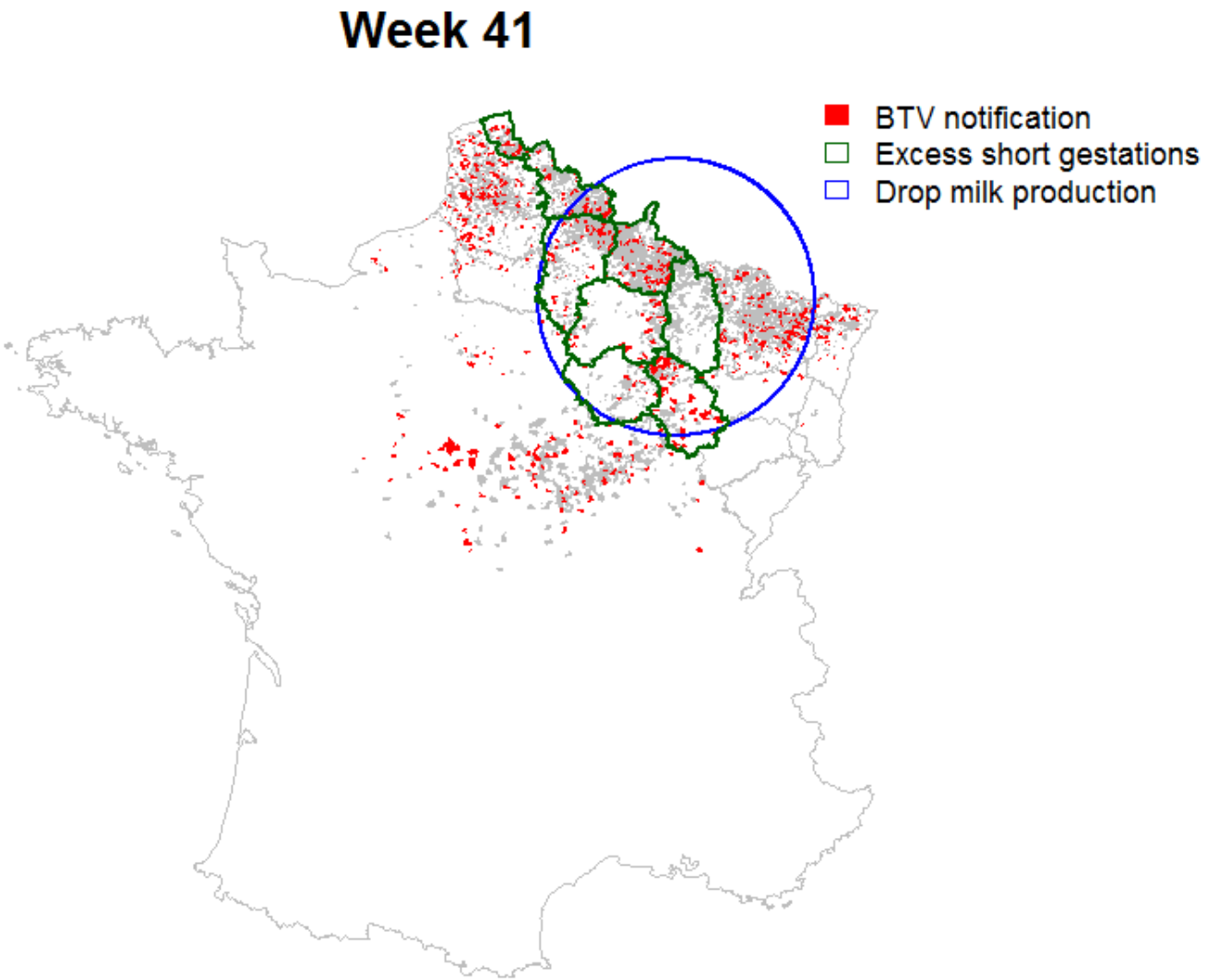
2007 emergence of BTV



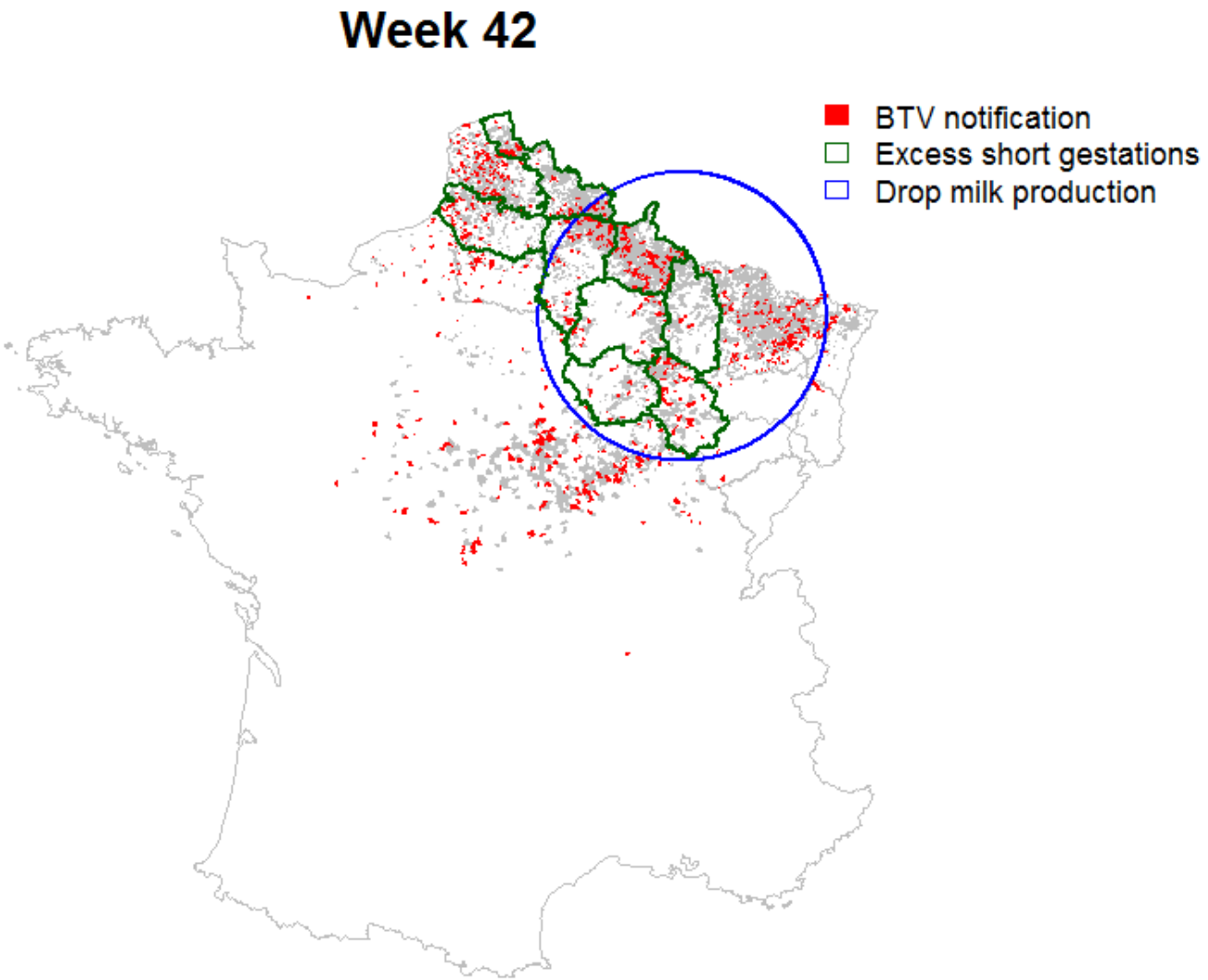
2007 emergence of BTV



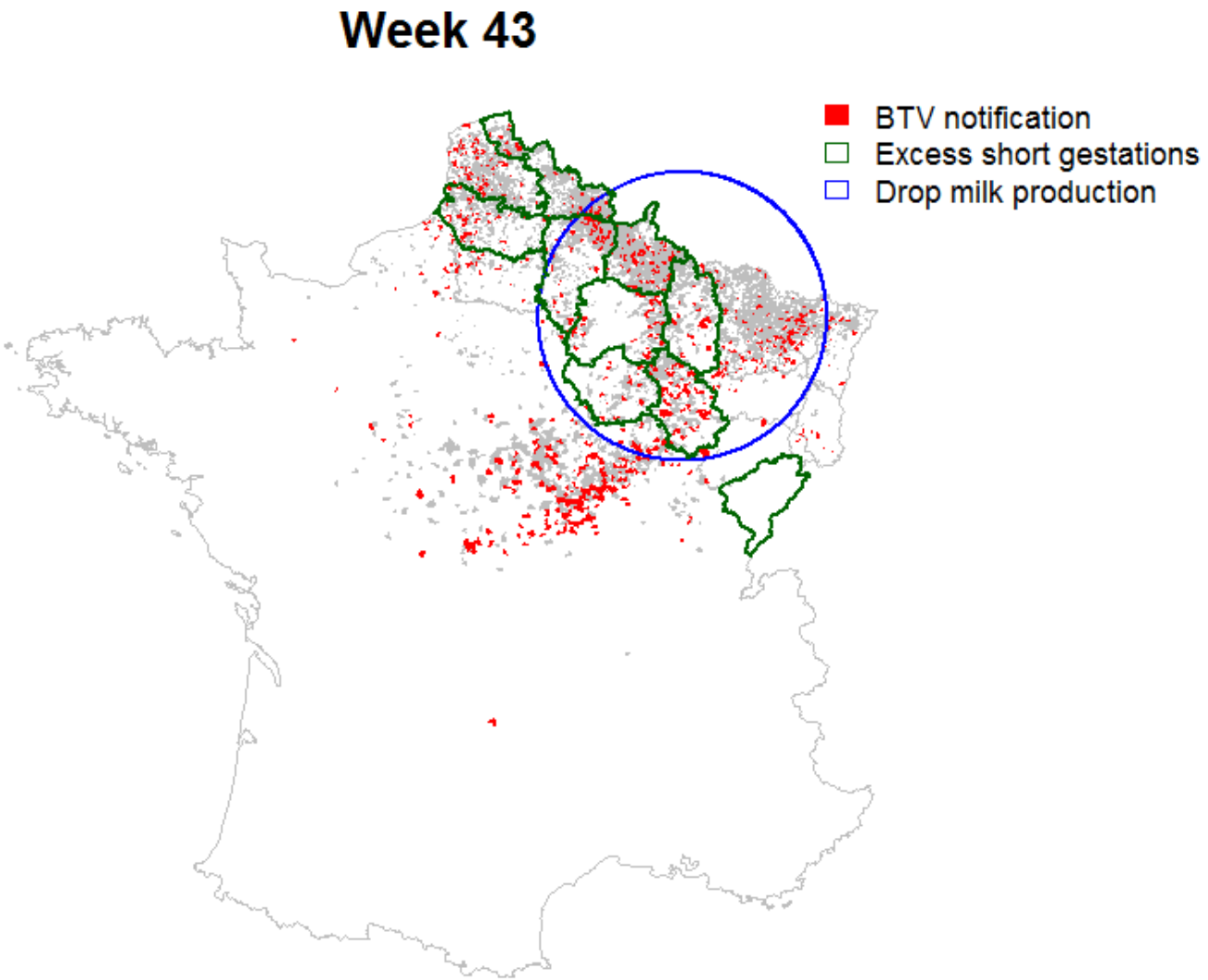
2007 emergence of BTV



2007 emergence of BTV



2007 emergence of BTV



Final thoughts

- Most timely and specific indicator identified in our study : short gestations
  - Not a disease!
  - Increase in the frequency of occurrence of an event in the range of normality

  $\Rightarrow$ Identification requires the use of appropriate methods
- False alarms = major problem
  - Lead to unnecessary investigations
  - Trade-off with timeliness

  $\Rightarrow$ Combination of indicators can help to increase the specificity of detection

Final thoughts

- Data
  - Essential!
  - Need to identify sources, relevance and availability
  - Who owns them? Governments, farmers, industry ...

  $\Rightarrow$ Need to see the interest of sharing
- Added value of syndromic surveillance?
  - What could have been achieved in past instances? (BSE, foot and mouth, BTV, Schmallenberg)

  $+$ Detecting earlier $\rightarrow$ economic impact, consequences on animal health and welfare ...

  $-$ Cost of running the system

  $\Rightarrow$ How should the costs be shared?

Thank you!

Aurelien.Madouasse@oniris-nantes.fr