

# An areal pest risk assessment based on spatial and temporal distribution of places of production

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# Introduction

**Resources for the plant health surveys are limited**

→ Necessary to develop methods that enable efficient targeting of the surveys

**We use**

information on spatial and temporal distribution of places of production

**To locate areas**

where the likelihood of invasion, and the magnitude of impacts of invasive pests are likely to be high

# Areal risk indices

- Not pest specific!
  - Based on distribution of crop plants (species, genus or other taxa)
  - **ENTRY**
  - **ESTABLISHMENT AND SPREAD**
  - **IMPACT** Index (€)
- } Index (0-1)
- 1 × 1 km grid
  - The length of the study period is not fixed, but needs be constant over one analysis
  - Indices do not represent actual likelihoods, but they allow comparison of the relative likelihoods

# Entry index

**Calculated for each cell based on**  
the average annual area where imported propagation  
material has been used

# Establishment and Spread index

**Calculated for each cell based on**

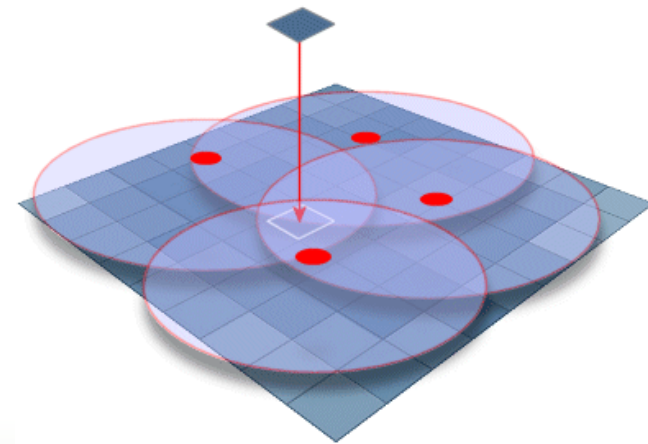
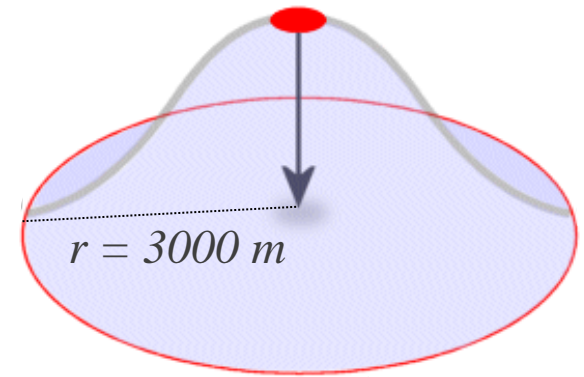
- Habitat density – spatial distribution of habitats
- Habitat persistence – temporal distribution of habitats

# Habitat density subindex

**Calculated for each cell** using the kernel density estimation

**In which**

- 1) a curved surface is fitted around the center point of each field based on the quadratic kernel function described by Silverman (1986) so that the size of a field is used to define the volume under the surface
- 2) the values of all the kernel surfaces in the cell center are added up



# Habitat persistence subindex

## Calculated for each field based on

- The number of years during which the studied plant has been cultivated ( $A$ )
- The longest gap in the production of the studied plant in years ( $B$ )
- The length of the study period in years ( $t$ )

## Each field is assigned weight based on its size ( $C$ )

$$A \times (t - B) \times C$$

## Calculated for each cell by

summing up the values of the fields located in the cell

# Establishment and Spread index

**Both subindices are calculated for each study year separately**

- habitat density subindex (spatial distribution of habitats)
- habitat persistence subindex (temporal distribution of habitats)

**The annual sub indices are multiplied with each other**

**An average over years is taken**



# Impact index

**Calculated for each cell based on  
average annual value of the production (€)**

# Strawberry as a case study

- Based on nine year cropping history (2006 – 2014)



# Strawberry production in Finland

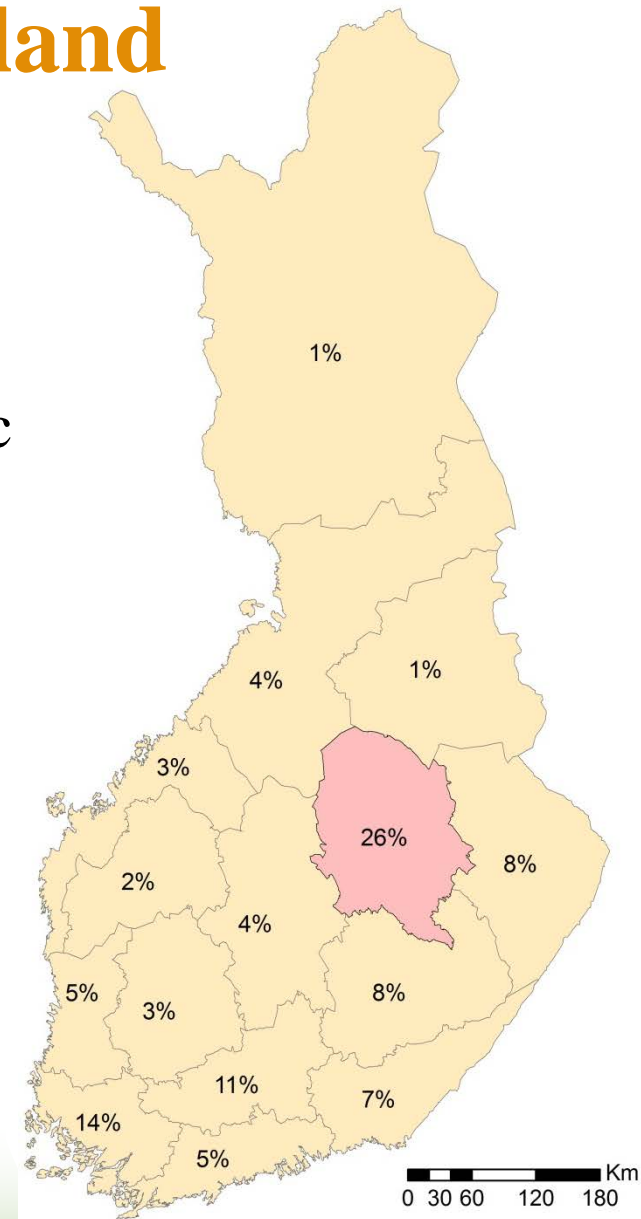
3300 ha, 1100 farms, 4800 fields

Only 20% of the propagation material domestic

80-85 farms inspected annually (7%)

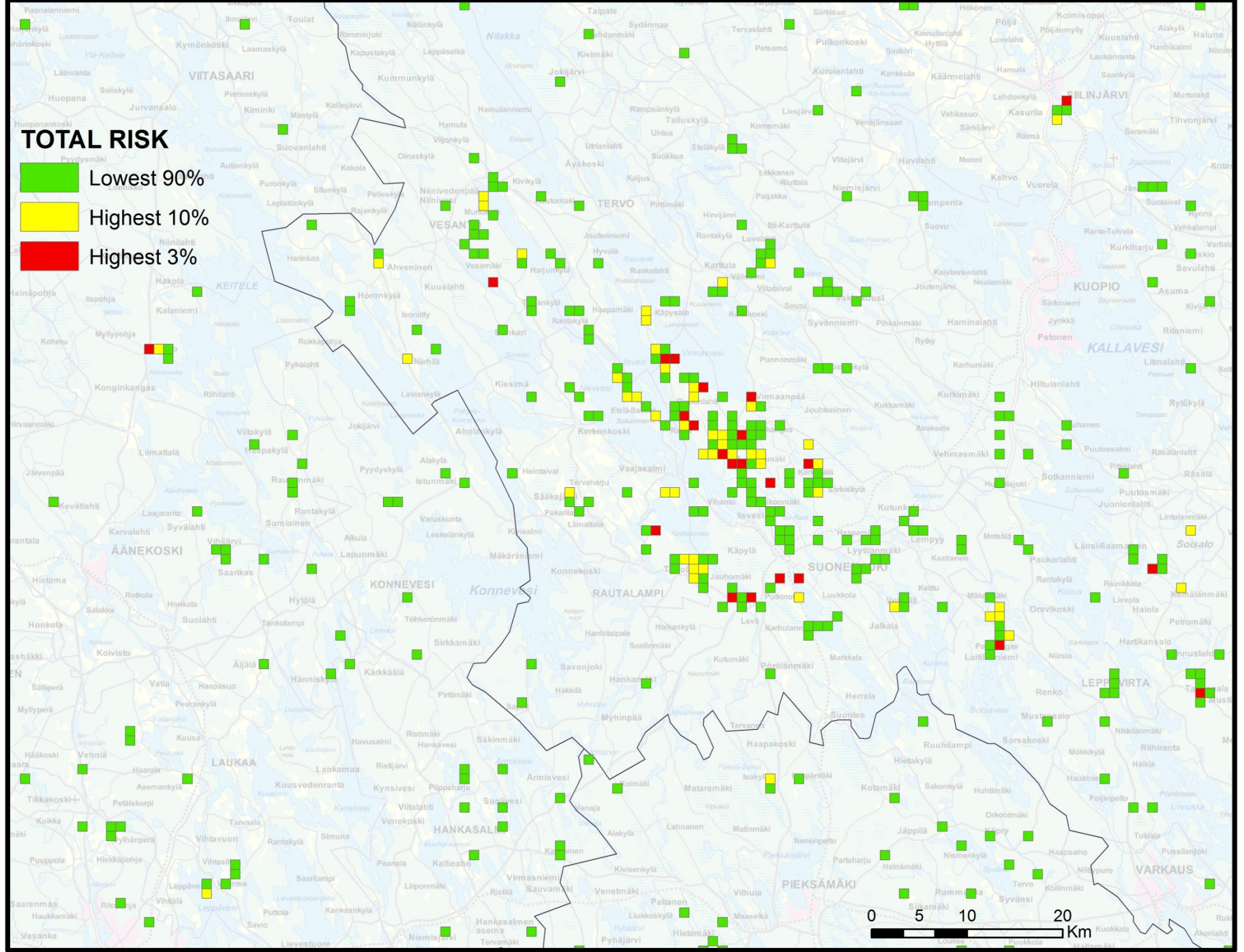
## Recent introductions

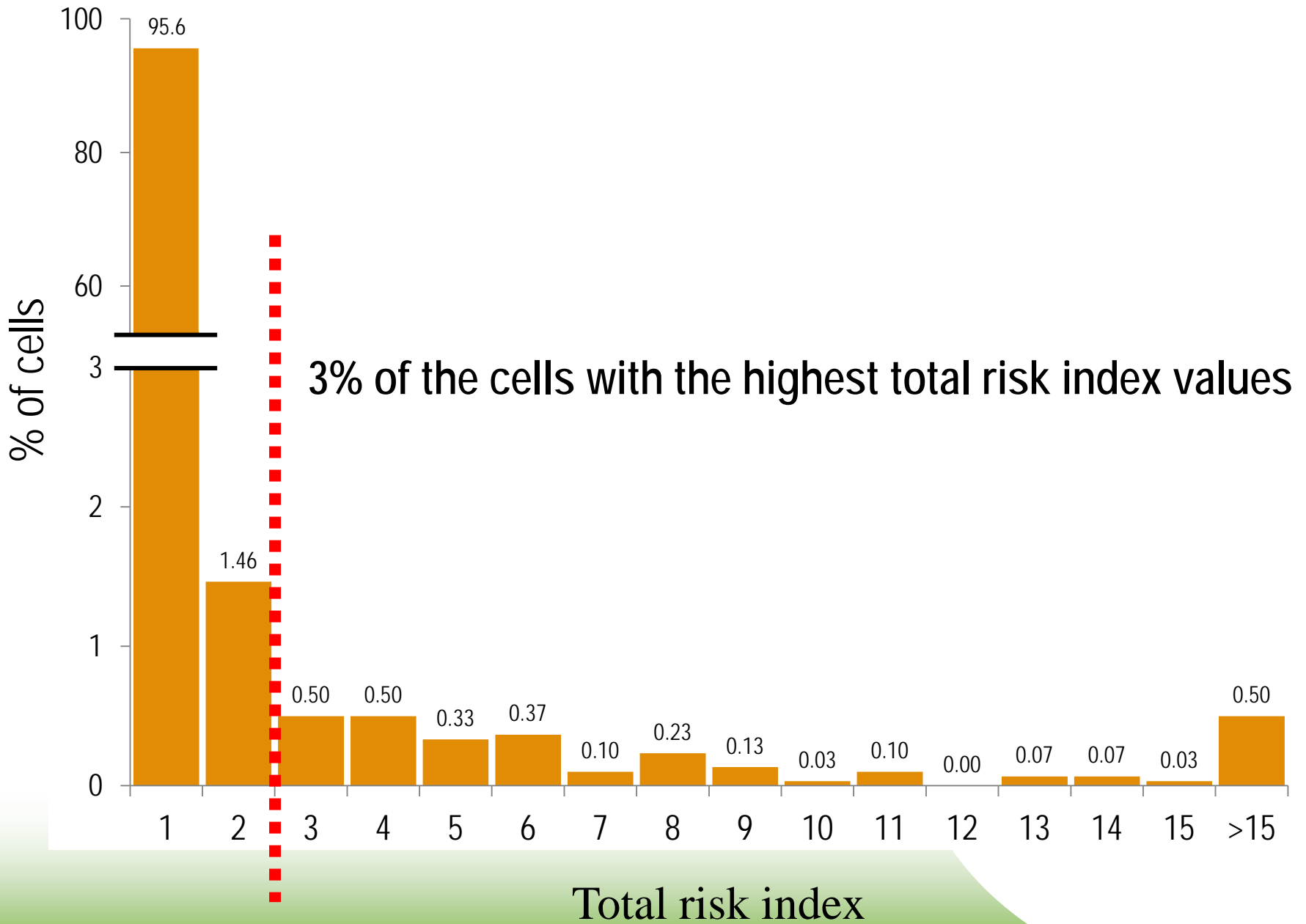
- *Phytophthora cactorum*
- *Colletotrichum acutatum*
- *Xanthomonas fragariae*
- *Phytophthora fragariae*

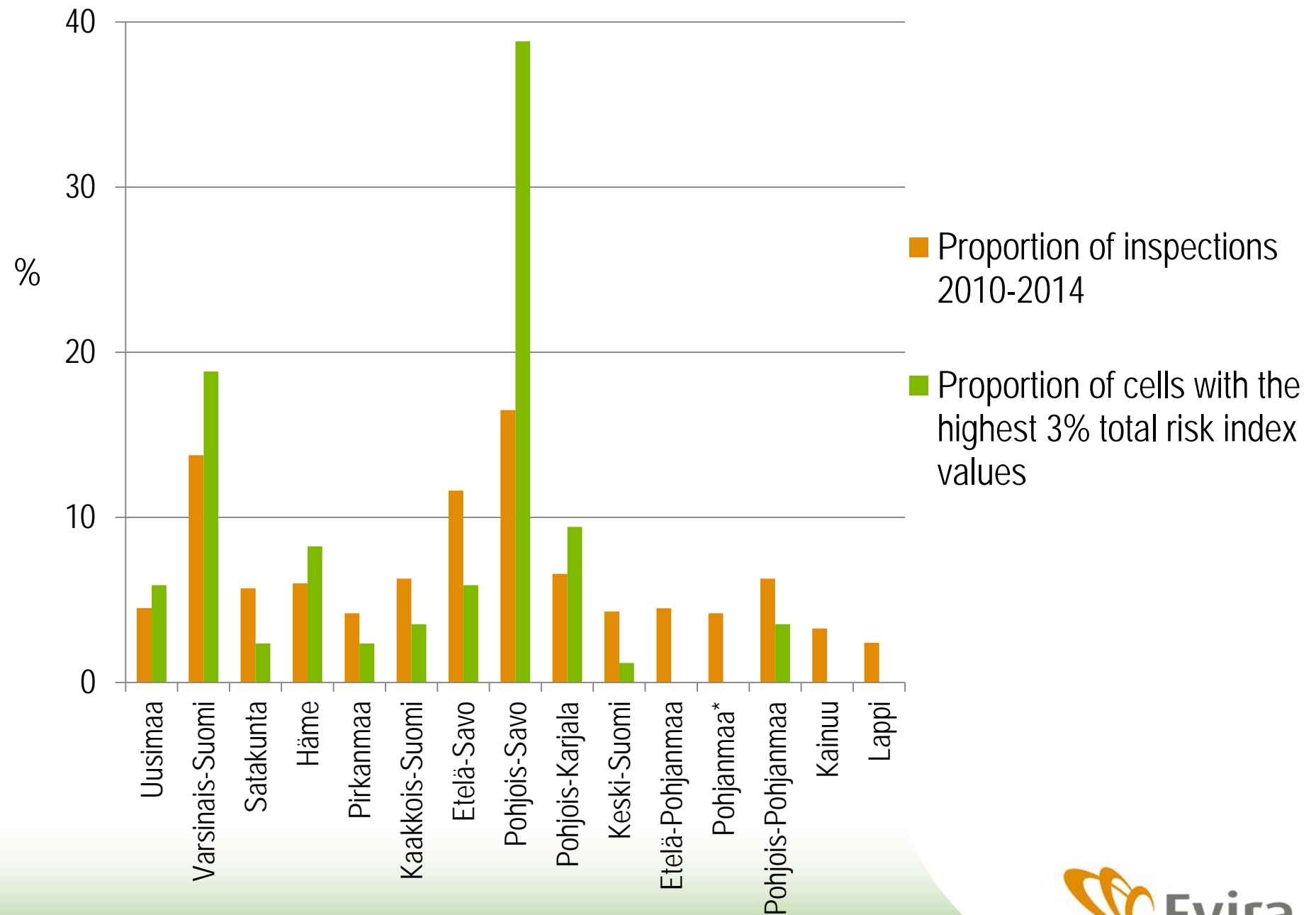


# TOTAL RISK

- Lowest 90%
- Highest 10%
- Highest 3%







# Summary

- Spatial and temporal distribution of places of production is used to describe areal risk with risk indices
- Indices do not represent actual likelihoods, but they allow comparison of the relative likelihoods
- Simple methodology for a practical problem, i.e. targeting phytosanitary surveys
- Results are published in an easy-to-use web mapping service for plant health inspectors

## How to

define connected production areas?

target the inspections based on the results?

**Thank you!**

