Joint EFSA-EPPO Workshop: Modelling in Plant Health
– how can models support risk assessment of plant
pests and decision making? Parma, Italy 12th – 14th Dec. 2016

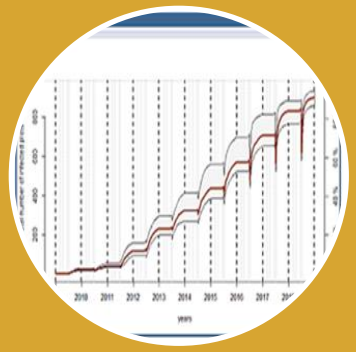
Modelling epidemiological consequences of "Flavescence dorée" to Austrian viticulture

I. Kopacka, R. Steffek, G. Strauß, Helga Reisenzein

Austrian Agency for Health and Food Safety

Insights into

Current status of FD and S. *titanus* in Austrian viticulture

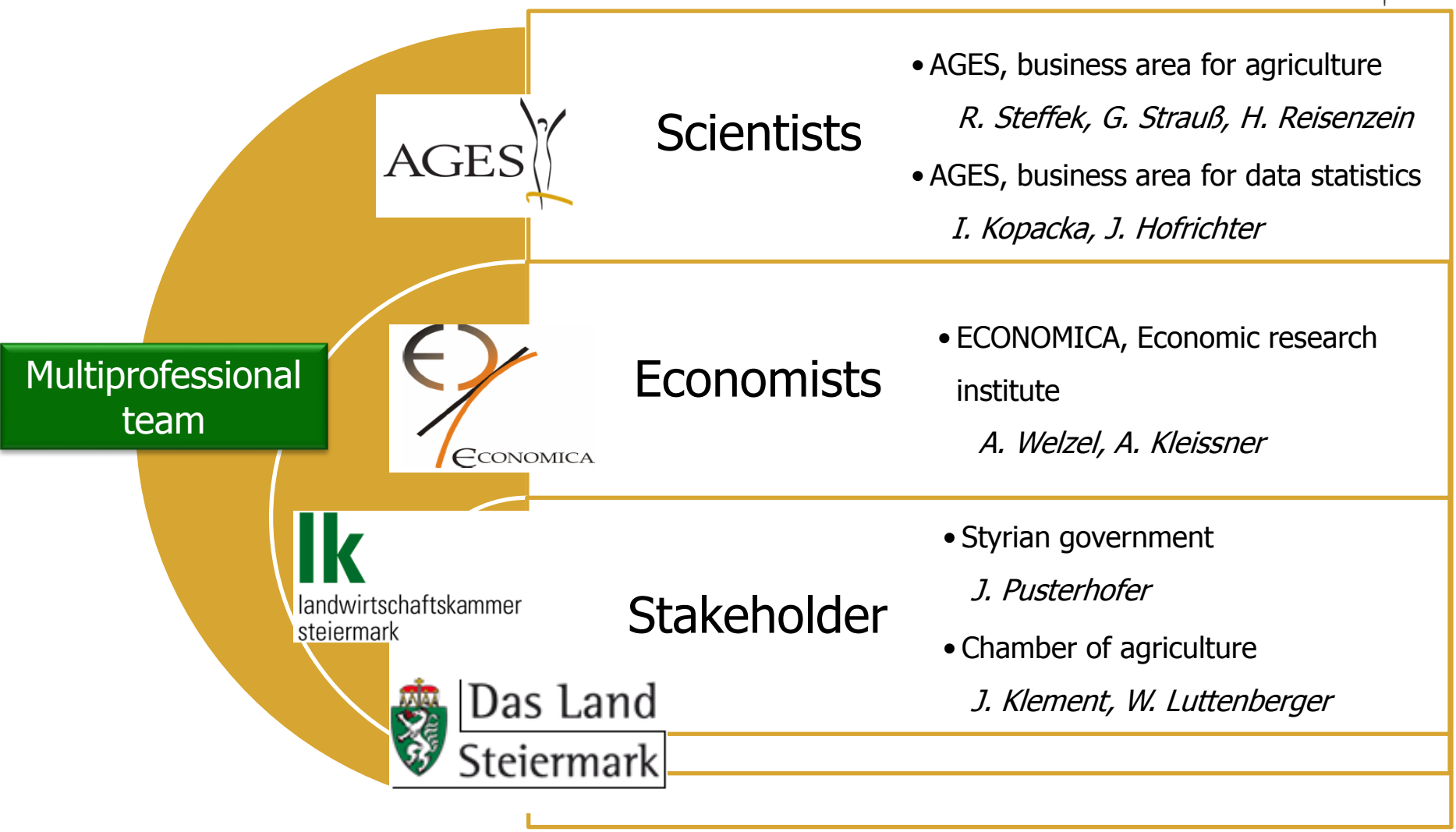


Stochastic spread simulation

Novel control strategies

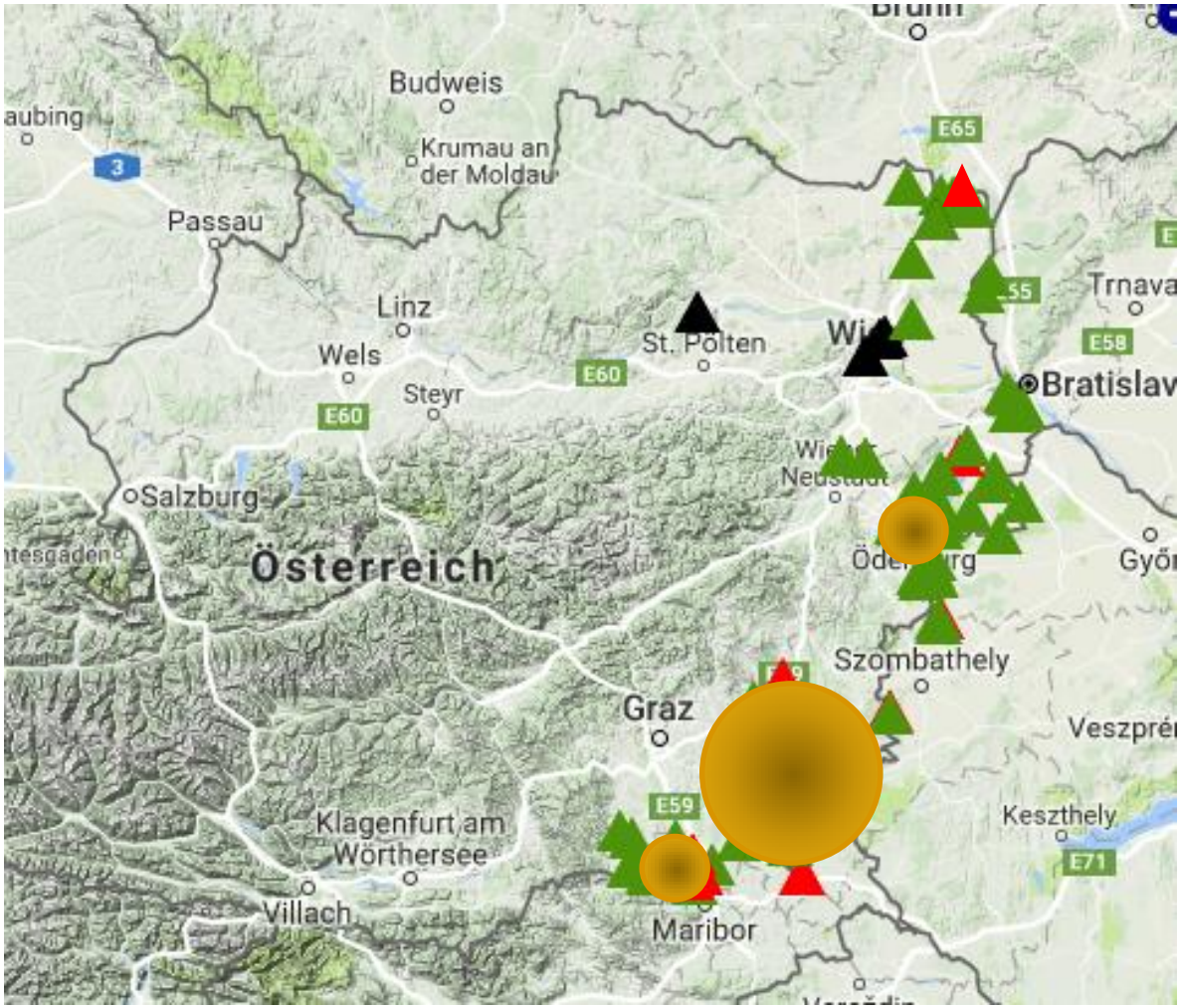
VitisCLIM, a project modelling spread and impact of FD in Austrian viticulture under a climate change scenario - Spread model concept

AGES



powered by klima+ energie fonds

Current status – spread of *S. titanus*



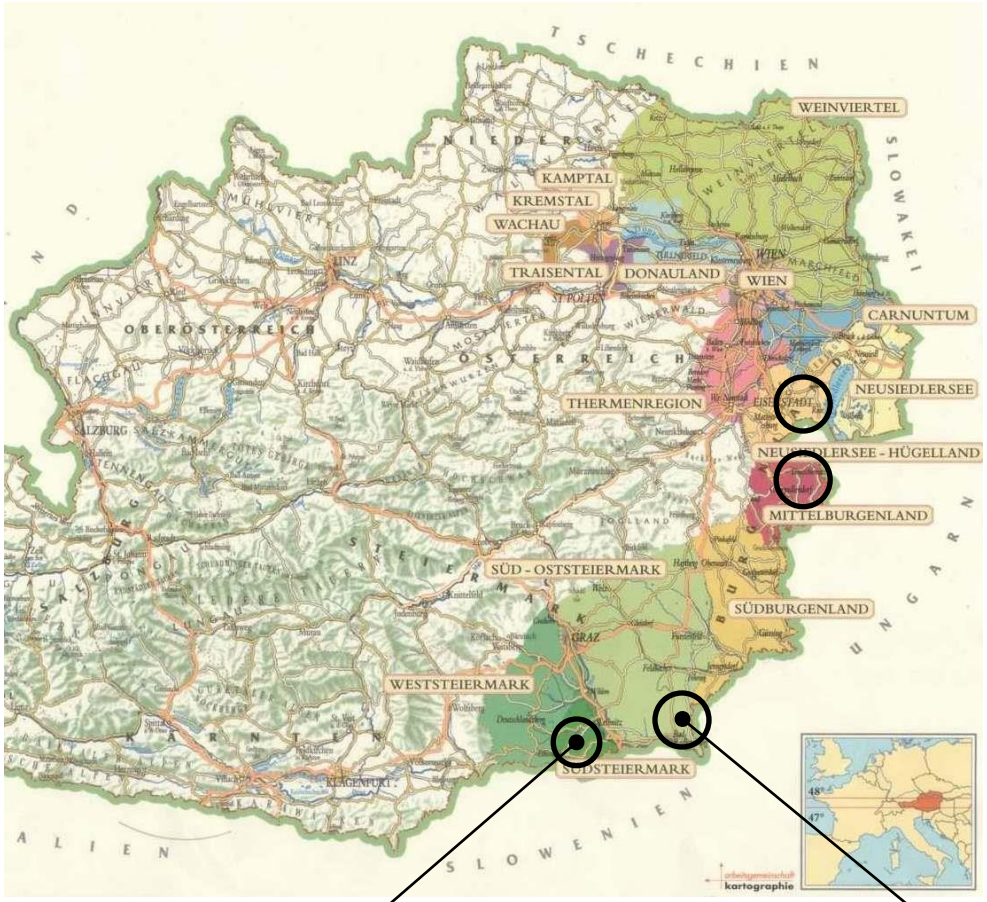
Sites

S. titanus

Established populations of *S. titanus*

Current status – spread of FD

4 established focus and saftey zones



model domains

´Glanz`

´Tieschen`

Two model regions with established focus & safety zones

Glanz a. d. Weinstraße

1. High average acreage of vineyards (10.000m²)
2. Low abundance of vine-arbours
3. High numbers of organic vineyards

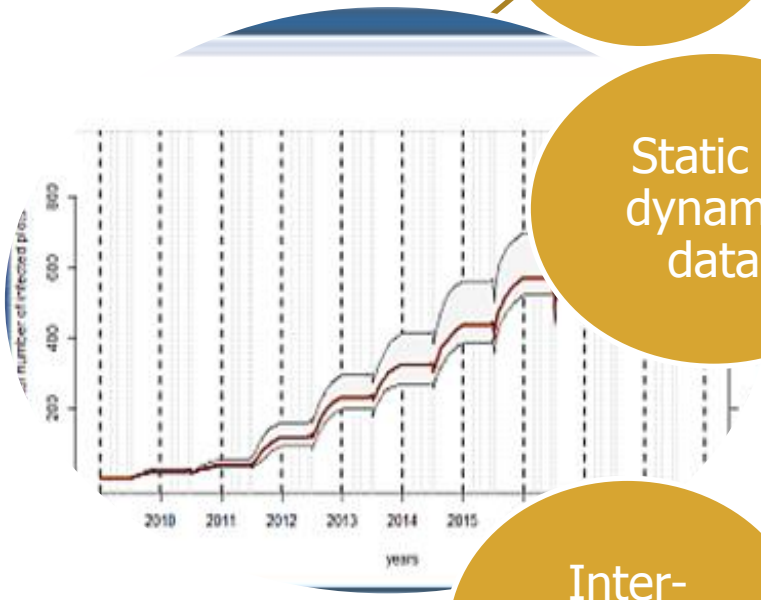
Tieschen

1. Low average acreage of vineyards (1.700m²)
2. High abundance of vine-arbours
3. Low numbers of organic vineyards

Model input parameters

Vector/ disease

- biology
- movement
- rates of infection



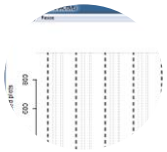
Static & dynamic data

- Static data of the vineyards (geographic/topographic data)
- Dynamic data: number of infested and infectious plants & leafhoppers

Inter-vention strategies

- High intensity of spraying (scenario A)
- Moderate intensity (scenario B)
- Low intensity (scenario C)
- No insecticides applied (scenario D)

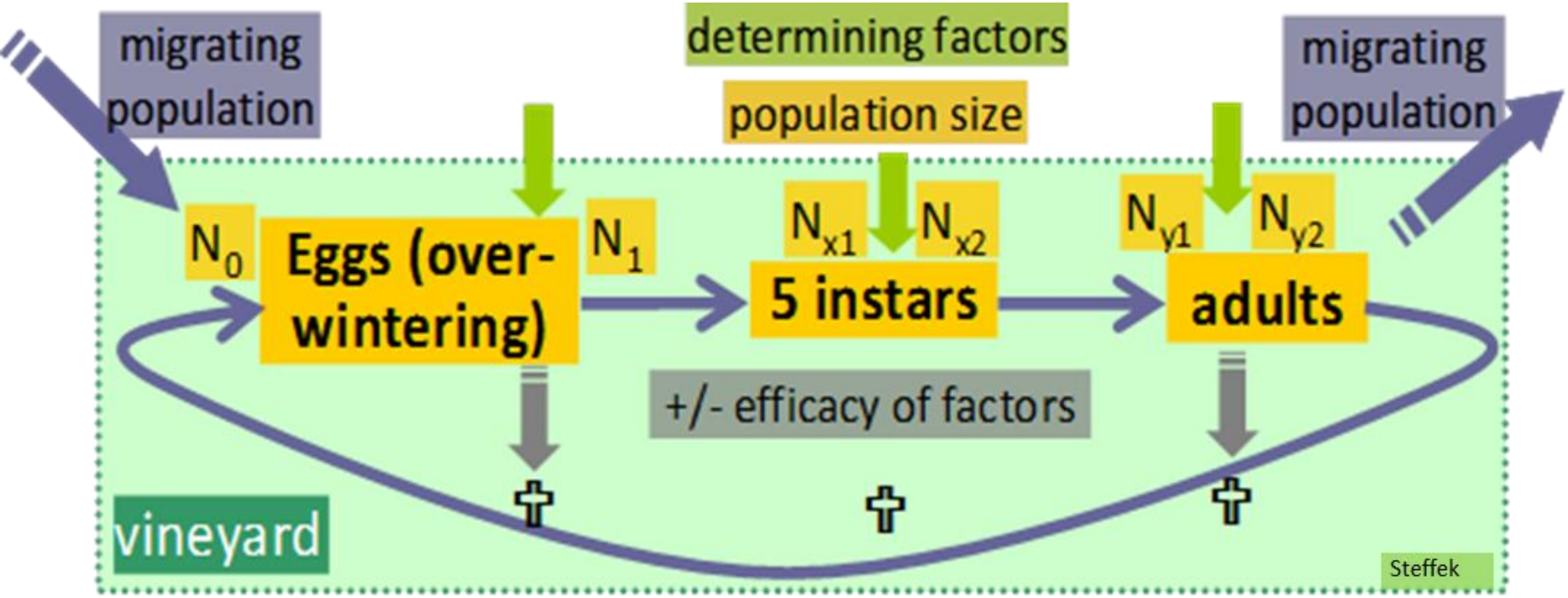
Model input parameters



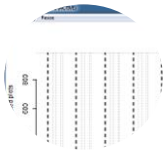
Vector/ disease

- biology
- movement
- rates of infection

Spread model concept – determining the natural spread of FD in an area



Model input parameters



Vector/ disease

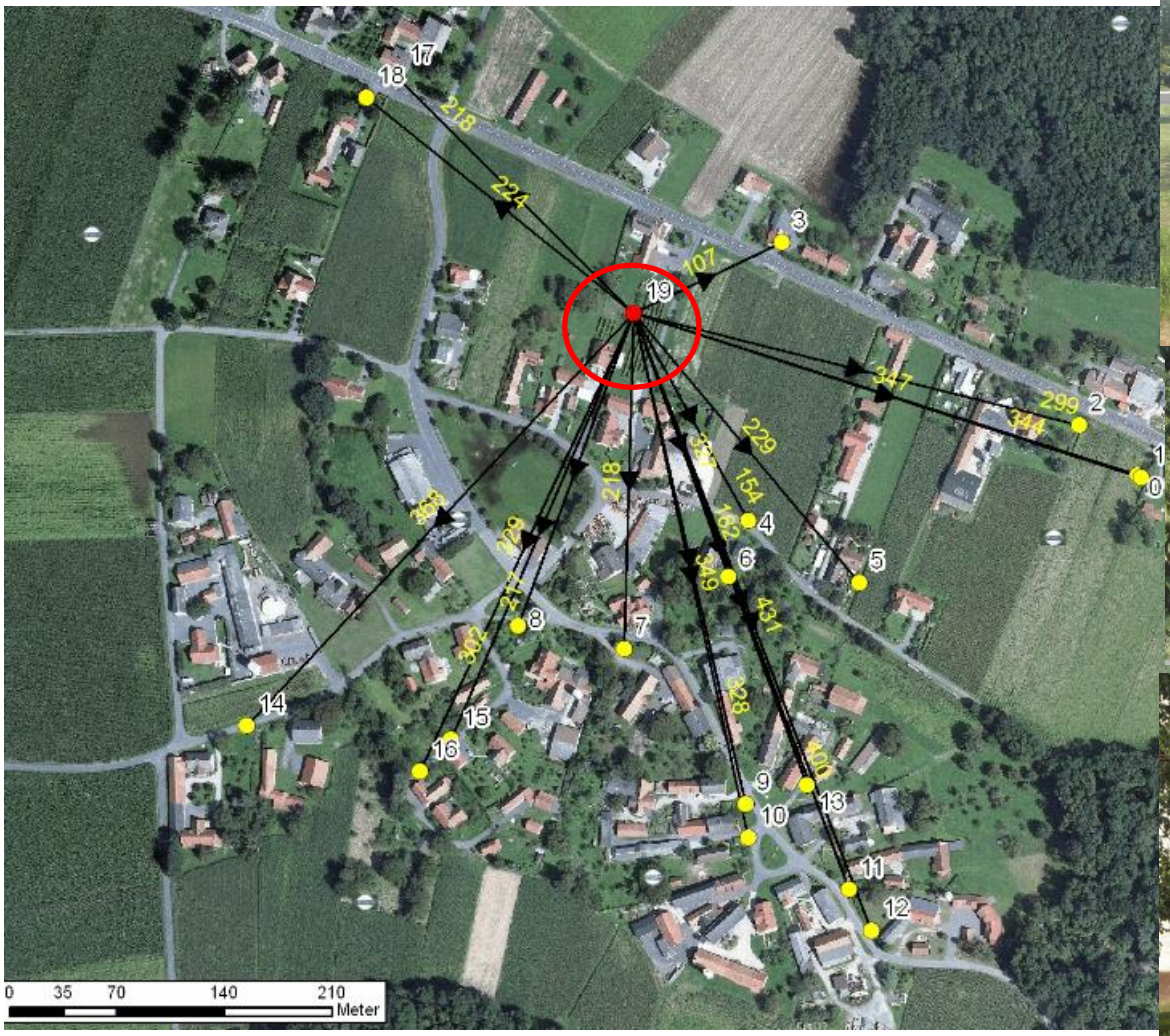
- biology
- movement
- rates of infection

Spread model concept – determining the natural spread of FD in an area

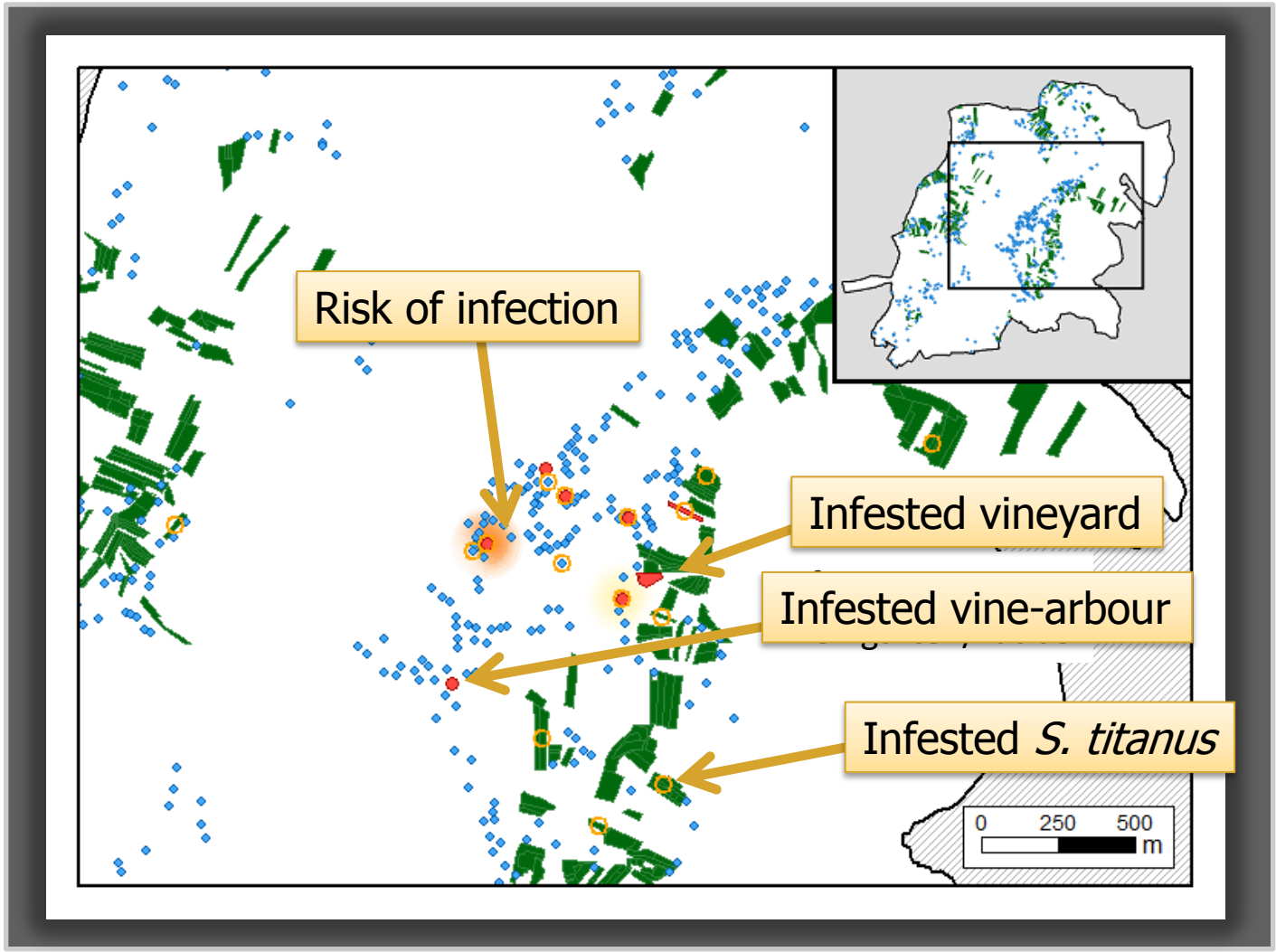
1. Efficacy of different measures having an influence on the population size of the vector in a vine-yard
2. Year to year multiplication factor of the vector in an vineyard
3. Migration rate of the vector populations
4. Flight distance (and direction) of migrating vector populations
5. Infection rate of a vector population in an area
6. Varieties used in an area (influencing the infection rate of the vector population)

Model input parameters

Spread from uncontrolled sources

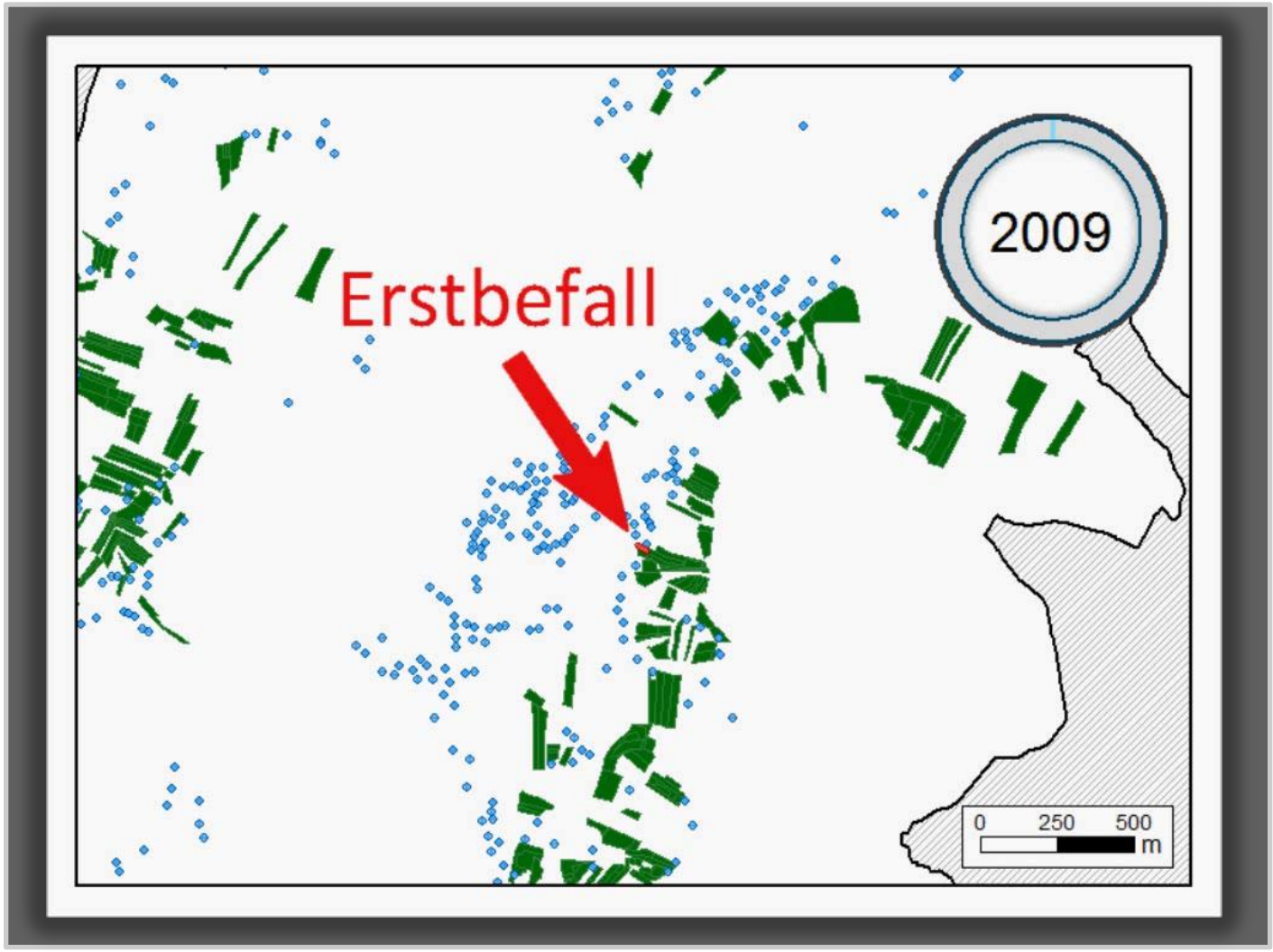


Simulation model for the dynamics of the spread of FD and *S. titanus* – model region ´Tieschen´

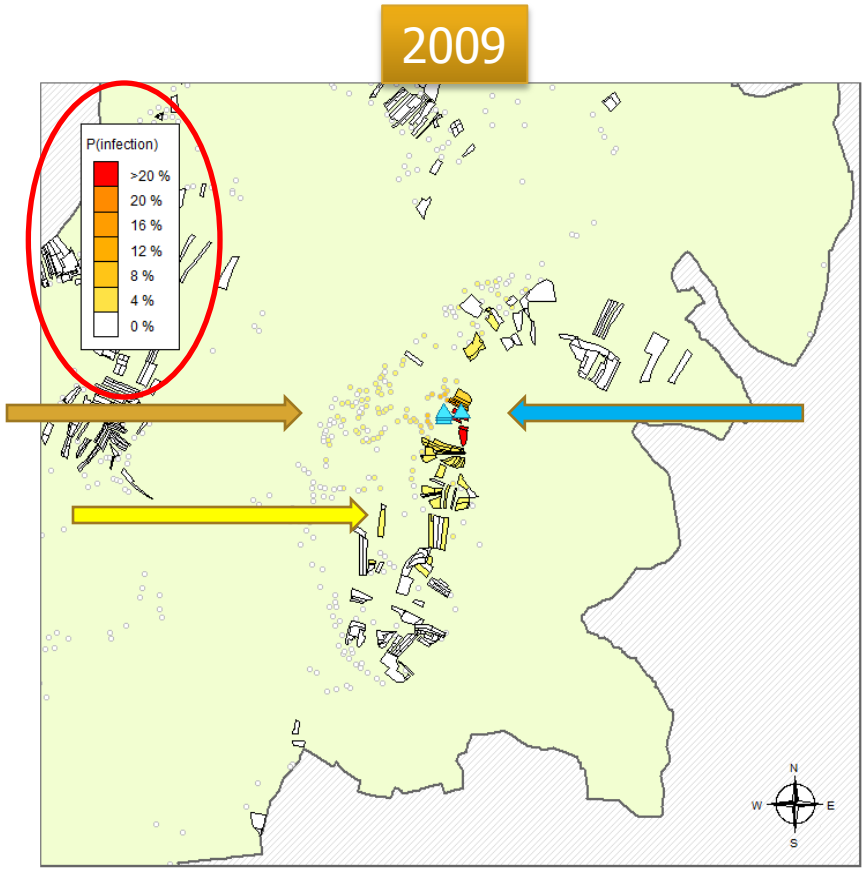


Simulation for each plot, each day in the season, over 10 years

Simulation model for the dynamics of the spread of FD and *S. titanus* – model region ´Tieschen´

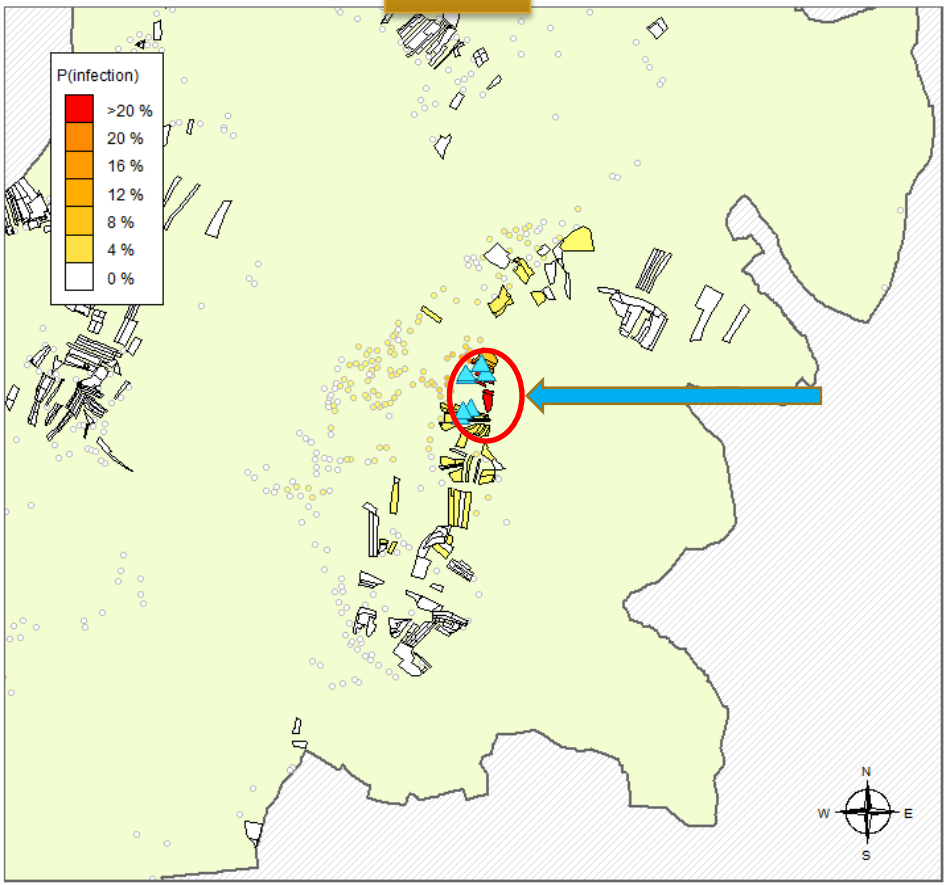


Comparison of simulation results with monitoring results in the model region `Tieschen´

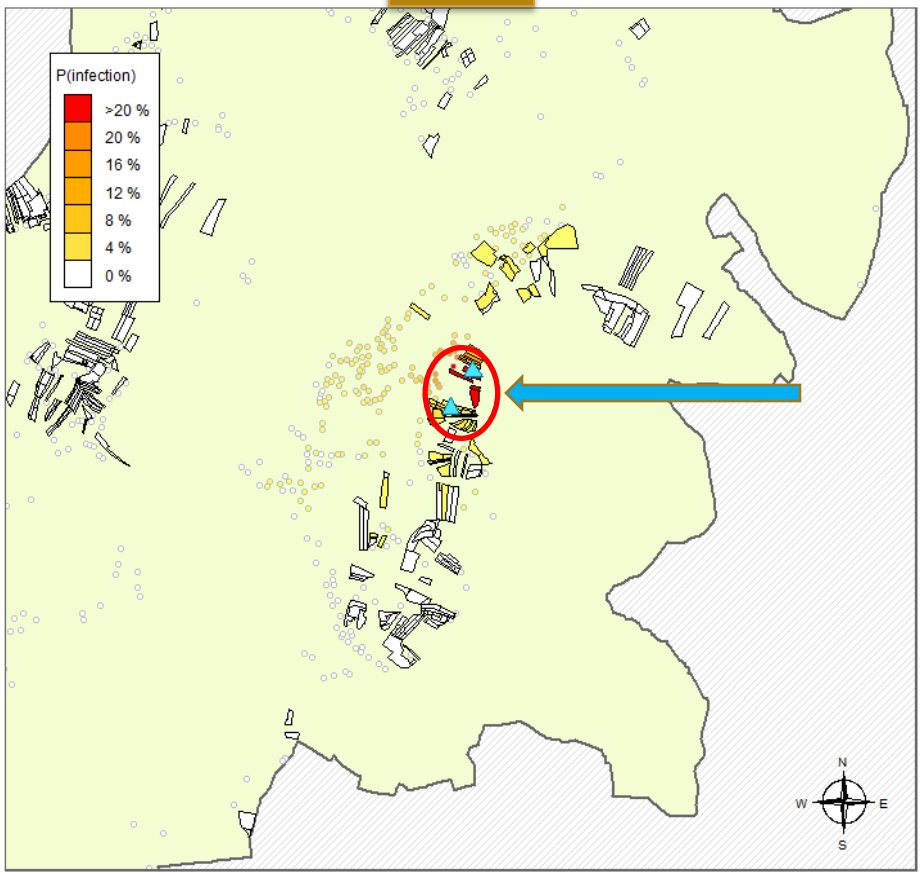


Probability of infection for vineyards (polygons) and arbours (dots) for 2009 based on the simulation model for Tieschen together with vineyards found positive in the monitoring (triangles).

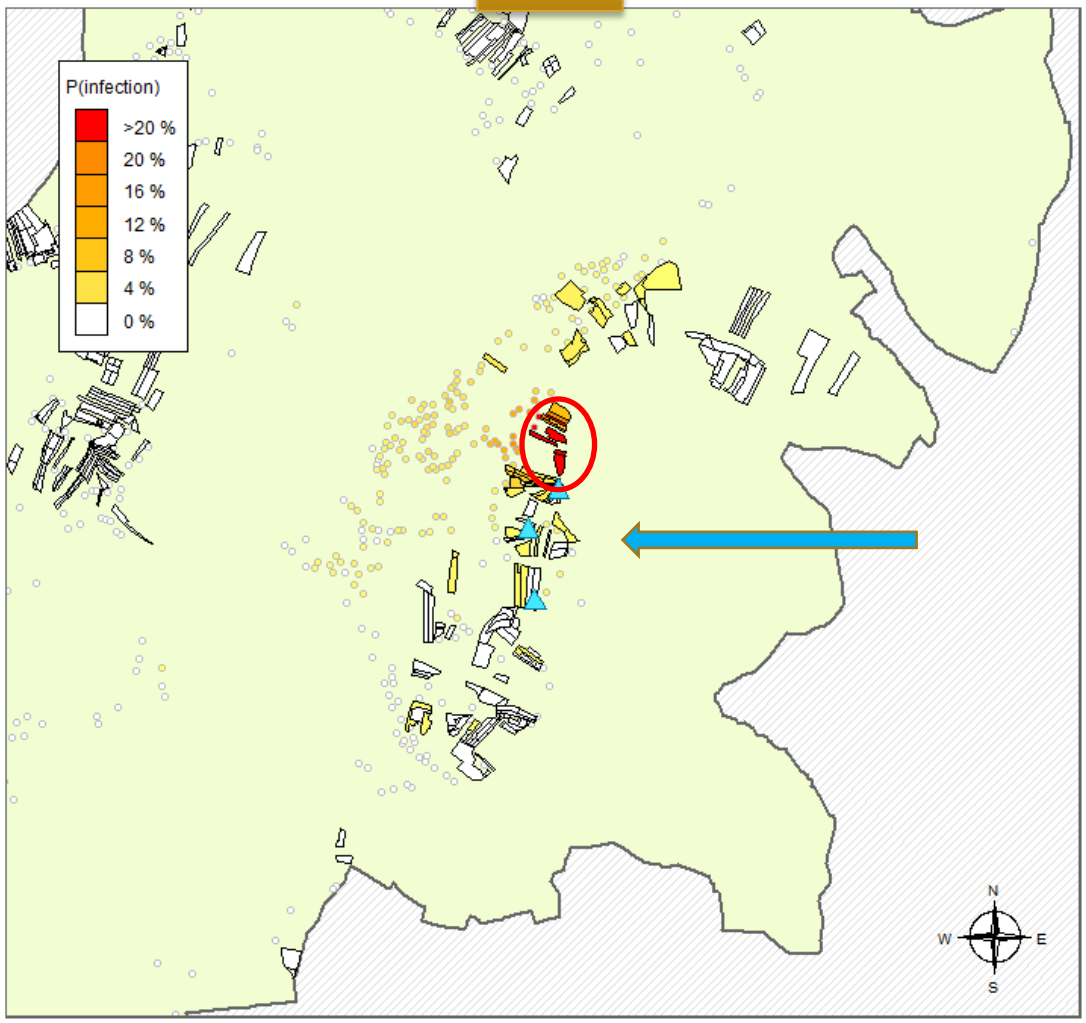
2010



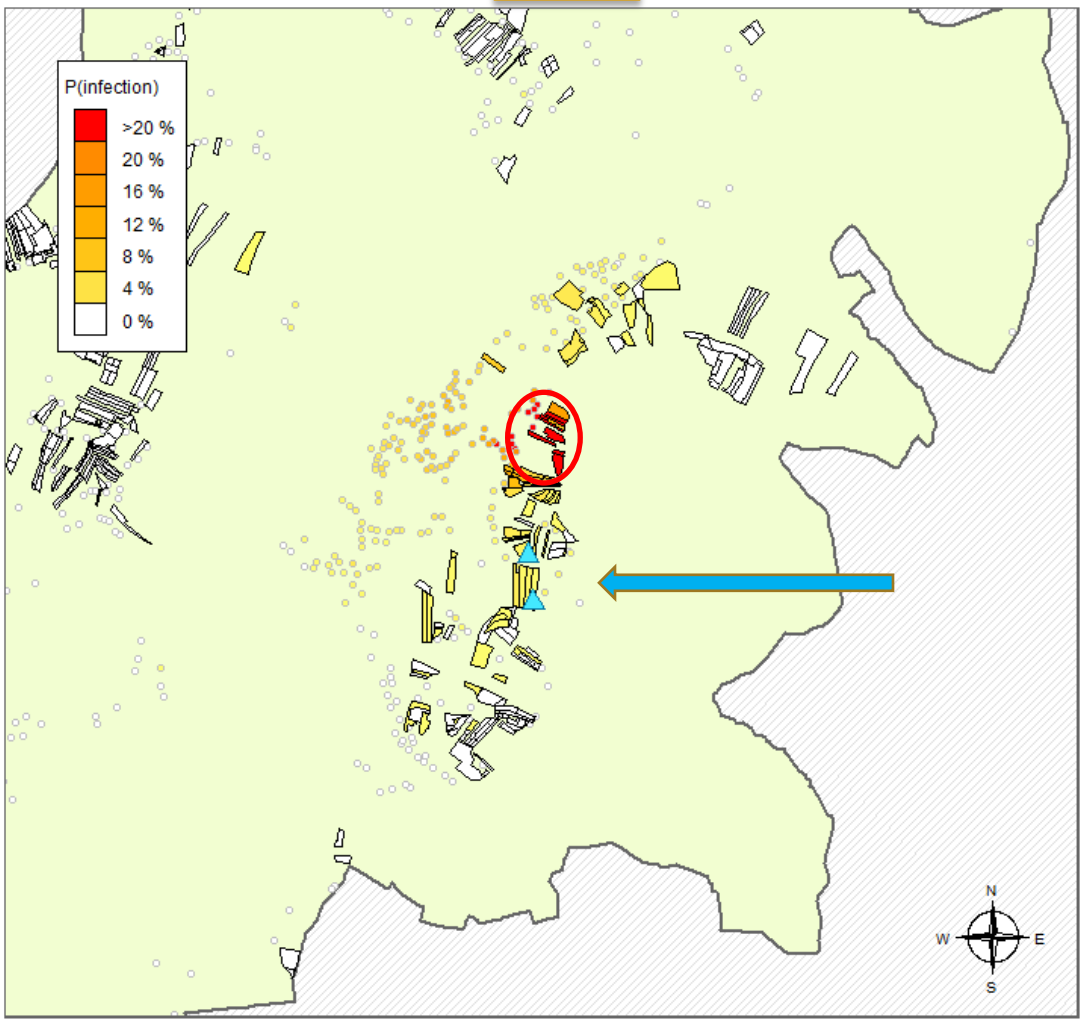
2011



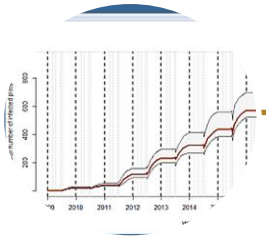
2012



2013



Testing of different pest management strategies



Inter-vention strategies

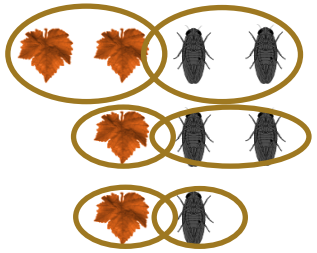
- High intensity (A)
- Moderate intensity (B)
- Low intensity (C)
- No insecticides applied (D)

	Scenarios	Conventional/ integrated vineyards	Organic vineyards	Spraying of vine-arbours, hedges, small vineyards
	A	2 x larvae 1 x adults	2 x larvae	2 x larvae 1 x adults
	B	2 x larvae	2 x larvae	2 x larvae
	C	2 x larvae	Applications at bud break spraying against larvae	—
	D	—	—	—

Testing of different pest management strategies

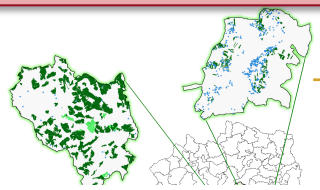
3 different initialization scenarios

Scenarios	Initial disease spread	*S. titanus* population
1	high	high
2	low	high
3	low	low



Simulation for each plot, each day in the season, over 10 years

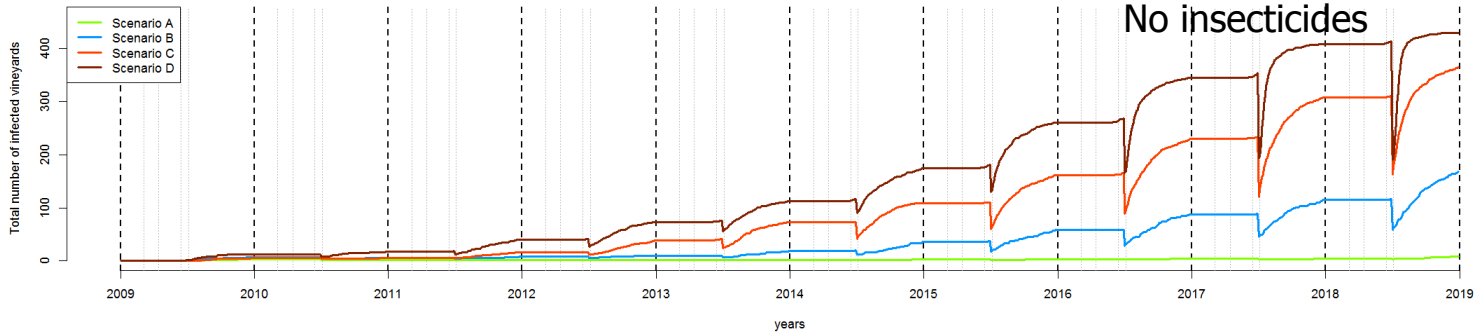
Tieschen: Number of infested vineyards (Median)



Tieschen

AGES

1

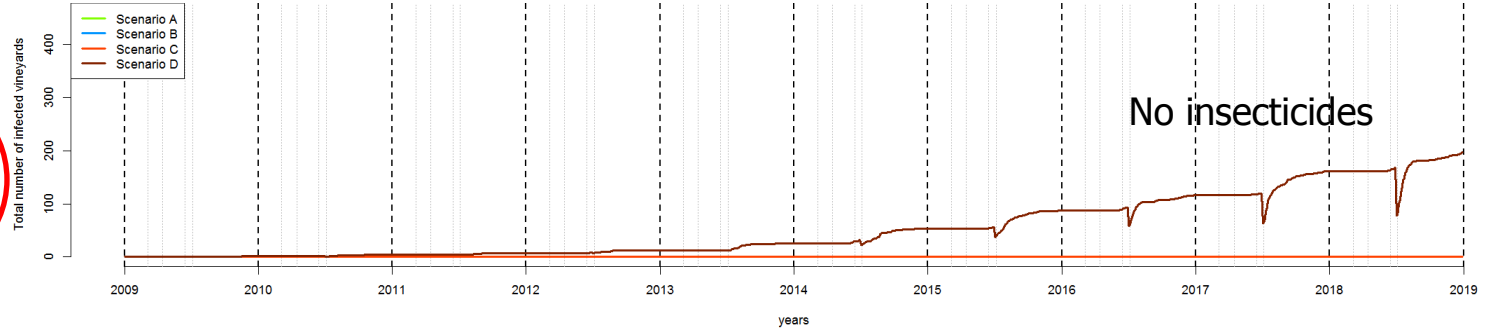


Low

Medium

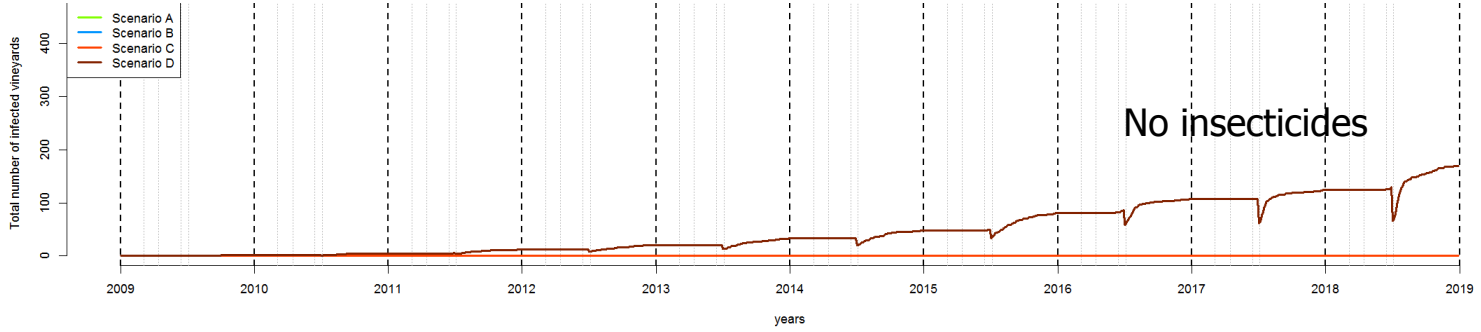
High

2



Low

3

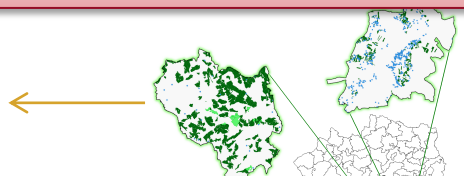


Low

www.ages.at

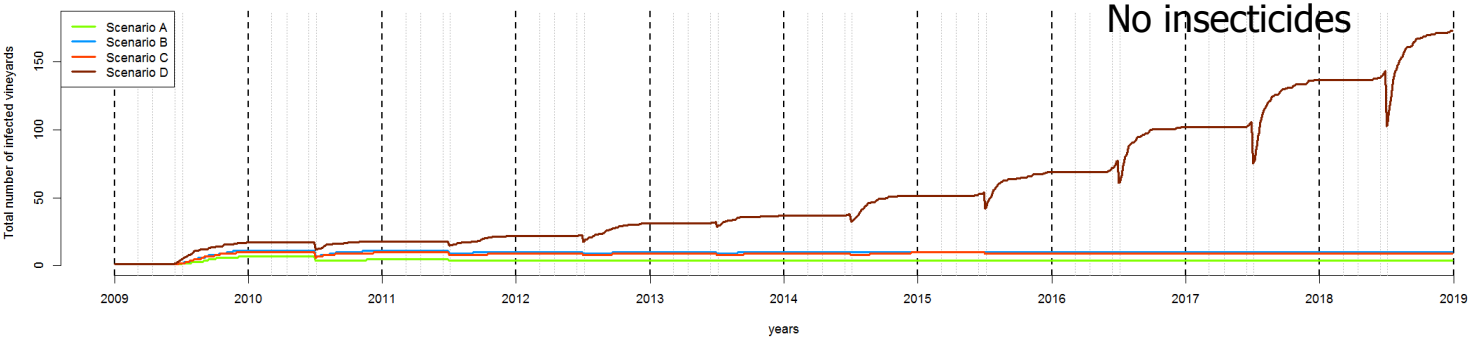
Glanz: Number of infested vineyards (Median)

Glanz a. d. Weinstraße



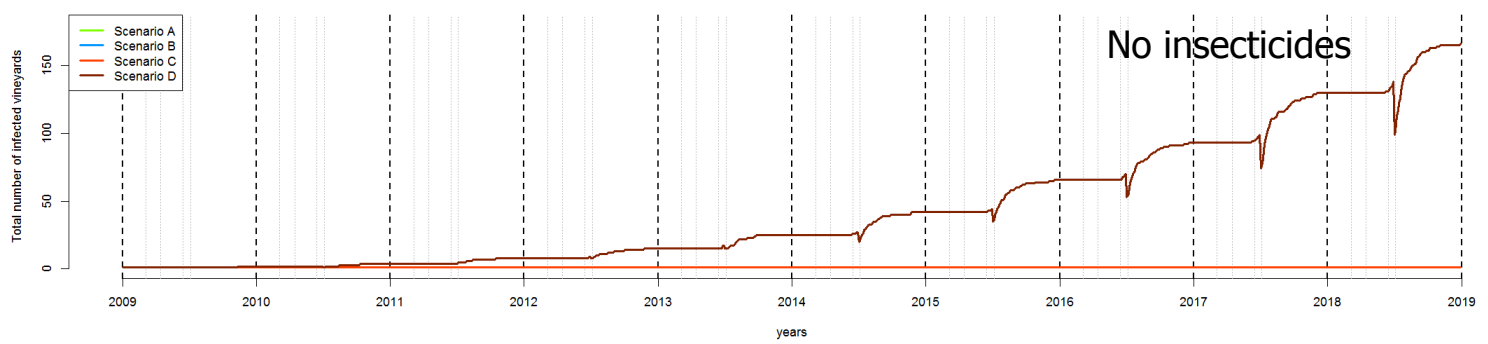
AGES

1



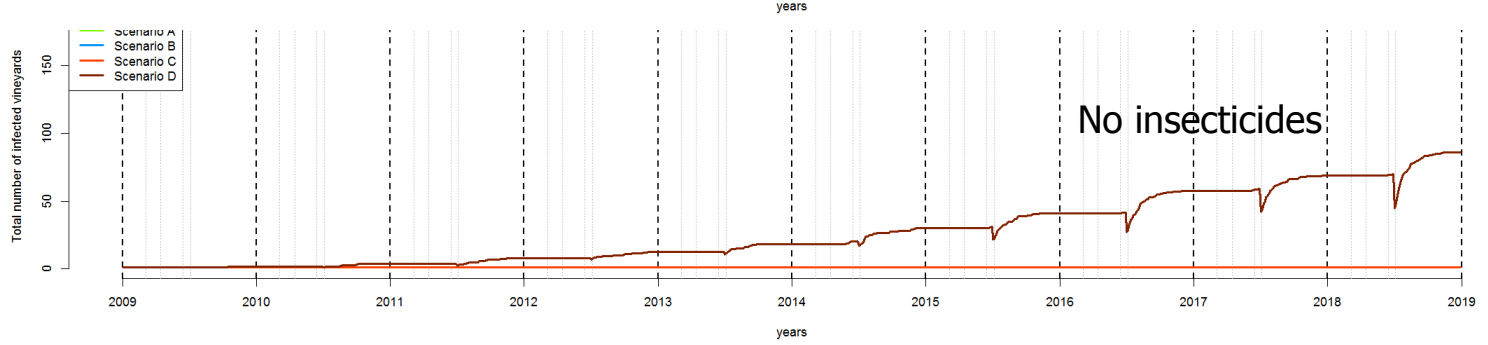
Low

2



Low

3

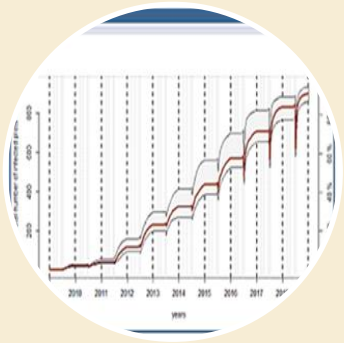


Low

www.ages.at

Insights into

Current status of disease and vector spread



Modelling of spread

IOA analysis - economic impact

Novel control strategies

Novel control strategies

1. **Intensive monitoring program** and a **rising public awareness** increase the **chance of early detection** of FD outbreaks and occurrence of *S.titanus*

2. **Vector control** strategies should be based
    * on **larvae monitoring**
    * monitoring of **arbours and hedges**
    * **uprooting** of **uncultivated vineyards**

Novel control strategies

4. **Regular testing of latent infections** in **vine-arbours and hedges** reduce the risk of a fast increase of the infested vector population

5. Applying of a **scenario specific pest control option** with respect to its efficacy on the **spread of the disease** and on its **cost-effectiveness**


Thanks for
listening.

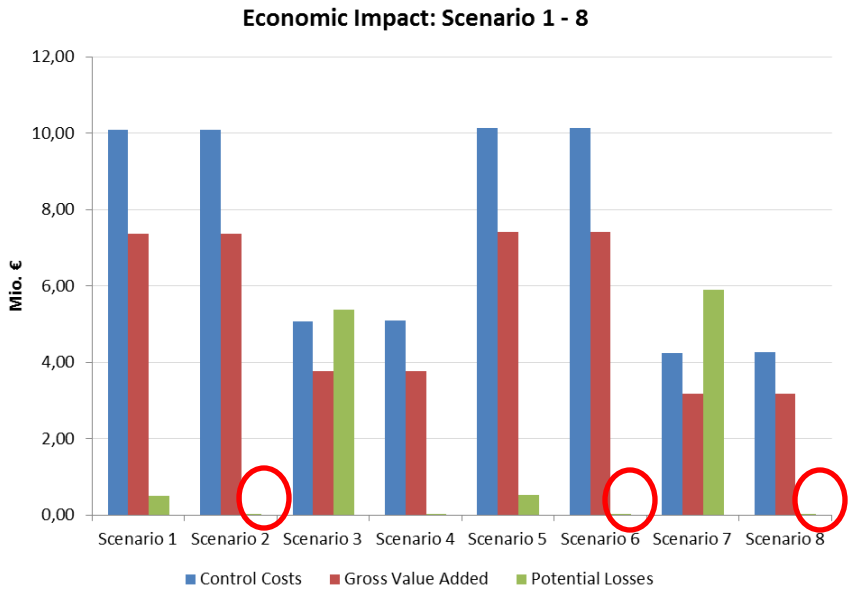
Modelling of the economic impact

Method: IOA – Input Output Analysis

to record the mutually lnked supply and deman structures of the sectors in an economy and

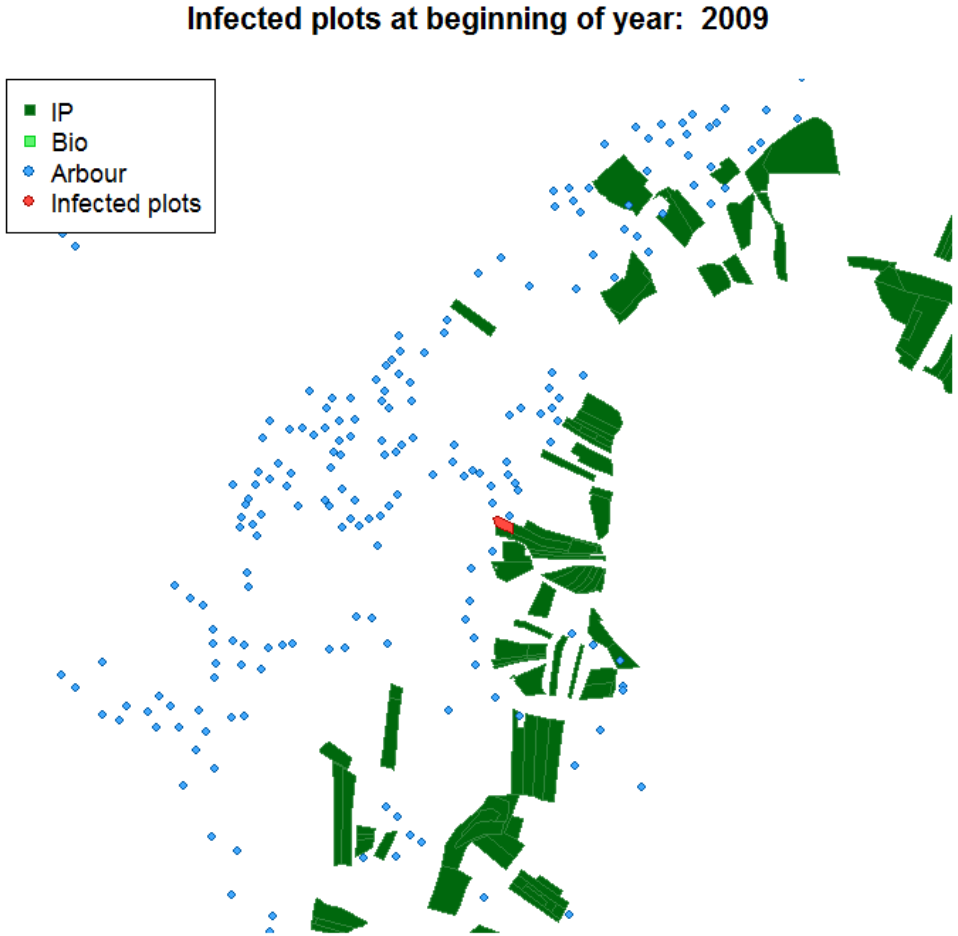
to quantify the overall economic effect

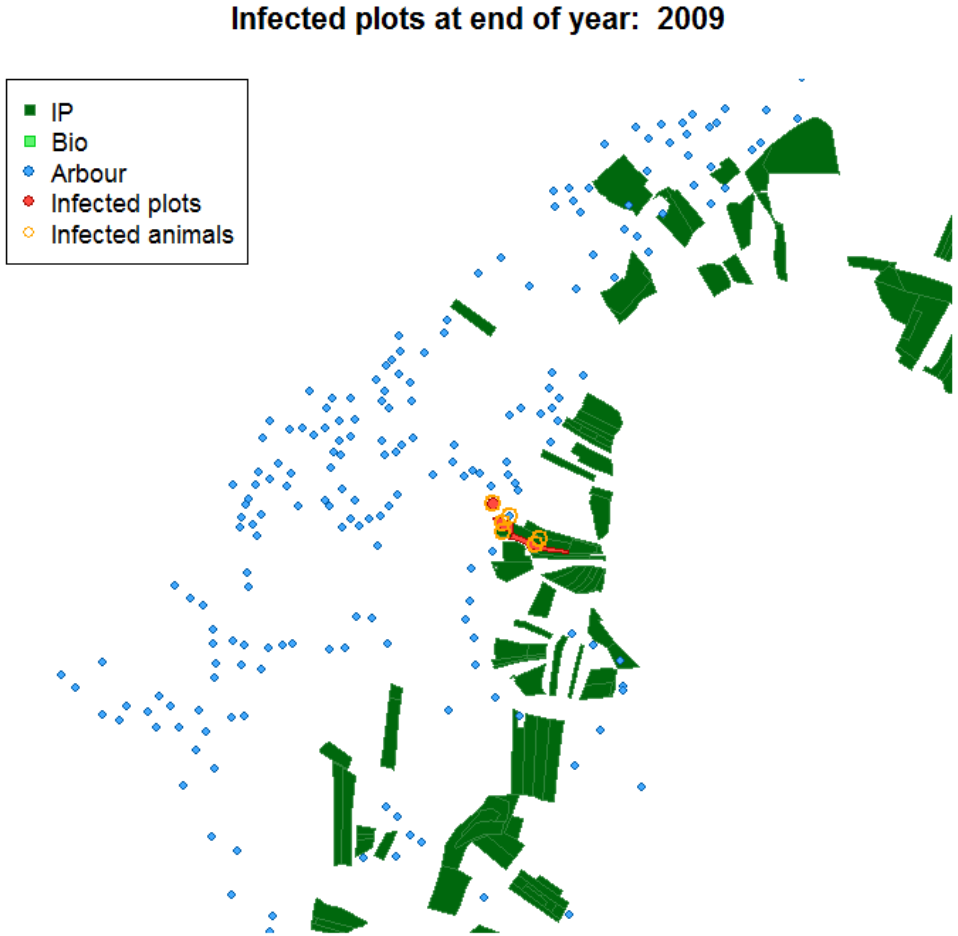
Eight scenarios combining the different spread scenarios and related control costs, gross value added and potential losses (2009-2018)

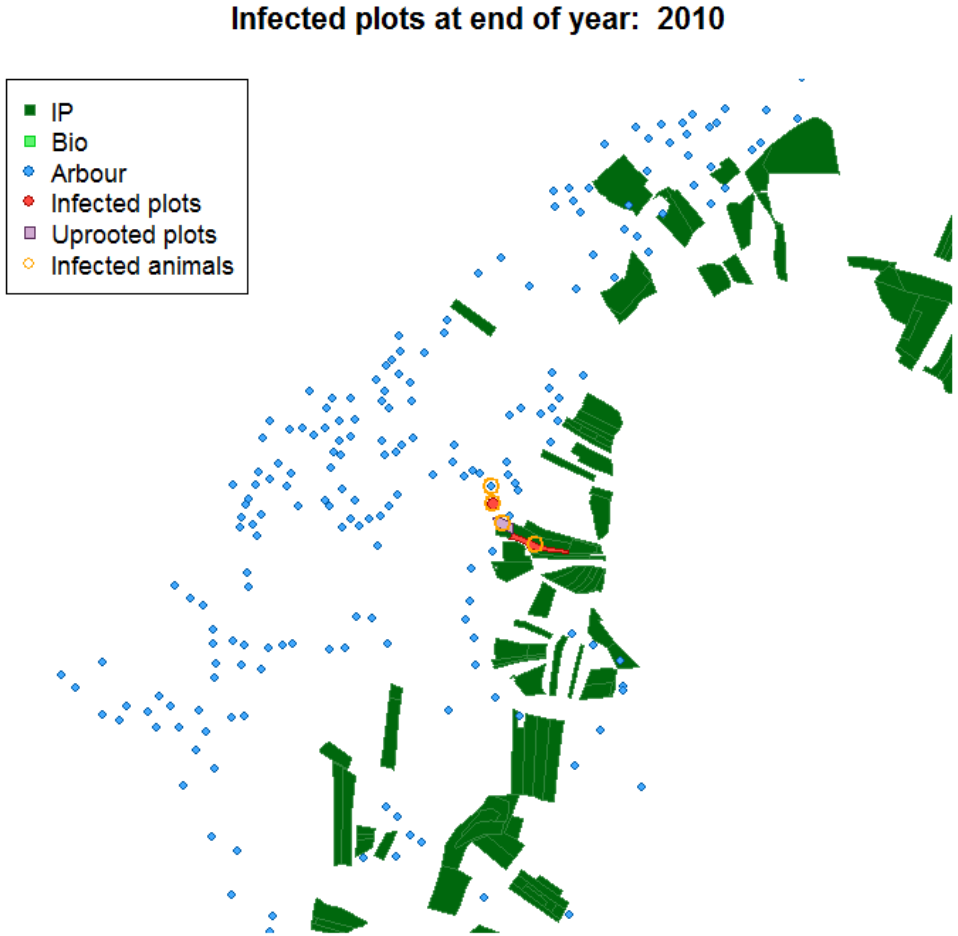


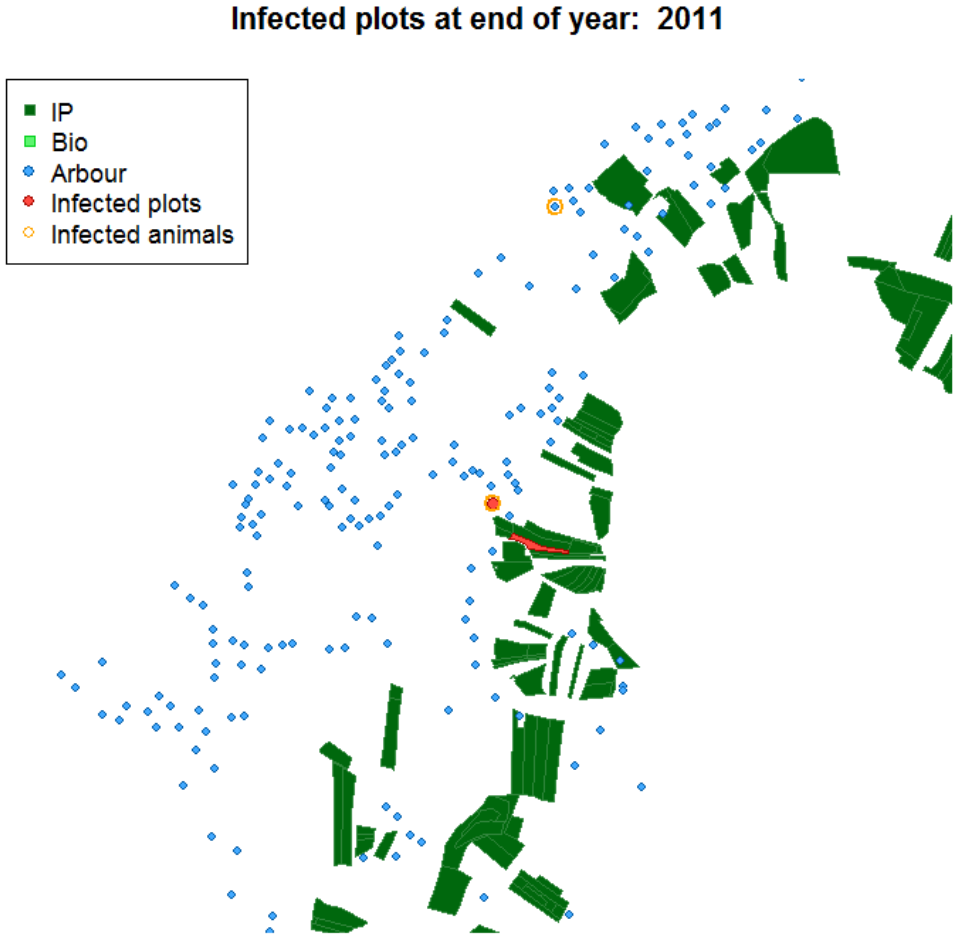
Szenarienvergleich, in Mio. €, 2009 - 2018			
	Control Costs	Gross Value Added	Potential Losses
Scenario 1	10,1	7,4	0,5
Scenario 2	10,1	7,4	0,0
Scenario 3	5,1	3,8	5,4
Scenario 4	5,1	3,8	0,0
Scenario 5	10,1	7,4	0,5
Scenario 6	10,1	7,4	0,0
Scenario 7	4,3	3,2	5,9
Scenario 8	4,3	3,2	0,0

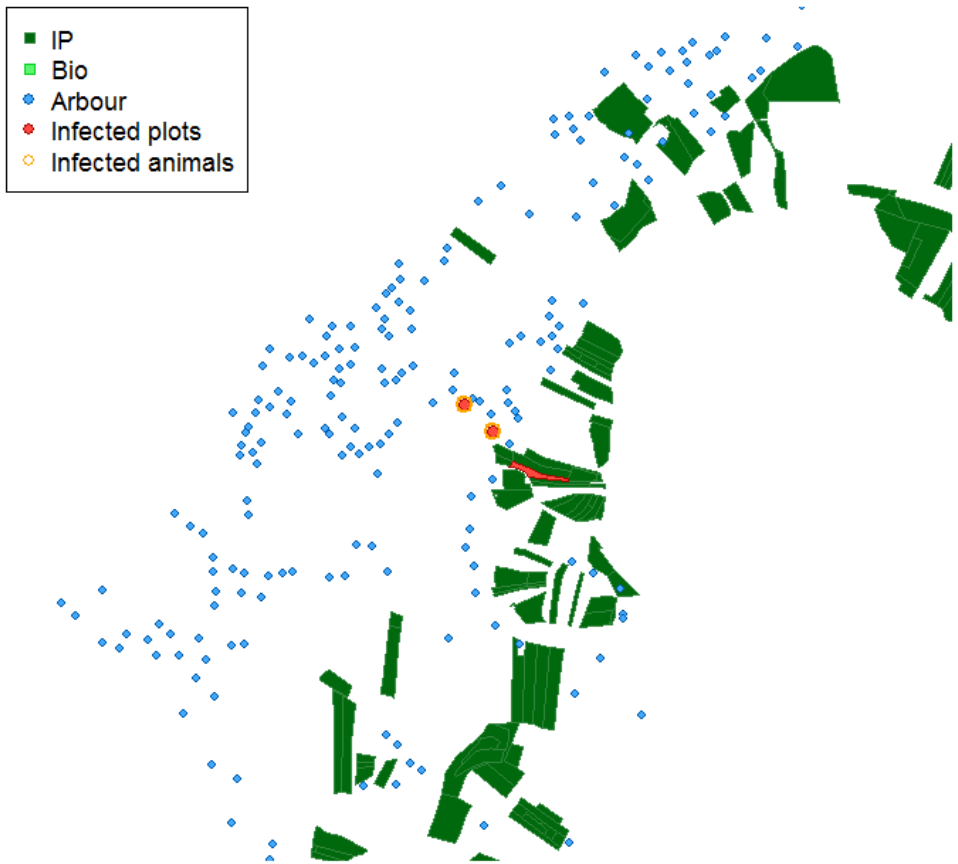
Spread simulation - Tieschen

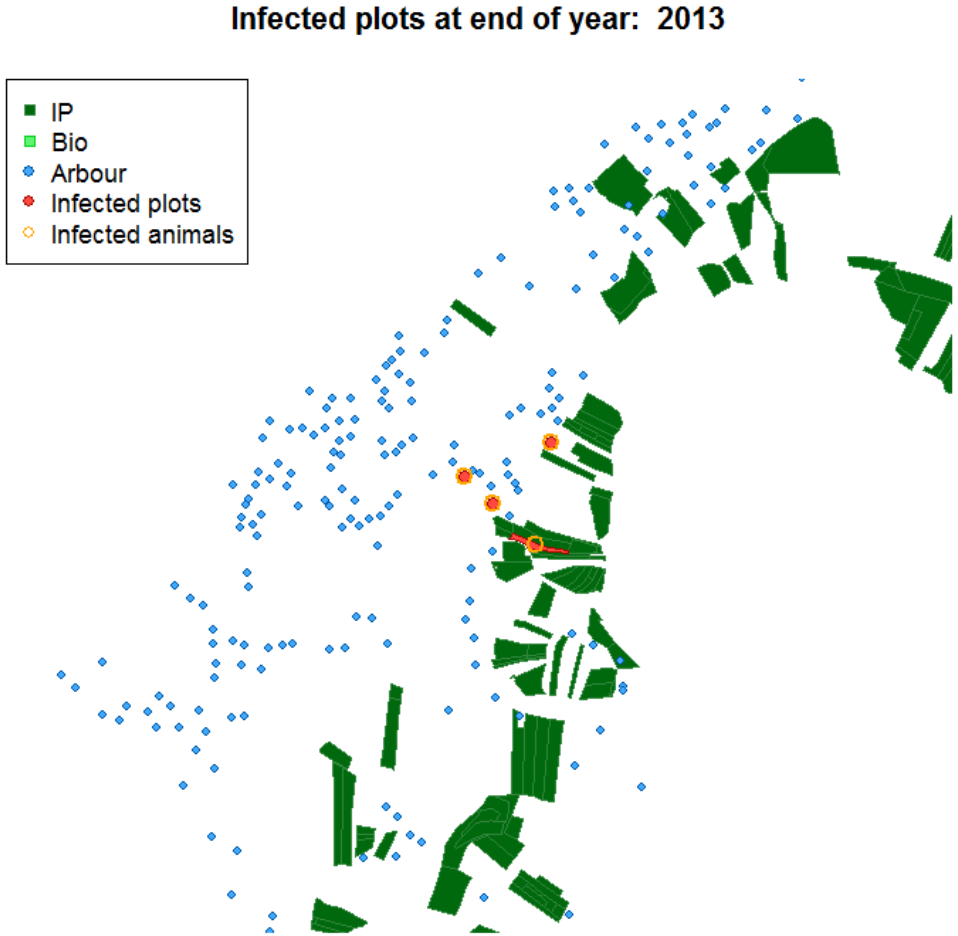


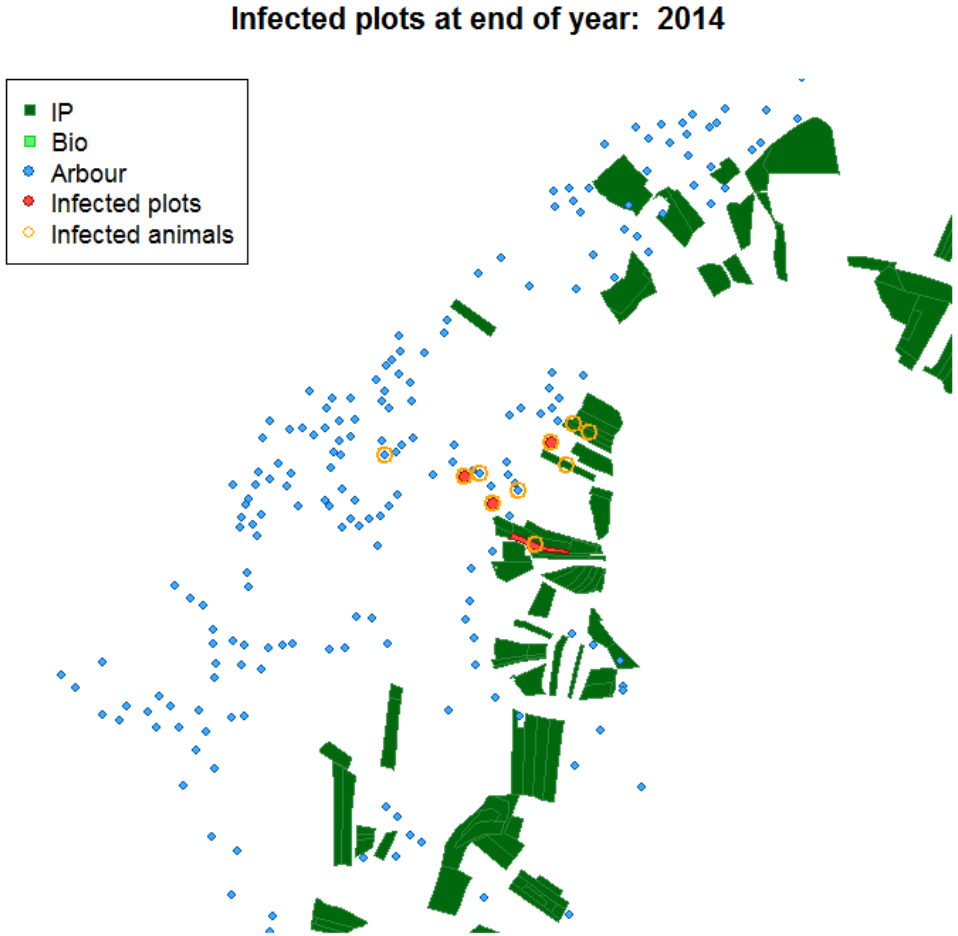

Infected plots at end of year: 2009
IP
Bio
Arbour
Infected plots
Infected animals

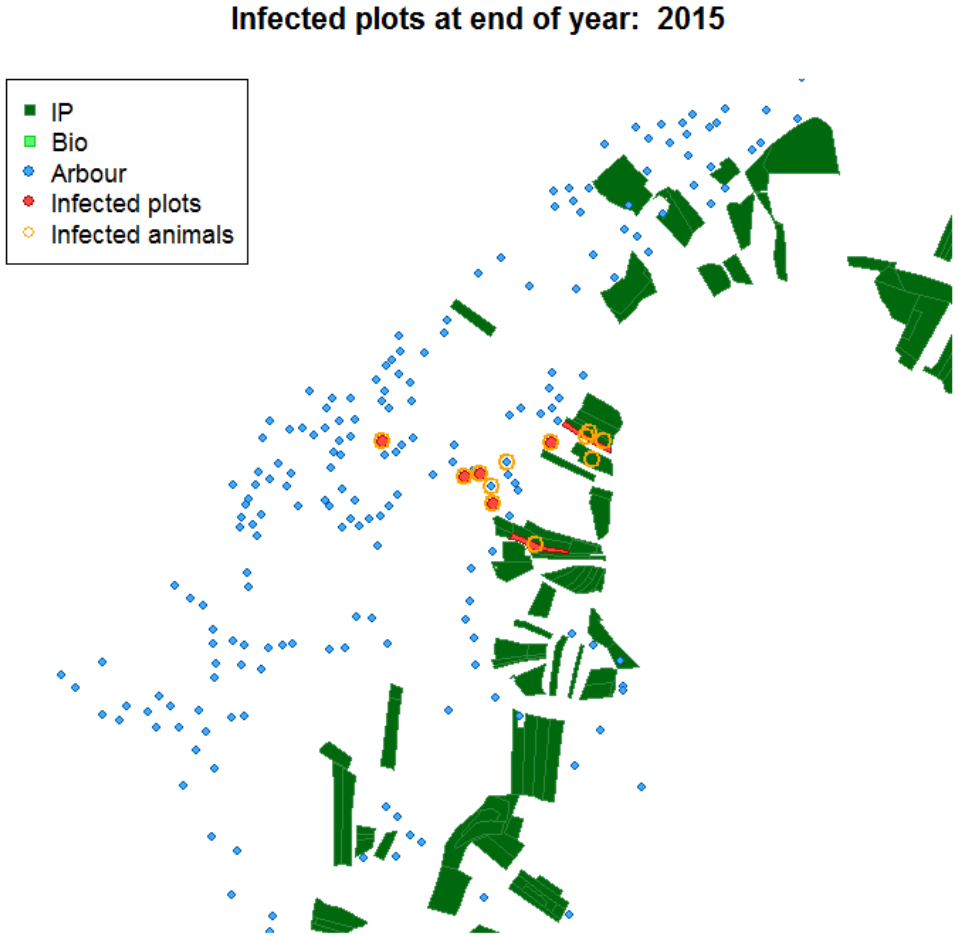

Infected plots at end of year: 2010
IP
Bio
Arbour
Infected plots
Uprooted plots
Infected animals

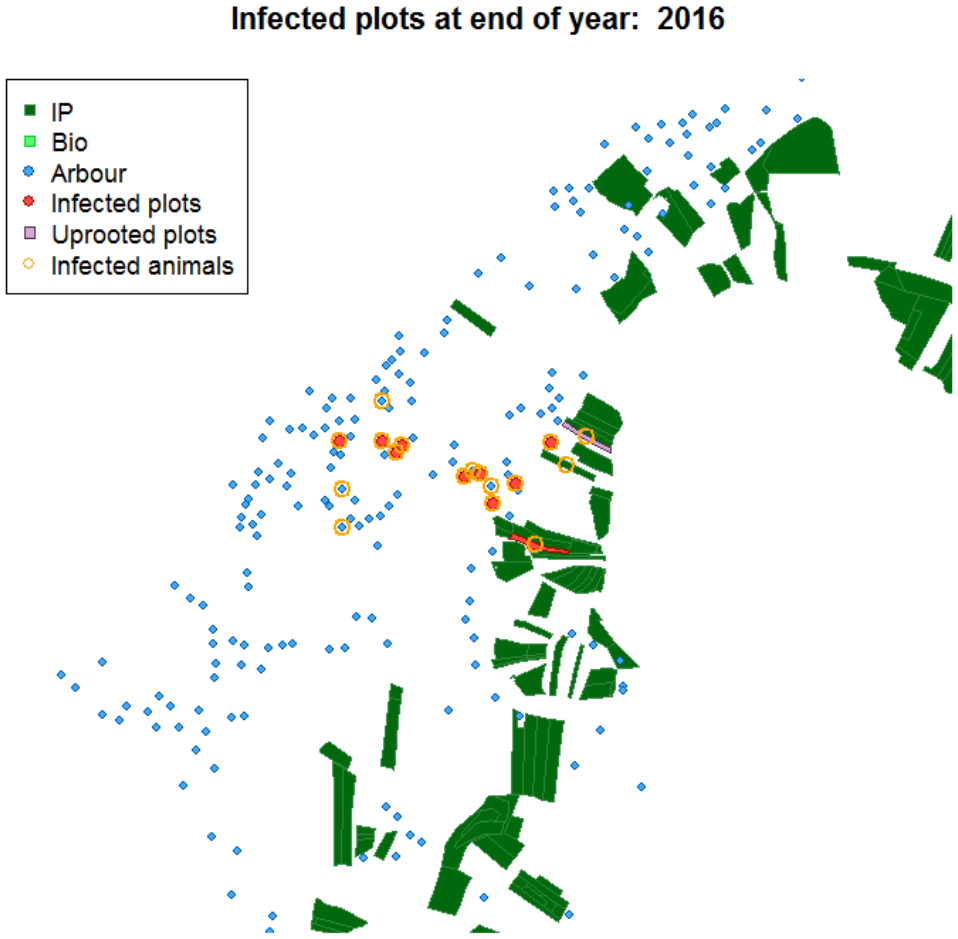

Infected plots at end of year: 2011
IP
Bio
Arbour
Infected plots
Infected animals

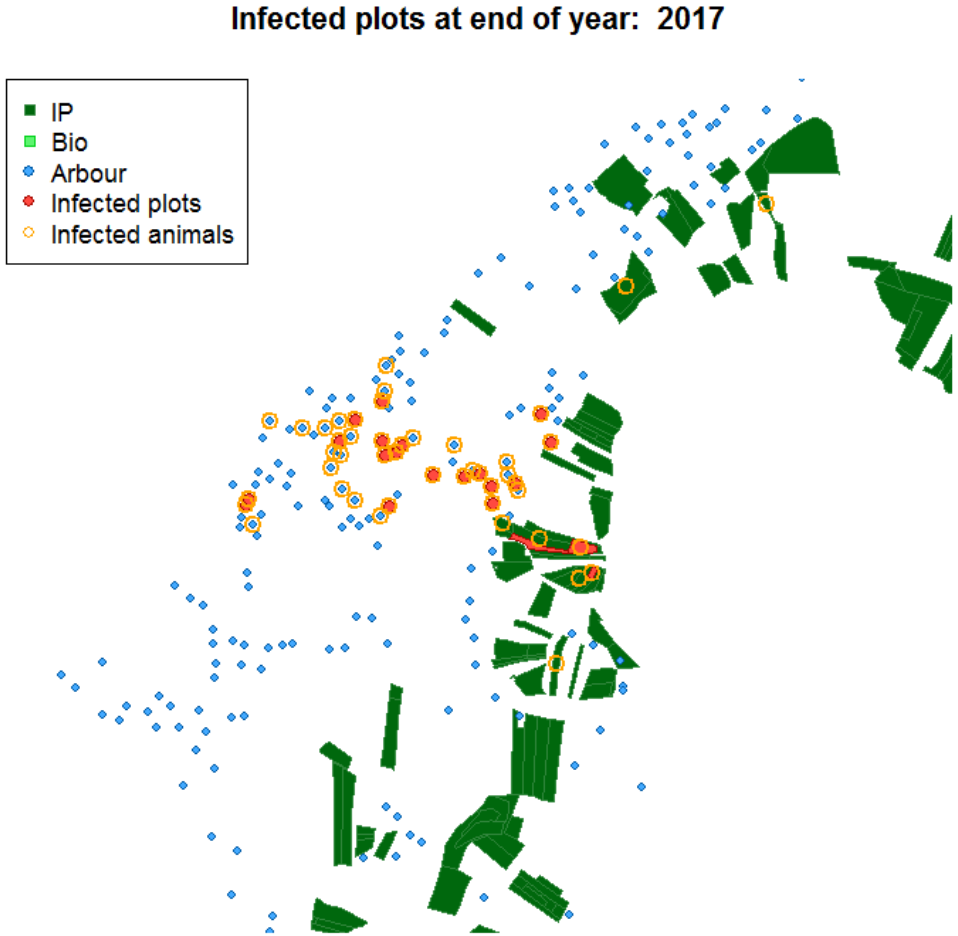

Infected plots at end of year: 2012
IP
Bio
Arbour
Infected plots
Infected animals

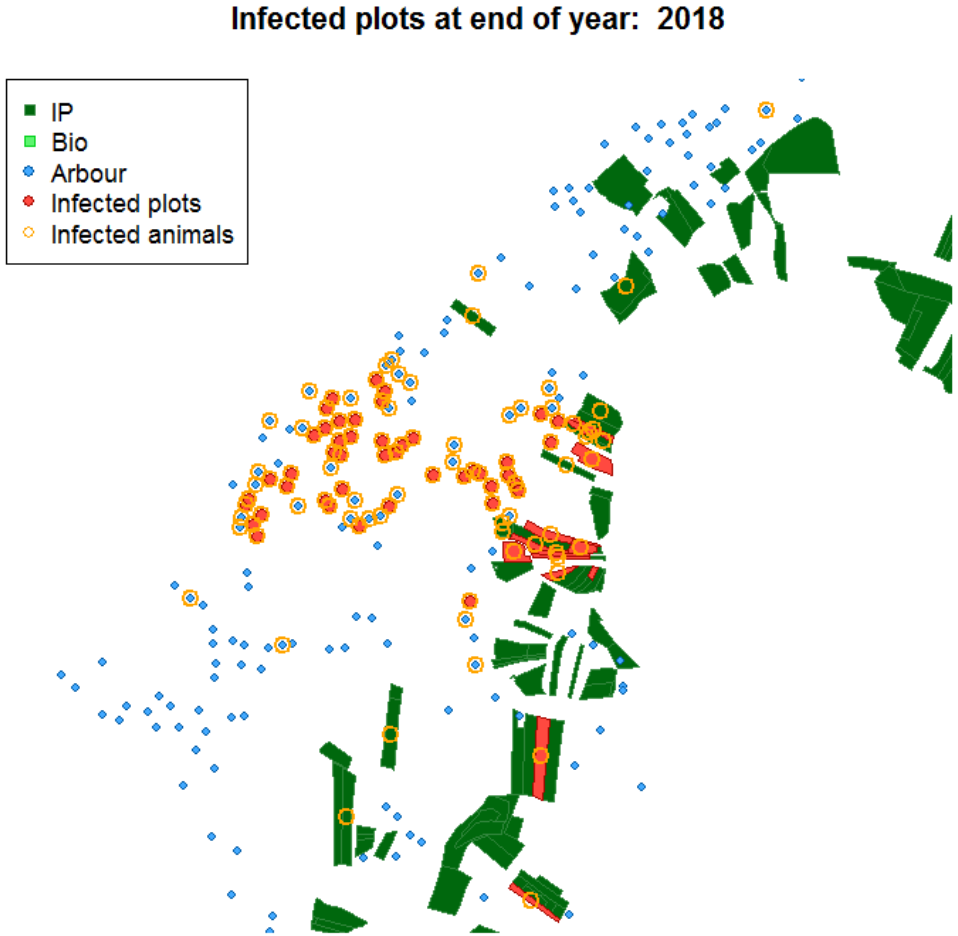

Infected plots at end of year: 2013
IP
Bio
Arbour
Infected plots
Infected animals


Infected plots at end of year: 2014
IP
Bio
Arbour
Infected plots
Infected animals

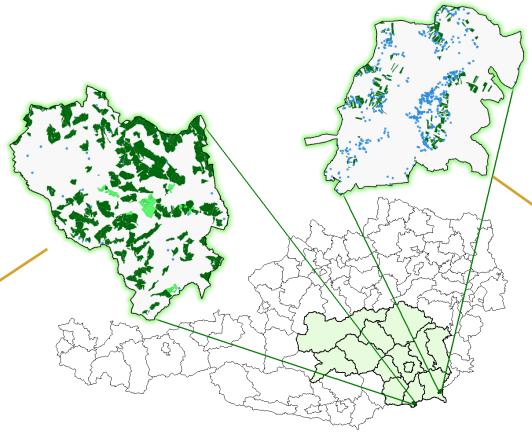

Infected plots at end of year: 2015
IP
Bio
Arbour
Infected plots
Infected animals


Infected plots at end of year: 2016
IP
Bio
Arbour
Infected plots
Uprooted plots
Infected animals


Infected plots at end of year: 2017
IP
Bio
Arbour
Infected plots
Infected animals

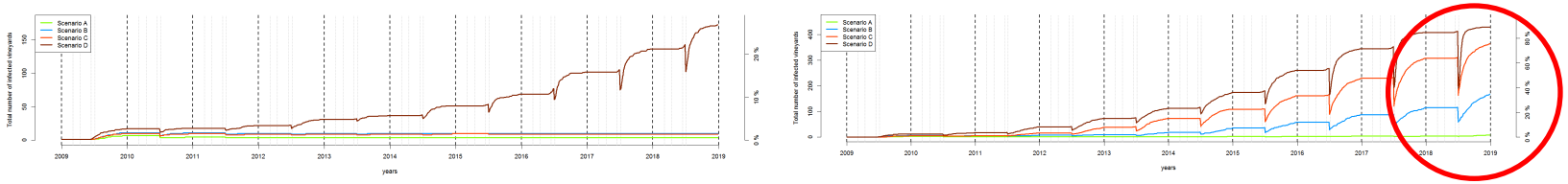

Infected plots at end of year: 2018
IP
Bio
Arbour
Infected plots
Infected animals

Glanz a. d. Weinstraße

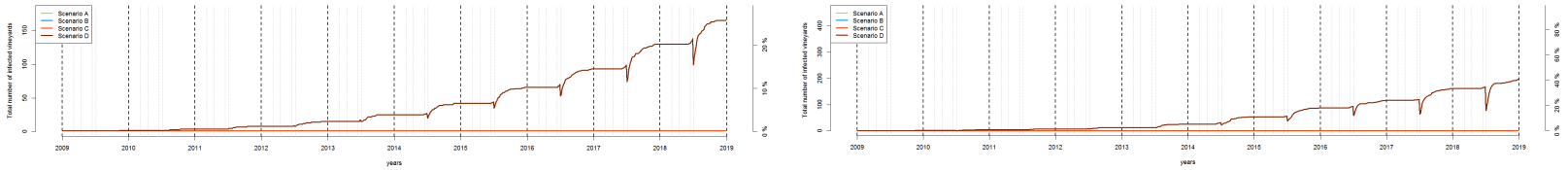


Tieschen

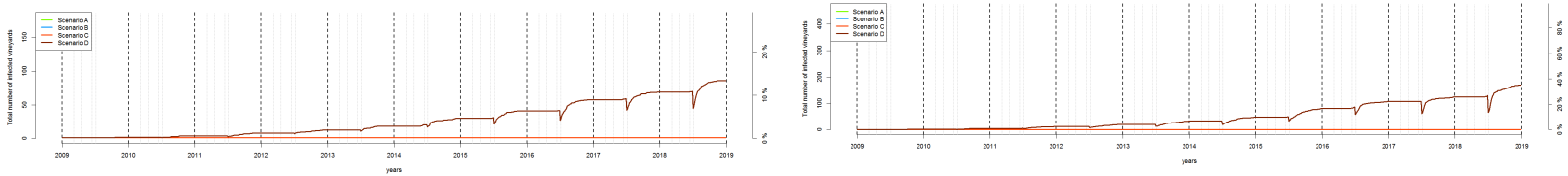
1



2



3



First findings