Reconstructing BVDV infection in Northern-Belgium using network analysis

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Introduction

A main influencer of the spread of BVD (Bovine Viral Diarrhoea) is the trade of **persistently infected (PI)-cattle**. Starting from the 1 of January 2015, Belgium takes up a national BVD-control programme though **systematic detection of PI cattle and banning them from trade**. This abstract **reconstructs the trade of (known) detected PI-animals in the voluntary phase of BVD-control (2010-2014) in Northern-Belgium through network analysis**.

Materials & Methods

- Five-year period (1 Jan 2010– 31 Dec 2014) before the national BVD-control programme: cattle tested positive for BVD-antigen at Animal Health Care Flanders & not (re)tested negative were assumed as PI-animals.
- I&R data to reconstruct the life-trajectory of (known) detected PI-anmals with livestock movements.
- Network analysis using NodeXl©– geolocation though Gephi© & Google Earth©.

Results & Discussion

- A directed graph of **3,052 vertices** (cattle farms) and **4,011 Edges** (PI-transports) was constructed (Figure 1).
- Evidence of (temporarily) presence of PI-animals in **16.7%** of cattle herds in Northern-Belgium (Figure 2).
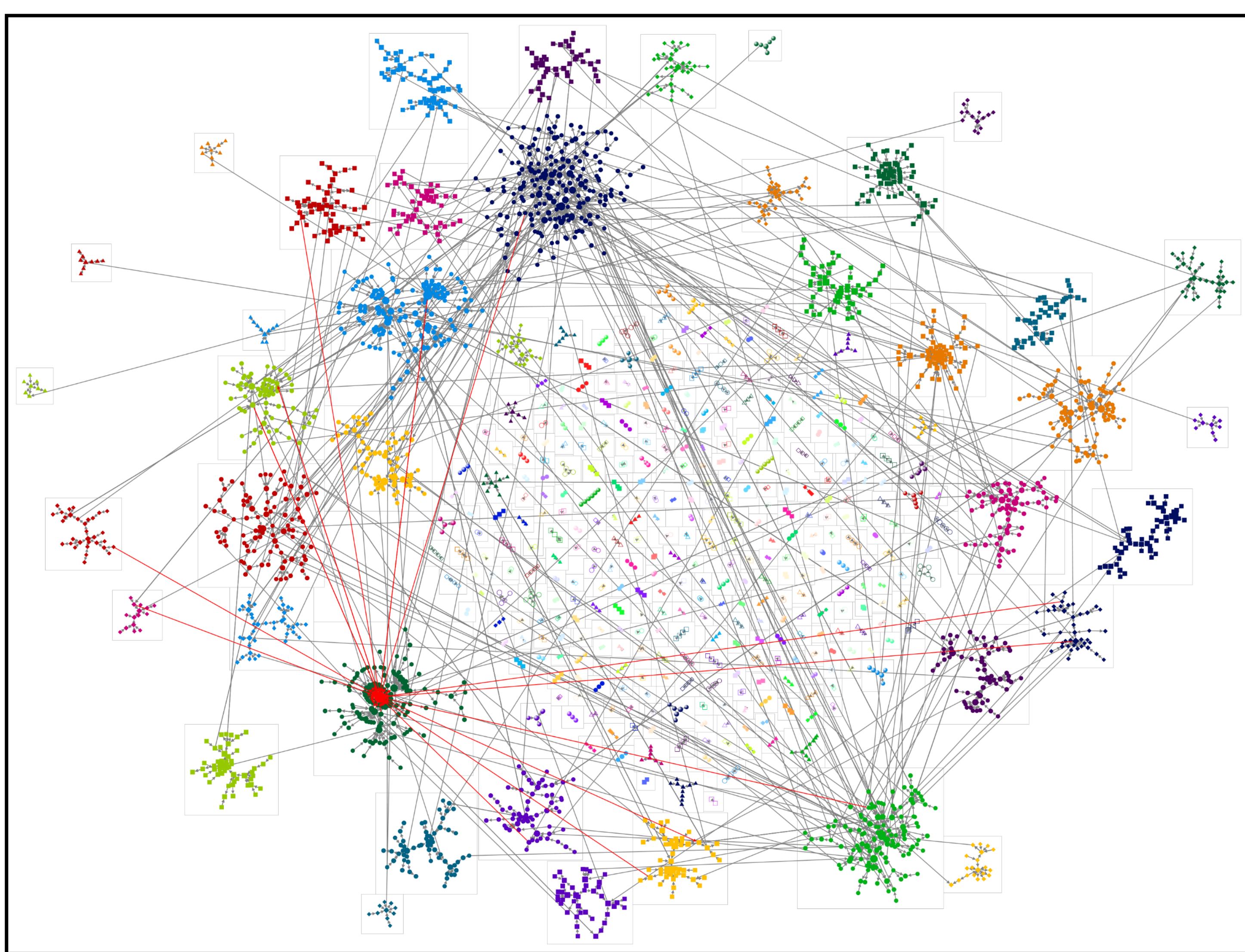

Figure 1: Directed graph of PI-trade between Belgian cattle and veal calf herds – graph layout using the Harel-Koren Fast Multiscale algorith – vertices are grouped by cluster using the Clauset-Newman-Moore cluster algorithm.
2,648 unique edges, 1,369 edges with duplicates. Maximum In-Degree: 38. Maximum Out-degree: 31.
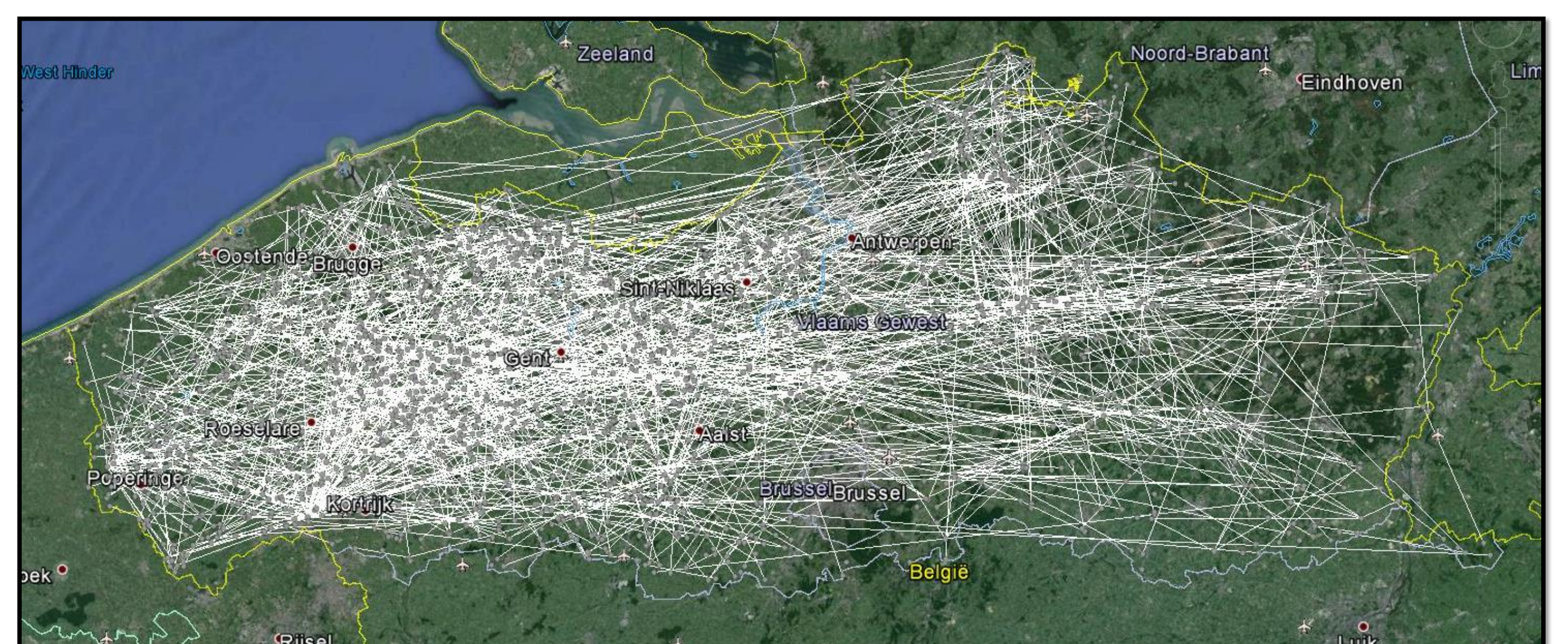

Figure 2: Geolocation of PI-trade between cattle herds in Northern-Belgium.

- Graph accounts for (known) detected PI-movements between 3,052 cattle and veal calf herds
- The actual trade of PI-animals is **underestimated:**
  - Not all PI animals were detected (e.g. only approx. 10% of annual traded animals is tested at purchase), testing-data of Southern-Belgium was not used.
- The actual dispersion of BVD is **underestimated** since other transmission routes are not graphed (e.g. transiently infected animals, Trojan pregnant cows, indirect transmission, etc.)

STOP BVD! Belgium is banning PI-animals from trade.