

A local risk map using field observations of the Asian longhorned beetle to optimize monitoring activities

Appendix S1

A. glabripennis spread simulation

We computed a stochastic simulation of *A. glabripennis* spread, implemented in R (R Core Team, 2014).

Method

1000 virtual *A. glabripennis* are released from a single origin point O (0,0).

We used the following assumptions:

(1)

Each day, on average only 1/10 of the individuals are moving (for each individual, probability 0.1 to move, Bernoulli distribution).

Why?

It was shown that many beetles do not move a lot, many even stays all their adult life on the same tree (Williams *et al.*, 2004; Bancroft & Smith, 2005). Others move only a few times; they can for example stop moving when they have found an appropriate tree or a partner, definitely or for a few days.

“The results of our small release experiment are consistent with larger dispersal studies showing that *A. glabripennis* prefer to stay on the same tree and disperse slowly in circles around the source.”
(Nehme, 2009)

(2)

Each day, each moving individual select randomly an angle between 0° and 360° (uniform continuous distribution).

Why?

No study showed that *A. glabripennis* shows generally significant trends in in the direction of moving.

(3)

Each day, each moving individual fly a distance randomly selected, following an exponential distribution (the distance D is a random variable exponentially distributed $D \sim \text{Exp}(\lambda)$, where $\lambda = 1/50$).

Why?

It was shown that most of the beetles fly very short distances, but rare individuals can fly quite far away. In the literature we can find:

“Median flight distance was estimated at 20 m per day.” (Bancroft & Smith, 2005)

“Although it is reported that adults can fly weakly 30 to 225 m in a single flight on a clear day, short-distance flight is typical of many cerambycids.” (CABI, 2015)

“The average movement distance was 14 m, with many beetles not moving at all and others moving 90 m. The rate of movement averaged almost 3 m per day” (Williams *et al.*, 2004)

“The median dispersal rate for all recaptured adults was 30 m/d.” (Smith *et al.*, 2004).

In our simulation, we consequently fixed $\lambda = 1/50$ as parameter for the exponential distribution, meaning that the mean fly distance is 50m and the median fly distance 34.66 m. On average, only 2% of the flying distances are above 196 m ($P(D < 196) = 0.98$) and the mean moving distance for all beetles is 5 m / day.

(4)

The previous steps are done during 50 days (looped 50 times).

Why?

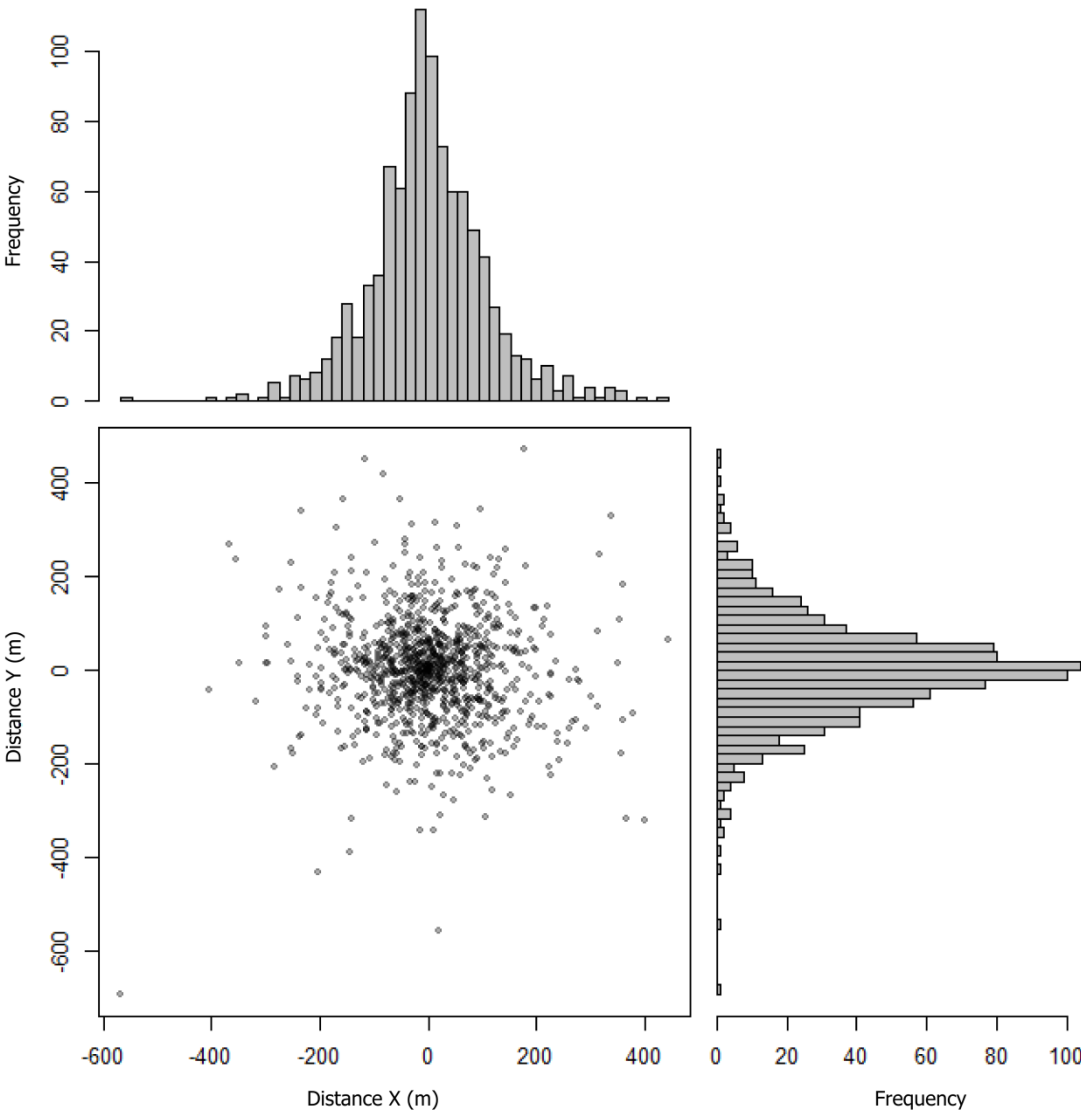
We assumed that the lifespan of each individual can be 50 days.

“Studies in China showed that male adults live for 3–50 days, and females live for 14–66 days.” (Li & Wu, 1993; Hu *et al.*, 2009)

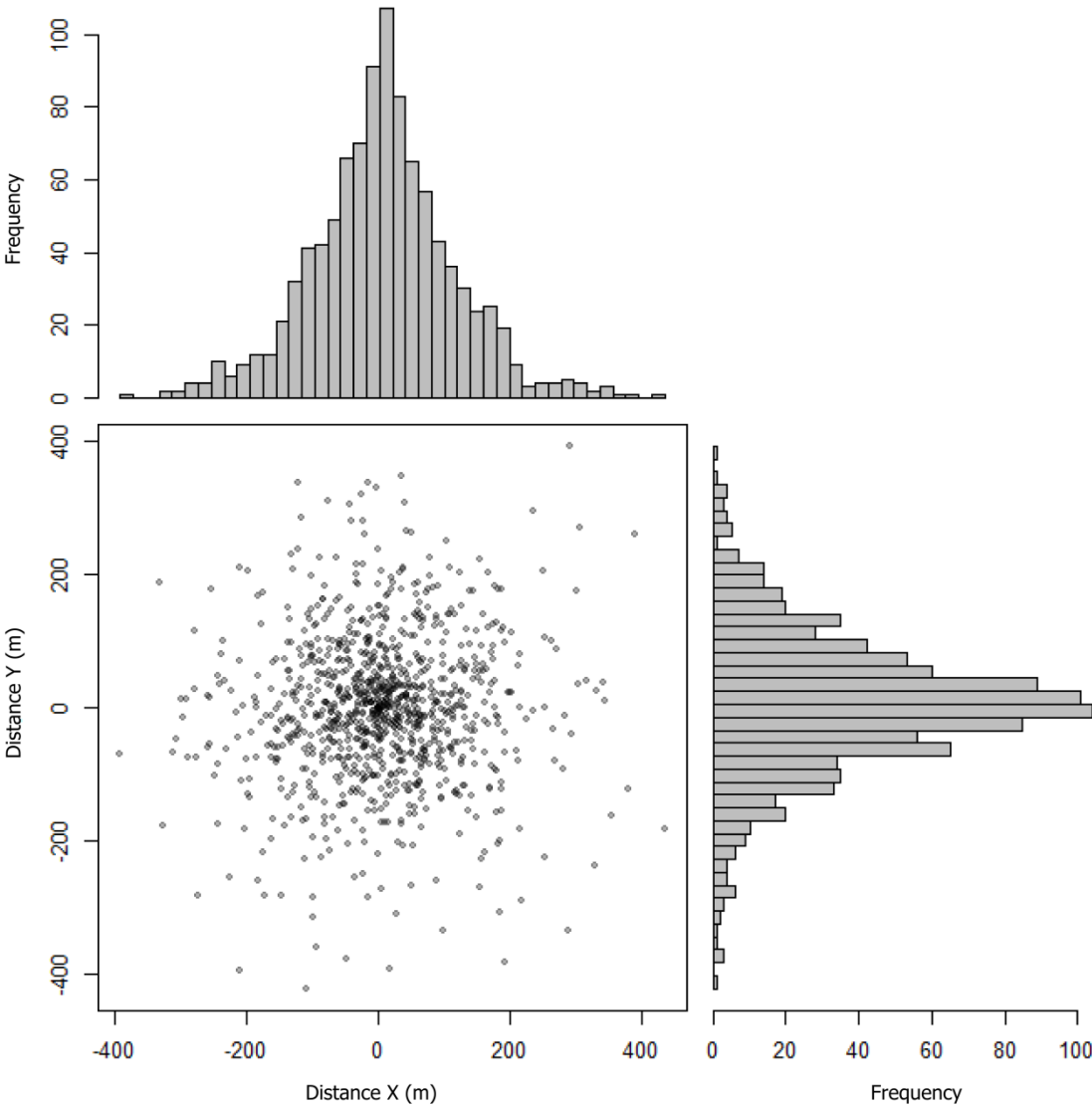
Results

We plotted the position of each individual after 50 days. We present the graphs for three trials:

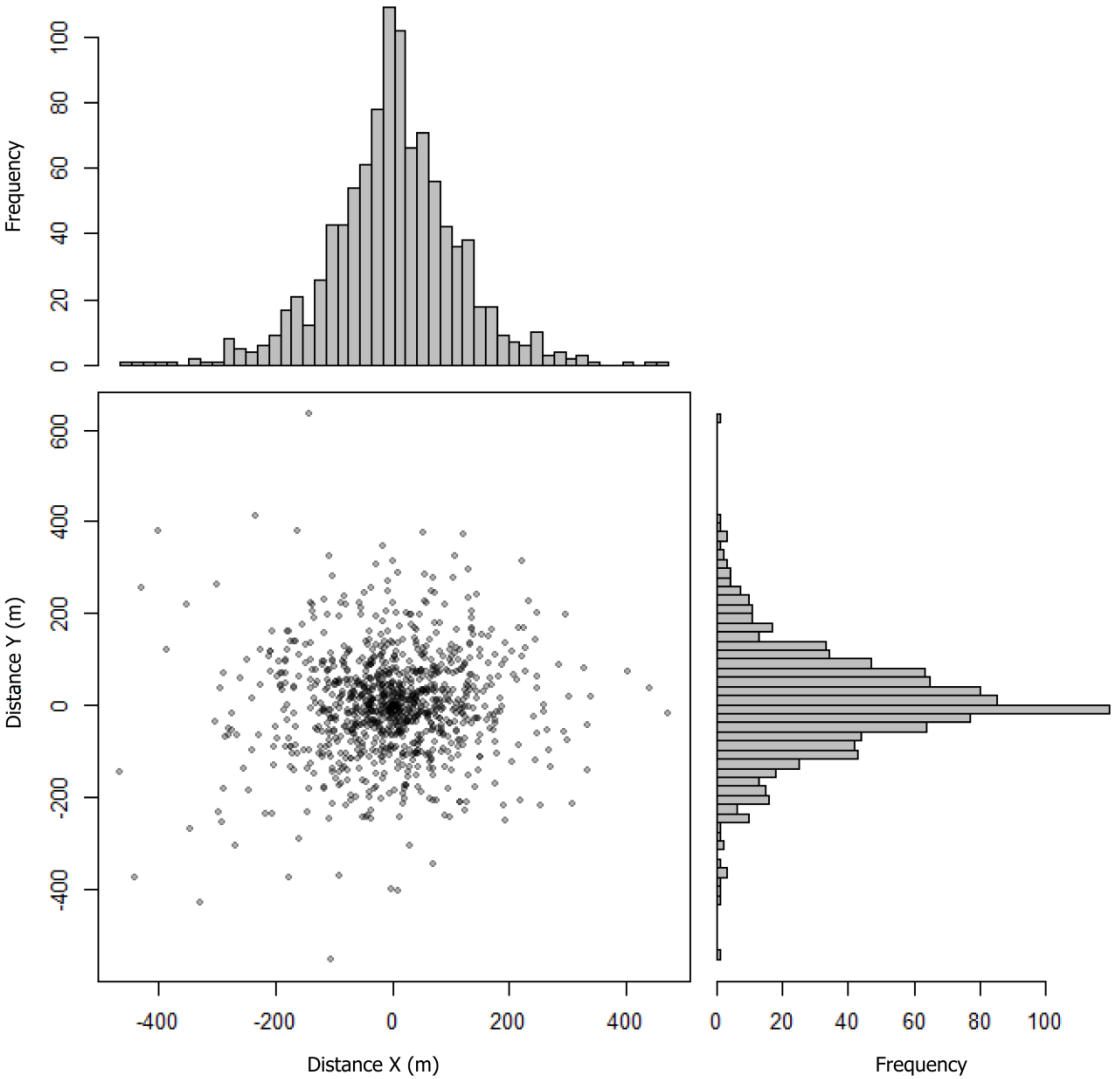
Trial 1



Trial 2



Trial 3

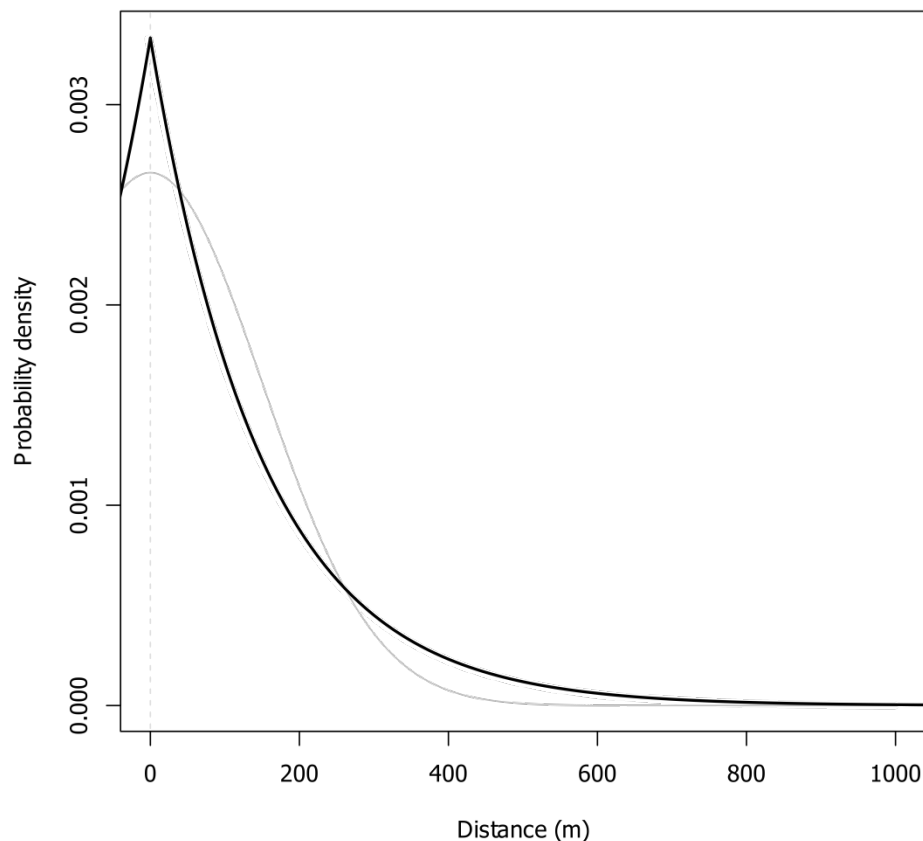


Simulation information

- Mean spread distance after 50 days: ~ 130 m
- Median spread distance after 50 days: ~ 110 m
- Min spread distance after 50 days: 0 m
- Max spread distance after 50 days: can rarely reach 1000 m

Discussion

A visual check of the above histograms indicates that the Laplace distribution is pertinent to represent the X and the Y dispersion in our simulation, better for example than the commonly used normal distribution (for comparison, see figure below). The heavier tails and the high central peak of the Laplace distribution are appropriate for modelling ALB dispersal as some individuals can spread over long distances and as many individuals do not disperse at all and stay on the same tree all their adult life (see the main manuscript). This pattern is also observable in this numerical simulation.



The probability density function of the univariate Laplace distribution, $\mathcal{L}(0, 150)$ (black line, mean = 0, scale parameter = 150), is compared with the normal distribution $N(0, 150)$ (grey line, mean = 0, standard deviation $\sigma = 150$). Only the positive range is shown.

References

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- Hu, J., Angeli, S., Schuetz, S., Luo, Y. & Hajek, A.E. (2009) Ecology and management of exotic and endemic Asian longhorned beetle *Anoplophora glabripennis*. *Agricultural and Forest Entomology*, 11, 359–375.
- Li, W. & Wu, C. (1993) Integrated Management of Longhorn Beetles Damaging Poplar Trees. Forest Press, China.
- Nehme, M.E. (2009) Developing monitoring traps for the Asian longhorned beetle. A dissertation in: Entomology & Comparative and International Education.
- R Core Team (2014). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.
- Smith, M.T., Tobin, P.C., Bancroft, J., Li, G. & Gao, R. (2004) Dispersal and spatiotemporal dynamics of Asian longhorned beetle (Coleoptera: Cerambycidae) in China. *Environmental Entomology*, 33(2), 435–442.
- Williams, D. W., Li, G. & Gao, R. (2004) Tracking movements of individual *Anoplophora glabripennis* (Coleoptera: Cerambycidae) adults: Application of harmonic radar. *Environmental Entomology*, 33, 644–649.

R-script

```
X<-rep(0,1000)
Y<-rep(0,1000)
for(i in 1:50)
{
a<-rexp(1000,1/50)
b<-runif(1000, min=0,max=2*pi)
c<-sample(c(0,0,0,0,0,0,0,0,0,1),1000, replace=T)
d<-a*c
x<-cos(b)*d
y<-sin(b)*d
X<-X+x
Y<-Y+y
}

scatterhist = function(x, y, xlab="", ylab=""){
  zones=matrix(c(2,0,1,3), ncol=2, byrow=TRUE)
  layout(zones, widths=c(4/12,1/5), heights=c(1/5,4/12))
  xhist = hist(x, plot=FALSE, breaks=50)
  yhist = hist(y, plot=FALSE, breaks=50)
  top = max(c(xhist$counts, yhist$counts))
  par(mar=c(3,3,1,1))
  plot(x,y,pch=20, col="#00000050")
  par(mar=c(0,3,1,1))
  barplot(xhist$counts, axes=TRUE, ylim=c(0, top), space=0)
  par(mar=c(3,0,1,1))
  barplot(yhist$counts, axes=TRUE, xlim=c(0, top), space=0, horiz=TRUE)
  par(oma=c(3,3,0,0))
  mtext(xlab, side=1, line=1, outer=TRUE, adj=0,
    at=.8 * (mean(x) - min(x))/(max(x)-min(x)))
  mtext(ylab, side=2, line=1, outer=TRUE, adj=0,
    at=(.8 * (mean(y) - min(y))/(max(y) - min(y))))
}
scatterhist(X,Y)
```


A local risk map using field observations of the Asian longhorned beetle to optimize monitoring activities

Appendix S2

R script

```
#Center of the map (x-y) >> must be adapted (we used x and y in Swiss coordinate system CH1903 LV03, 1 unit corresponds to 1 meter)
```

```
###
```

```
x<-578400
```

```
y<-181100
```

```
###
```

```
#D : sigma of the bivariate symmetric Laplace distribution. The default value is 150, see manuscript.
```

```
###
```

```
D<-150
```

```
###
```

```
#Data, O-points list with X and Y coordinates
```

```
data<-read.table("Opoints.txt", sep="\t", header=T)
```

```
attach(data)
```

```
#300 points on the X axis (10m interval, centered on x) and 300 points on the Y axis (10m interval, centered on y). Production of 300 × 300 = 90000 regular points. The map will be about 3km × 3km.
```

```
CoorX <- rep(0,90000)
```

```
for (j in 0:299)
```

```
{
```

```
for (i in 1:300 )
```

```
{
```

```
n<-(x-1495+10*j)
```

```
CoorX[i+(300*j)]<-n
```

```
}
```

```
}
```

```
CoorY<-rep(0,90000)
```

```
for (j in 0:299)
```

```
{
```

```
for (i in 1:300 )
```

```
{
```

```
n<-(y-1495+10*(i-1))
```

```
CoorY[i+(300*j)]<-n
```

```
}
```

```
}
```

```
#Production of a bivariate symmetrical Laplace curve for each O-point and storage of the corresponding value in a matrix for the 90000 regular points.
```

```
mat<-matrix(nrow=90000,ncol=length(X))
```

```
col<-rep(0,90000)
```

```
for (k in 1:(length(X)))
```

```
{
```

```
for (i in 1:90000)
```

```

{
u<-sqrt(2*(((CoorX[i]-X[k])^2/D^2)+((CoorY[i]-Y[k])^2/D^2)))
fK<-function(t)
{
1/t*exp(-t-u^2/(4*t))
}
int<-integrate(fK, lower=0, upper= Inf)
col[i]<-1/(pi*D*D)*1/2*int$value
}
mat[,k]<-col
}

```

#Curve volume over each 10 × 10 m square (100 m²). An estimation using the central point of the 10 × 10 m square was suitable.

```
mat100<-mat*100
```

#Calculation of the risk index, $RI = 1 - (1 - P_1)(1 - P_2) \dots$

```

RI<-rep(0,90000)
li<-rep(0,length(X))
for(l in 1 : 90000)
{
for (m in 1:(length(X)))
{
li[m]<-(1-mat100[l,m])
}
RI[l]<-1-(prod(li))
}

```

#Creation of the output file

```

raster <- data.frame(x=CoorX,y=CoorY,riskindex=RI)
summary(raster)
str(raster)
write.table(raster,file="Raster.csv",sep="," ,row.names=F)

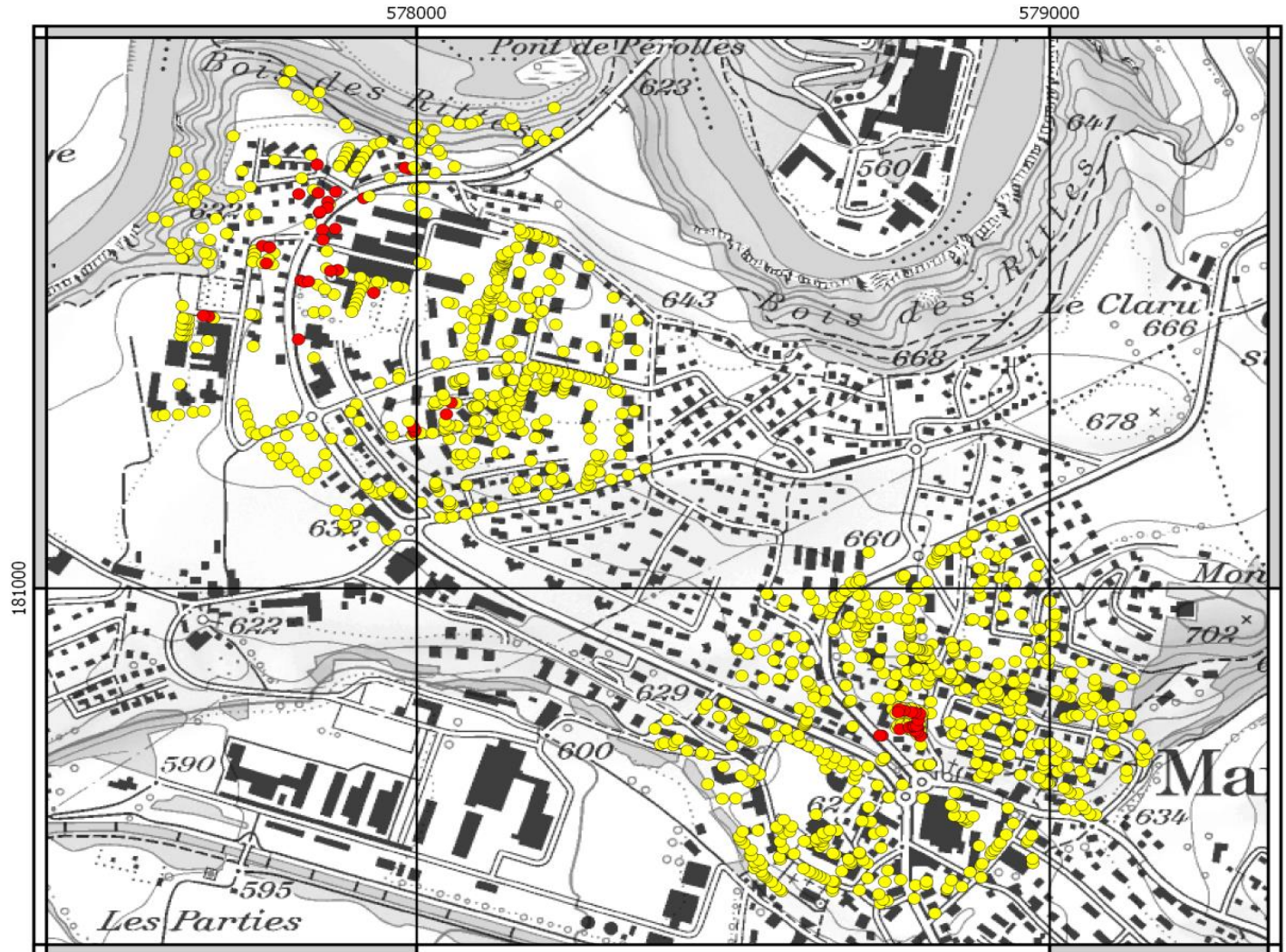
```

#With a GIS software, rasterise the output file.

Appendix S3

Monitored primary hosts, Marly, Switzerland

X-Y : Swiss coordinate system CH1903 LV03



Legend

Monitored primary hosts

- not infested (situation 2016)
- infested

0 100 200 300 400 500 m



Background © Swiss Federal Office of Topography

	X	Y	Tree infested 1=Y, 0=N	Risk index (calculated by the model at the location of the tree)
1	577954.5628	181085.4687	0	0.001851
2	577964.7493	181093.4062	0	0.002055
3	577889.8059	181106.0401	0	0.002137
4	577889.409	181107.4291	0	0.002137
5	577930.9487	181107.5614	0	0.002261
6	577884.845	181113.3823	0	0.002361
7	578046.8989	181123.8169	0	0.002524
8	578043.6445	181123.8433	0	0.002524
9	578037.7575	181124.6768	0	0.002593
10	578056.801	181126.2797	0	0.002447
11	577887.0234	181129.9055	0	0.002609
12	578077.9677	181130.7776	0	0.002517
13	577904.9291	181135.905	0	0.002975
14	577872.7689	181136.8508	0	0.002831
15	577907.8726	181139.0976	0	0.002975
16	578095.0326	181140.778	0	0.002537
17	578119.1461	181143.0027	0	0.002289
18	578051.377	181143.4115	0	0.003011
19	578055.7426	181147.8433	0	0.003011
20	578051.3109	181148.0417	0	0.003011
21	578007.0718	181150.7317	0	0.003818
22	578051.358	181153.0443	0	0.003343
23	578201.9609	181161.0473	0	0.001543
24	577975.6535	181164.6014	0	0.004358
25	577938.8369	181164.8695	0	0.004222
26	578205.5592	181164.9103	0	0.001543
27	577938.6517	181166.8274	0	0.004222
28	577972.3793	181167.8425	0	0.004358
29	577932.7872	181168.4744	0	0.004222
30	578035.2713	181170.401	0	0.004448
31	577947.1184	181170.7697	0	0.004754
32	578155.3445	181175.9897	0	0.002318
33	578165.4516	181176.3601	0	0.002167
34	578259.6402	181176.6049	0	0.00119
35	577923.7966	181176.8141	0	0.004608
36	578170.9021	181177.3655	0	0.002025
37	577957.9595	181178.5582	0	0.00481
38	578029.8928	181178.5926	0	0.004582
39	578031.8441	181178.8902	0	0.004448
40	578030.6865	181179.5186	0	0.004448
41	578276.2428	181211.477	0	0.001277
42	578212.8617	181213.5143	0	0.001981
43	578276.1105	181214.9827	0	0.001277
44	577855.7591	181215.2895	0	0.005862
45	578283.4527	181216.5041	0	0.001193
46	578280.0793	181216.8348	0	0.001193
47	578072.3673	181217.7686	0	0.005596
48	577804.1652	181217.9882	0	0.005279

49	577784.5752	181218.0265	0	0.005041
50	578081.6542	181220.6261	0	0.005758
51	578180.1856	181224.0315	0	0.002664
52	578288.8965	181227.0114	0	0.001249
53	578063.6008	181227.0154	0	0.006582
54	577795.8465	181229.774	0	0.00568
55	578089.0662	181230.6346	0	0.006308
56	578292.4023	181232.6999	0	0.001217
57	577773.1452	181233.3723	0	0.005962
58	578284.3986	181233.9567	0	0.001307
59	577895.1046	181260.203	0	0.009983
60	578325.7398	181260.2828	0	0.001112
61	578051.549	181262.0198	0	0.010458
62	578077.4715	181262.3373	0	0.008909
63	578274.1165	181262.939	0	0.001618
64	577864.7833	181263.2193	0	0.009449
65	578191.9008	181264.1648	0	0.003118
66	578332.2883	181264.8469	0	0.001037
67	578187.7048	181265.2918	0	0.003395
68	577794.1532	181268.3503	0	0.008349
69	577834.9628	181268.6296	0	0.008998
70	578121.9162	181268.8671	0	0.00573
71	577993.0255	181269.5564	0	0.016248
72	577962.4331	181269.5994	0	0.013238
73	577998.3701	181271.2498	0	0.022105
74	578006.1488	181272.7843	0	0.017994
75	578024.8814	181272.7843	0	0.014293
76	577995.8301	181274.5835	1	0.022105
77	578089.2354	181276.7688	0	0.008856
78	578166.7472	181277.041	0	0.004271
79	578044.831	181277.4939	0	0.012387
80	578324.3375	181277.8644	0	0.001154
81	578141.6849	181309.3392	0	0.005981
82	578158.5146	181319.7491	0	0.00572
83	578088.7417	181320.0813	0	0.011728
84	578091.2552	181320.7956	0	0.010539
85	578274.8378	181321.2997	0	0.00211
86	578026.9377	181322.7409	0	0.01673
87	578031.7002	181323.0055	0	0.016781
88	577904.4698	181323.5038	0	0.01647
89	578121.5501	181324.05	0	0.007861
90	578134.0649	181325.1348	0	0.007165
91	578102.4736	181325.32	0	0.009525
92	578062.1935	181325.3867	0	0.015103
93	578054.3221	181326.0482	1	0.020118
94	578146.675	181326.381	0	0.006541
95	578035.0075	181326.4451	0	0.016781
96	578137.0812	181326.5106	0	0.007165
97	578132.8478	181327.0927	0	0.007165
98	578028.6575	181327.5696	0	0.01673
99	578161.134	181328.7979	0	0.005468
100	578135.4355	181328.921	0	0.007165
101	578148.6911	181330.318	0	0.006815
102	578044.5325	181330.6784	0	0.016559

103	578123.1799	181337.639	0	0.008162
104	578163.7534	181337.926	0	0.005708
105	578041.4898	181340.0711	0	0.016058
106	578098.7324	181340.5918	0	0.011063
107	578230.4285	181343.0854	0	0.003241
108	578139.6503	181343.3276	0	0.007741
109	578143.4206	181344.4521	0	0.007089
110	578310.8041	181344.9805	0	0.001633
111	578320.5937	181344.9805	0	0.001501
112	578201.4946	181347.1354	0	0.004203
113	578166.5315	181347.2129	0	0.005952
114	578315.5004	181348.0232	0	0.001633
115	578200.6629	181348.721	0	0.004203
116	578232.1748	181348.9592	0	0.003241
117	578233.7623	181355.3886	0	0.003383
118	578203.0441	181355.5473	0	0.004388
119	578169.3097	181356.4204	0	0.006202
120	578189.8247	181357.9243	0	0.005217
121	578061.1219	181358.3671	0	0.014293
122	578236.6992	181360.9448	0	0.003529
123	578297.1831	181361.4211	0	0.002094
124	578295.2202	181361.4314	0	0.002094
125	578248.6848	181373.7242	0	0.003372
126	578174.7072	181374.518	0	0.006182
127	578240.6679	181375.788	0	0.003372
128	578200.1866	181376.5817	0	0.004776
129	578128.1012	181377.4854	0	0.009398
130	578230.8254	181378.2486	0	0.00368
131	578221.4592	181380.4711	0	0.004187
132	578143.5	181381.0837	0	0.008293
133	578138.9491	181381.4012	0	0.009004
134	578129.1066	181382.2479	0	0.009764
135	578212.1723	181382.773	0	0.004568
136	578177.4059	181383.7255	0	0.006446
137	578203.2822	181384.9161	0	0.004982
138	578307.8275	181385.184	0	0.002073
139	578140.2721	181385.5816	0	0.008293
140	578307.5894	181386.6922	0	0.002073
141	578193.9953	181387.0592	0	0.005431
142	578185.026	181389.2024	0	0.005918
143	577837.5236	181404.8751	0	0.036571
144	578163.0807	181405.7012	0	0.007638
145	578144.1894	181406.7066	0	0.009023
146	578145.1419	181407.7649	0	0.009023
147	578098.3381	181408.0954	0	0.013359
148	578104.7543	181410.0136	0	0.012973
149	578085.2412	181410.4105	0	0.015057
150	578231.4686	181415.5847	0	0.004338
151	578083.2568	181417.8188	0	0.015057
152	578347.426	181418.1017	0	0.001617
153	578280.5128	181422.9833	0	0.002877
154	578277.2584	181423.3008	0	0.00315
155	578086.8949	181424.9626	0	0.015836
156	577741.6828	181425.2624	0	0.035615

157	578135.511	181429.4608	0	0.010714
158	578145.7769	181429.937	0	0.009865
159	578315.6098	181431.7278	0	0.002269
160	578149.4811	181433.6412	0	0.010331
161	578145.7769	181434.4879	0	0.010331
162	578089.5936	181439.5147	0	0.016698
163	578316.9989	181441.0544	0	0.002346
164	578219.6162	181463.1273	0	0.006347
165	578181.8661	181465.0738	0	0.008337
166	578348.7463	181471.2103	0	0.001947
167	578103.5636	181473.4873	0	0.017649
168	578133.7119	181478.4088	0	0.013611
169	577744.8789	181480.0549	0	0.062432
170	578130.7562	181480.0837	0	0.014275
171	577742.5373	181480.3724	0	0.062432
172	577737.5367	181481.4836	0	0.059039
173	578193.0056	181483.151	0	0.00826
174	578198.714	181487.5219	0	0.00826
175	578107.797	181488.1981	0	0.0186
176	578102.6111	181491.9023	0	0.019585
177	578114.7167	181492.2503	0	0.017915
178	578179.7049	181492.6768	0	0.010355
179	578153.5111	181494.6612	0	0.012459
180	578098.1802	181497.1451	0	0.021394
181	578115.8412	181498.4018	0	0.017915
182	578137.9012	181502.7721	0	0.015657
183	578111.9386	181507.53	0	0.018812
184	578121.8605	181508.6545	0	0.017167
185	578170.7752	181509.1802	0	0.010781
186	578176.7614	181509.2133	0	0.010781
187	578310.8579	181510.6333	0	0.002895
188	578133.4032	181511.8341	0	0.016367
189	578118.4871	181512.8217	0	0.019725
190	578114.1214	181513.7477	0	0.019725
191	577869.3971	181515.9599	0	0.11926
192	578122.5881	181518.6425	0	0.017972
193	578115.8412	181519.304	0	0.019725
194	578191.966	181520.3823	0	0.00959
195	578116.7673	181522.5451	0	0.020649
196	578209.6402	181522.9488	0	0.008703
197	578127.3109	181527.8765	0	0.018784
198	578080.0936	181542.6609	0	0.030091
199	578223.4382	181542.991	0	0.007604
200	578132.0205	181543.4208	0	0.018499
201	578128.4486	181544.1484	0	0.020402
202	578133.608	181550.8953	0	0.01919
203	578211.0127	181552.602	0	0.008636
204	578124.976	181552.8466	0	0.021193
205	578162.4545	181554.2866	0	0.014234
206	577882.6704	181555.0588	0	0.174736
207	578126.5966	181557.6752	0	0.021193
208	578135.5924	181558.9982	0	0.01919
209	577857.8657	181561.9644	0	0.208831
210	578136.3531	181563.1653	0	0.01986

211	578129.0109	181565.3151	0	0.02196
212	578271.7137	181566.1065	0	0.004842
213	578137.7752	181567.101	0	0.01986
214	578133.8395	181568.2917	0	0.01986
215	578012.9687	181568.987	0	0.065184
216	578140.4541	181570.6068	0	0.018516
217	578138.8336	181570.6729	0	0.0205
218	578136.9484	181571.8966	0	0.0205
219	578005.0163	181571.9904	0	0.075709
220	578138.5359	181573.6164	0	0.0205
221	578177.9966	181577.1268	0	0.013641
222	578140.7187	181577.2544	0	0.018516
223	578137.9406	181578.3128	0	0.0205
224	578135.5593	181580.7932	0	0.021105
225	578192.2842	181580.9368	0	0.011392
226	578142.4716	181581.157	0	0.019042
227	578137.4114	181583.4391	0	0.021105
228	578140.6195	181584.3321	0	0.019042
229	578135.2617	181585.0597	0	0.021105
230	577774.338	181588.5593	0	0.178803
231	578145.1697	181590.9739	0	0.019529
232	577858.1679	181591.9577	0	0.27274
233	578158.2785	181598.8139	0	0.017603
234	578214.7577	181608.7737	0	0.009629
235	578212.1648	181610.52	0	0.009772
236	578204.8784	181613.5534	0	0.010847
237	578199.289	181615.2732	0	0.012042
238	578188.7718	181617.4891	0	0.013371
239	578165.0519	181618.7635	0	0.016494
240	578188.3088	181621.1271	0	0.013557
241	577700.0012	181622.8324	0	0.105742
242	578175.4434	181623.4092	0	0.015065
243	578168.6502	181624.4785	0	0.016744
244	578162.6442	181630.156	0	0.016947
245	577831.7308	181640.203	0	0.48215
246	577737.4398	181655.4292	0	0.154071
247	577745.0441	181656.398	0	0.17507
248	578014.0122	181658.9856	0	0.088739
249	577846.2658	181659.176	1	0.634349
250	577989.2471	181671.6856	0	0.12572
251	577861.8168	181674.3322	0	0.56505
252	578059.6348	181740.423	0	0.050437
253	577833.0625	181761.0103	0	0.189346
254	577933.8974	181779.7503	0	0.124714
255	577944.5325	181783.0885	0	0.106218
256	578273.7954	181181.116	0	0.001107
257	578078.7812	181181.2027	0	0.004157
258	578269.2181	181181.8436	0	0.001177
259	578029.8319	181181.8476	0	0.005128
260	577919.775	181182.6614	0	0.005003
261	578221.8047	181183.9603	0	0.001534
262	578029.8954	181185.5941	0	0.005128
263	578220.4818	181186.1828	0	0.001534
264	578160.742	181186.7318	0	0.002338

265	578189.2079	181189.6753	0	0.00203
266	578212.9676	181190.2045	0	0.001751
267	578269.6414	181190.7336	0	0.001238
268	578306.8199	181191.2981	0	0.00097
269	577828.8509	181192.6676	0	0.004559
270	578230.9196	181193.7367	0	0.001519
271	578271.5464	181199.1474	0	0.001161
272	578333.9618	181199.1695	0	0.000835
273	578275.7798	181200.047	0	0.001217
274	577839.6459	181202.6688	0	0.00512
275	578287.5714	181204.5273	0	0.00114
276	577813.214	181205.1295	0	0.004906
277	578274.1261	181208.1036	0	0.001217
278	578361.3198	181210.5432	0	0.000768
279	578212.9279	181210.67	0	0.001981
280	577895.8973	181309.6926	0	0.01391
281	578343.7051	181310.0422	0	0.001146
282	578155.6571	181310.9385	0	0.00572
283	578138.5099	181311.8262	0	0.006868
284	578343.8638	181312.3441	0	0.001146
285	578141.2616	181313.3344	0	0.006264
286	578092.1813	181313.8106	0	0.010178
287	578094.6419	181316.2977	0	0.010178
288	578091.9167	181316.5358	0	0.010178
289	578089.853	181318.1498	0	0.011358
290	578097.129	181318.3879	0	0.010178
291	578095.4092	181319.1288	0	0.010178
292	578321.5065	181234.4859	0	0.000997
293	578064.1365	181234.9264	0	0.007269
294	578071.0157	181235.0322	0	0.006782
295	577855.2828	181235.4508	0	0.007058
296	578128.0347	181236.606	0	0.004622
297	578090.49	181237.1141	0	0.005852
298	578136.4477	181240.0955	0	0.004582
299	577783.3582	181246.2311	0	0.006727
300	577764.0435	181246.5486	0	0.006401
301	577997.153	181277.9702	1	0.022105
302	578095.7311	181278.042	0	0.008069
303	578322.2209	181279.1873	0	0.001154
304	578118.3912	181279.4411	0	0.006699
305	578048.1118	181279.8752	0	0.012387
306	577827.8984	181280.9327	0	0.010708
307	578044.6722	181281.0923	0	0.013647
308	578272.9125	181281.842	0	0.001772
309	578142.7114	181282.3166	0	0.005397
310	577958.9935	181283.5165	0	0.014227
311	577994.1896	181284.3202	1	0.023297
312	578063.881	181285.0081	0	0.011616
313	578050.8106	181286.4369	0	0.0127
314	578190.3321	181287.7011	0	0.003468
315	578154.4436	181288.5732	0	0.004931
316	578148.8442	181288.7789	0	0.005397
317	578096.0015	181289.2415	0	0.008651
318	578092.4561	181290.5115	0	0.009213

319	578160.942	181290.5875	0	0.00475
320	577909.5498	181293.0238	0	0.01299
321	578044.4077	181293.1044	0	0.01527
322	577987.1517	181293.2631	0	0.018262
323	578099.7352	181293.689	0	0.009213
324	578092.1386	181293.8981	0	0.009213
325	578203.2151	181295.4358	0	0.003345
326	578129.3024	181295.6866	0	0.006857
327	578137.0812	181300.5021	0	0.006561
328	578153.4346	181302.5247	0	0.00546
329	578324.8006	181306.8363	0	0.001292
330	578204.5522	181362.2148	0	0.004579
331	578289.7535	181363.1188	0	0.002284
332	578059.0052	181363.1825	0	0.015283
333	578072.6049	181363.3942	0	0.013466
334	578289.8012	181363.6436	0	0.002284
335	578062.2861	181363.8705	0	0.014403
336	578281.7049	181364.993	0	0.002284
337	578171.9291	181365.7073	0	0.00593
338	578152.0196	181366.0024	0	0.007036
339	578069.1653	181367.4688	0	0.014403
340	578273.1324	181367.533	0	0.002491
341	578072.6049	181368.3684	0	0.013466
342	578206.6954	181368.4855	0	0.004579
343	578265.1155	181369.5173	0	0.002718
344	578257.0192	181371.5811	0	0.00309
345	578127.7475	181541.0924	0	0.020402
346	577916.2926	181684.7693	1	0.284325
347	577818.2976	181720.0698	0	0.267948
348	577958.4909	181720.6551	0	0.153953
349	578028.6851	181729.0554	0	0.075204
350	577900.4699	181731.5008	0	0.224673
351	578180.3315	181458.2475	0	0.007989
352	578321.2984	181460.8982	0	0.00228
353	577924.8915	181688.3412	0	0.250517
354	577837.0086	181699.8316	0	0.425738
355	577996.0276	181701.3184	0	0.109537
356	578002.3512	181701.9004	0	0.098143
357	578010.5004	181702.5354	0	0.087784
358	577736.5242	181704.9421	0	0.13916
359	578818.3746	180429.8724	0	0.003115
360	578732.0846	180447.2864	0	0.003885
361	578743.2501	180452.2606	0	0.004374
362	578736.2122	180453.8481	0	0.004326
363	578785.8039	180455.855	0	0.004418
364	578729.8621	180463.426	0	0.004749
365	578575.9245	180468.7465	0	0.002646
366	578656.4076	180469.1765	0	0.003908
367	578699.2233	180470.5169	0	0.004948
368	578837.3453	180471.2401	0	0.005134
369	578573.6491	180471.3924	0	0.002895
370	578838.4169	180473.7801	0	0.005134
371	578656.487	180474.2565	0	0.004325
372	578860.9197	180476.5583	0	0.00473

373	578566.9816	180477.1603	0	0.002726
374	578787.7221	180479.055	0	0.005494
375	578804.4306	180480.4044	0	0.006027
376	578660.9214	180485.0171	0	0.004978
377	578739.2813	180485.1219	0	0.00599
378	578560.1024	180485.1507	0	0.002975
379	578658.6196	180485.7315	0	0.004785
380	578805.1847	180485.8813	0	0.006027
381	578656.9527	180486.3665	0	0.004785
382	578844.5023	180487.9486	0	0.005574
383	578764.4168	180488.8261	0	0.006143
384	578643.3795	180490.7321	0	0.005065
385	578711.9234	180491.6307	0	0.00644
386	578891.4352	180492.6882	0	0.005179
387	578551.5288	180493.1	0	0.003039
388	578636.3945	180494.939	0	0.004833
389	578548.0892	180495.4813	0	0.002841
390	578630.997	180497.7965	0	0.004833
391	578546.171	180498.1271	0	0.002841
392	578625.0439	180500.8128	0	0.005063
393	578873.8429	180502.2656	0	0.006228
394	578543.9882	180503.0881	0	0.003086
395	578620.0432	180503.5115	0	0.005063
396	578671.3702	180503.8671	0	0.006353
397	578744.0968	180505.0715	0	0.007554
398	578610.7563	180508.6709	0	0.004796
399	578533.0137	180509.1266	0	0.002875
400	578537.5381	180512.8176	0	0.003114
401	578890.9562	180513.3675	0	0.006324
402	578545.2772	180515.7545	0	0.003347
403	578685.9229	180516.2673	0	0.007314
404	578892.9671	180516.9129	0	0.006324
405	578683.9385	180517.458	0	0.007314
406	578711.5875	180517.5638	0	0.007998
407	578972.7948	180518.0089	0	0.003991
408	578533.3312	180519.8621	0	0.003114
409	578685.4143	180521.155	0	0.008125
410	578704.8142	180523.3317	0	0.00868
411	578540.475	180523.3348	0	0.003627
412	578573.9827	180524.6665	0	0.004483
413	578681.8424	180524.8856	0	0.008125
414	578972.5566	180525.5099	0	0.004345
415	578572.7127	180528.54	0	0.004483
416	578526.6637	180530.5513	0	0.003367
417	578528.5158	180530.6571	0	0.003367
418	578660.8874	180533.2994	0	0.008297
419	578907.3075	180533.6875	0	0.007322
420	578595.8075	180534.0939	0	0.005588
421	578657.2361	180534.8869	0	0.007912
422	578699.9987	180535.1163	0	0.009361
423	578699.0991	180536.598	0	0.009361
424	578909.1596	180539.3629	0	0.007322
425	578527.8808	180541.0288	0	0.003625
426	578913.2871	180541.7441	0	0.007618

427	578578.2656	180544.2539	0	0.005303
428	578733.2146	180544.9429	0	0.011616
429	578637.0748	180546.3963	0	0.007842
430	578888.2575	180548.2926	0	0.008957
431	578917.5337	180548.4116	0	0.007618
432	578641.5198	180550.1269	0	0.00914
433	578516.5037	180553.0409	0	0.00359
434	578921.6215	180553.8091	0	0.007866
435	578619.8582	180554.8108	0	0.007611
436	578963.8711	180555.054	0	0.00599
437	578573.8206	180555.8427	0	0.005757
438	578631.1295	180555.9697	0	0.008624
439	578639.8607	180556.1284	0	0.008624
440	578612	180556.4777	0	0.007611
441	578966.3582	180558.7582	0	0.00599
442	578511.1591	180559.2851	0	0.00359
443	578634.2251	180559.9385	0	0.008624
444	578631.8438	180561.526	0	0.009477
445	578644.4645	180563.1135	0	0.010067
446	578509.5187	180564.471	0	0.003532
447	578647.1632	180566.2091	0	0.010067
448	578971.8087	180567.0132	0	0.006029
449	578930.9084	180568.0173	0	0.008057
450	578722.3561	180569.4064	0	0.014224
451	578580.0912	180570.1302	0	0.007297
452	578641.5276	180571.051	0	0.011079
453	578514.7502	180573.2635	0	0.004111
454	578588.9813	180573.3846	0	0.007297
455	578734.6328	180573.9572	0	0.016296
456	578538.9272	180575.1138	0	0.004875
457	578663.5067	180575.1301	0	0.012437
458	578652.4814	180575.5754	0	0.01176
459	578570.09	180578.7027	0	0.006753
460	578568.2643	180581.5602	0	0.006725
461	578592.1563	180582.5921	0	0.008543
462	578942.2185	180587.4691	0	0.008898
463	578869.1413	180589.9645	0	0.014866
464	578713.7042	180590.3085	0	0.019316
465	578717.0115	180590.626	0	0.019316
466	578703.2175	180591.9703	0	0.018593
467	578863.7826	180593.7529	0	0.016483
468	578579.6548	180593.7877	0	0.007867
469	578869.8028	180595.3224	0	0.016483
470	578862.4883	180598.2619	0	0.016483
471	578865.9808	180598.2619	0	0.016483
472	578857.9097	180599.3387	0	0.017339
473	578878.6663	180600.2172	0	0.017241
474	578848.4641	180601.2437	0	0.020226
475	579070.2697	180601.6814	0	0.003302
476	579064.4488	180601.8799	0	0.003627
477	579072.0556	180603.0044	0	0.003302
478	578630.5738	180603.4678	0	0.013672
479	579062.8613	180603.9965	0	0.003627
480	579038.6732	180609.8626	0	0.004787

481	579023.9094	180612.826	0	0.005567
482	579055.5853	180613.0585	0	0.004204
483	578934.0031	180614.4037	0	0.01228
484	578713.5627	180616.0342	0	0.024177
485	578847.8688	180616.833	0	0.022533
486	579050.0952	180619.4086	0	0.004204
487	578843.8603	180620.008	0	0.0251
488	578482.5944	180630.8748	0	0.004369
489	578503.8934	180631.4701	0	0.005314
490	578800.021	180631.7451	0	0.033088
491	578685.9401	180632.4648	0	0.025683
492	578683.3208	180632.6236	0	0.025683
493	578744.4552	180633.3647	0	0.033609
494	578746.0741	180633.3647	0	0.033609
495	579034.5449	180639.8457	0	0.005653
496	579043.7326	180640.1566	0	0.005384
497	578853.4634	180641.0583	0	0.029241
498	579031.2905	180641.7242	0	0.005943
499	578693.0442	180641.8708	0	0.030355
500	578849.8915	180641.9473	0	0.031113
501	579026.237	180648.1483	0	0.006558
502	579022.3344	180650.0004	0	0.006886
503	578727.4872	180654.4262	0	0.039952
504	578766.966	180655.5672	0	0.044381
505	578993.7384	180655.9549	0	0.009279
506	578459.4433	180656.6717	0	0.003519
507	578998.4353	180657.6059	0	0.009279
508	578992.2567	180657.6483	0	0.009279
509	578994.9428	180659.0876	0	0.009279
510	578527.2826	180659.3175	0	0.007136
511	578523.2477	180661.6326	0	0.007467
512	578690.0093	180664.2607	0	0.03742
513	579053.8992	180667.8863	0	0.005309
514	579120.8328	180668.0424	0	0.002597
515	578980.1261	180668.1628	0	0.010802
516	578983.354	180668.1628	0	0.010802
517	578887.9426	180668.7747	0	0.028089
518	578512.2278	180671.753	0	0.007018
519	578693.1843	180672.1903	0	0.041462
520	578953.8248	180673.0725	0	0.015422
521	578541.4483	180673.7104	0	0.009583
522	578903.0247	180675.1891	0	0.025305
523	578893.8701	180676.3004	0	0.027822
524	579012.3524	180678.3493	0	0.008337
525	578766.9143	180820.3725	0	0.111022
526	578646.4503	180820.4014	0	0.033773
527	578625.826	180820.9702	0	0.026955
528	578858.7168	180821.6566	0	0.059859
529	579034.5034	180822.0642	0	0.007847
530	578866.9237	180824.4312	0	0.053397
531	578893.3027	180825.3462	0	0.037786
532	579111.9107	180827.8315	0	0.003313
533	578954.6862	180828.1244	0	0.019049
534	578618.0422	180829.3496	0	0.024088

535	578677.725	180829.64	0	0.047353
536	579072.7788	180829.7365	0	0.005085
537	579070.1594	180830.054	0	0.004985
538	578757.7616	180830.91	0	0.091993
539	578789.4455	180830.91	0	0.096138
540	578757.4309	180831.1085	0	0.091993
541	578756.7694	180831.3069	0	0.091993
542	578755.3142	180831.8361	0	0.091993
543	578754.9173	180831.9684	0	0.091993
544	578908.7147	180832.027	0	0.032089
545	578754.2558	180832.1668	0	0.091993
546	578754.322	180832.1668	0	0.091993
547	578621.2172	180832.313	0	0.025807
548	578753.7267	180832.4975	0	0.091993
549	578806.5773	180832.5637	0	0.087649
550	578753.1314	180832.6298	0	0.091993
551	578752.073	180833.0267	0	0.091993
552	578751.4116	180833.2251	0	0.091993
553	578912.2866	180833.7468	0	0.028707
554	578951.7096	180833.8791	0	0.018404
555	579049.0507	180679.1342	0	0.006115
556	579121.2958	180680.4778	0	0.002752
557	578695.0893	180681.6359	0	0.045843
558	578915.0897	180681.8566	0	0.024542
559	578531.5731	180681.9469	0	0.008989
560	578991.255	180683.8596	0	0.010707
561	578646.2353	180684.0058	0	0.02845
562	578916.8359	180684.4496	0	0.024542
563	579021.7042	180685.7862	0	0.007818
564	578671.2804	180685.8888	0	0.038256
565	579027.8311	180686.4367	0	0.007818
566	578484.1819	180687.2973	0	0.005312
567	578899.2253	180687.4229	0	0.029969
568	578713.0083	180687.8907	0	0.053561
569	578689.3346	180689.5973	0	0.041977
570	578808.2499	180689.7942	0	0.061113
571	578793.3274	180690.1117	0	0.072392
572	578794.7032	180690.1117	0	0.072392
573	578796.9257	180690.1117	0	0.072392
574	578809.4141	180690.4292	0	0.06943
575	578989.6675	180690.4997	0	0.012399
576	578810.4724	180691.2759	0	0.065664
577	578656.252	180692.5563	0	0.033769
578	578883.8265	180693.7464	0	0.035588
579	579064.0134	180694.8844	0	0.0053
580	578675.1424	180696.2251	0	0.041545
581	579147.1517	180696.252	0	0.002289
582	578735.23	180697.788	0	0.068285
583	578992.4457	180698.5695	0	0.011145
584	578734.6347	180698.5818	0	0.068285
585	579010.1948	180698.9227	0	0.009007
586	578642.3261	180699.6229	0	0.030378
587	579067.3471	180700.9963	0	0.005445
588	578738.4712	180702.6828	0	0.077658

589	578661.0929	180703.726	0	0.040206
590	578931.5475	180707.1291	0	0.02219
591	578460.6646	180707.9291	0	0.004539
592	579144.7308	180708.1186	0	0.002338
593	579093.8452	180708.2591	0	0.003959
594	578936.0718	180708.7563	0	0.02219
595	579025.7127	180709.2415	0	0.008357
596	578449.1414	180709.6566	0	0.003672
597	579154.4939	180710.2221	0	0.002142
598	578647.0356	180710.3936	0	0.033977
599	578967.2401	180711.6254	0	0.016599
600	579021.7836	180712.2578	0	0.00859
601	578450.4114	180712.8316	0	0.004167
602	579018.6086	180713.0118	0	0.009578
603	578888.1128	180713.2198	0	0.040599
604	579097.4171	180713.8154	0	0.004043
605	578427.138	180715.1112	0	0.003031
606	578632.4504	180715.7117	0	0.030294
607	579101.2536	180716.4612	0	0.003635
608	579148.8583	180718.7946	0	0.00238
609	579009.8712	180722.4623	0	0.010961
610	578618.7847	180723.1888	0	0.024999
611	578497.9087	180724.1296	0	0.006527
612	578404.9129	180724.7023	0	0.002493
613	578973.0408	180724.8319	0	0.015309
614	578862.2474	180725.2926	0	0.054179
615	578384.9368	180726.2237	0	0.002021
616	578886.741	180726.3951	0	0.042906
617	578982.8966	180726.6179	0	0.013689
618	579075.8535	180728.3675	0	0.005104
619	578390.9561	180728.9026	0	0.002244
620	579000.248	180729.4264	0	0.010961
621	578605.1586	180729.8696	0	0.022274
622	578407.5257	180730.457	0	0.002523
623	578528.9134	180731.6951	0	0.009229
624	578932.3023	180732.3218	0	0.024841
625	578877.4276	180732.7451	0	0.05077
626	578525.1828	180733.7588	0	0.009229
627	578412.2558	180734.8795	0	0.002804
628	578519.2296	180737.4101	0	0.008262
629	578591.1026	180737.6087	0	0.020375
630	578515.8165	180739.6326	0	0.008262
631	578568.793	180740.5046	0	0.014688
632	578953.9057	180741.2827	0	0.020144
633	578602.5921	180742.5167	0	0.023359
634	579140.3541	180742.8928	0	0.002471
635	578928.3708	180743.021	0	0.028669
636	578511.054	180743.0457	0	0.008371
637	579100.9338	180743.0736	0	0.003793
638	578846.1353	180743.3893	0	0.077987
639	578851.0036	180747.2523	0	0.068399
640	578512.959	180747.6495	0	0.008371
641	578923.2908	180749.371	0	0.028669
642	578583.3981	180752.53	0	0.018714

643	578879.2268	180752.7477	0	0.054535
644	578888.2864	180753.2537	0	0.04795
645	578376.2717	180753.9124	0	0.00187
646	578505.5771	180753.9995	0	0.007559
647	579113.9645	180756.5674	0	0.003432
648	578500.0526	180757.2063	0	0.007559
649	578688.3845	180757.8383	0	0.064679
650	578966.8703	180759.6448	0	0.018203
651	578613.1712	180759.6463	0	0.02668
652	578611.5097	180759.7918	0	0.02668
653	578858.7295	180761.0106	0	0.072773
654	578899.8355	180761.3897	0	0.042864
655	578956.4986	180762.2377	0	0.020641
656	579101.6614	180762.4544	0	0.00384
657	578612.621	180762.5699	0	0.026865
658	578503.7038	180762.8419	0	0.007592
659	578558.3933	180763.3023	0	0.013316
660	578555.4564	180764.2548	0	0.013316
661	578614.2085	180765.1496	0	0.026865
662	578841.849	180765.4027	0	0.083825
663	579102.7197	180766.5555	0	0.00384
664	579084.5097	180766.5677	0	0.004771
665	579085.1712	180768.1552	0	0.004771
666	578615.915	180768.3643	0	0.026865
667	578512.8796	180769.0014	0	0.008484
668	578395.8509	180769.4699	0	0.002315
669	579101.6614	180771.2518	0	0.003845
670	578912.8927	180772.0657	0	0.0335
671	578516.134	180772.3352	0	0.008487
672	579027.5861	180772.4242	0	0.00927
673	578479.0975	180772.8432	0	0.005462
674	579024.3838	180772.9843	0	0.00927
675	579107.8791	180773.0378	0	0.003845
676	578477.2532	180775.2661	0	0.005462
677	579035.6948	180777.2838	0	0.00829
678	579043.3016	180777.2838	0	0.007417
679	579126.3391	180777.5245	0	0.003099
680	579064.9974	180778.739	0	0.005947
681	578811.5255	180780.7211	0	0.131948
682	578938.3746	180782.1794	0	0.026139
683	578617.3438	180782.2947	0	0.026638
684	578618.5344	180783.1281	0	0.026638
685	578954.8562	180786.5697	0	0.020612
686	578935.6229	180787.1536	0	0.026139
687	578751.6501	180788.1136	0	0.174873
688	578452.6469	180788.4953	0	0.004383
689	578953.2026	180789.2155	0	0.020612
690	578604.985	180789.6554	0	0.023654
691	579088.5083	180791.3322	0	0.004741
692	579100.2161	180794.1765	0	0.003818
693	579056.9037	180794.9702	0	0.006583
694	578489.3369	180795.1476	0	0.00603
695	578458.0709	180796.5651	0	0.004356
696	579081.0338	180797.0207	0	0.004741

697	578486.3814	180798.4172	0	0.00603
698	578682.3287	180800.6284	0	0.059211
699	578811.9223	180801.0941	0	0.113808
700	578928.9554	180801.3353	0	0.028521
701	578636.8724	180801.5233	0	0.032461
702	578683.9956	180801.6206	0	0.059211
703	579053.3557	180802.1547	0	0.006516
704	578885.7969	180802.1965	0	0.046315
705	578643.487	180802.6478	0	0.036549
706	578685.2259	180803.3272	0	0.059211
707	578935.7684	180803.8488	0	0.02534
708	579066.6801	180804.6937	0	0.005841
709	578955.3413	180804.9252	0	0.020061
710	578746.8964	180805.6246	0	0.12476
711	578915.2632	180806.2962	0	0.032137
712	579056.3481	180806.8765	0	0.006516
713	578896.1157	180807.0119	0	0.040949
714	578728.1414	180807.4767	0	0.096993
715	579072.964	180808.3979	0	0.005237
716	578909.7995	180808.4261	0	0.036253
717	579031.3284	180808.7688	0	0.008122
718	578627.9427	180809.0639	0	0.028854
719	579069.9874	180810.0515	0	0.005763
720	579024.1185	180810.8855	0	0.008931
721	578764.6918	180811.464	0	0.130187
722	578916.1892	180811.5217	0	0.031178
723	579015.5856	180811.8777	0	0.009976
724	579020.282	180812.6053	0	0.008931
725	578910.4345	180812.977	0	0.031178
726	578943.4414	180813.1092	0	0.021992
727	578918.9674	180813.7707	0	0.031178
728	578902.1001	180814.8952	0	0.035081
729	579011.0877	180815.4496	0	0.009976
730	579008.6403	180815.5157	0	0.01115
731	578896.9143	180816.2093	0	0.039504
732	578916.4538	180819.5254	0	0.031178
733	579010.1617	180819.6168	0	0.009976
734	578906.3335	180834.0775	0	0.032089
735	578957.9935	180834.0775	0	0.018404
736	578946.0872	180834.9374	0	0.020561
737	578942.8196	180836.2603	0	0.020561
738	578616.8251	180836.4934	0	0.023125
739	578921.4809	180838.1124	0	0.025681
740	578853.8946	180838.5713	0	0.055507
741	578852.7437	180838.611	0	0.055507
742	578808.6278	180838.7814	0	0.087649
743	578854.8868	180838.955	0	0.055507
744	578853.2331	180839.6164	0	0.055507
745	578843.1789	180839.7487	0	0.061604
746	579071.1649	180839.9257	0	0.004985
747	578851.4472	180839.9472	0	0.055507
748	578571.9451	180840.7664	0	0.014378
749	578547.1125	180841.3536	0	0.010427
750	579132.1514	180841.4047	0	0.002585

751	578839.2102	180841.5479	0	0.061641
752	578915.2632	180842.015	0	0.027276
753	578959.9096	180842.2746	0	0.017684
754	578839.4086	180842.593	0	0.061641
755	578913.1465	180844.1317	0	0.027276
756	578513.4571	180846.7346	0	0.007573
757	578842.6366	180846.7933	0	0.05627
758	578810.3476	180846.9173	0	0.072307
759	578757.4309	180848.3726	0	0.080631
760	578592.9134	180849.2992	0	0.017819
761	578843.2848	180850.5173	0	0.051144
762	578736.9785	180851.2697	0	0.063843
763	578777.8038	180851.8121	0	0.073996
764	579029.0167	180852.4405	0	0.008041
765	579034.6259	180852.4405	0	0.007233
766	578825.1411	180852.9943	0	0.059984
767	578774.2981	180854.8549	0	0.073996
768	578825.6173	180856.328	0	0.059984
769	578787.2561	180856.4424	0	0.072982
770	578799.5592	180857.8314	0	0.070881
771	579104.0526	180858.8672	0	0.00346
772	578813.9611	180901.6899	0	0.035357
773	578844.0329	180905.6632	0	0.030506
774	578699.4946	180906.1752	0	0.028626
775	579002.77	180908.777	0	0.007885
776	578790.0342	180859.3528	0	0.070881
777	578681.5703	180860.8136	0	0.038882
778	578879.5401	180862.2714	0	0.035705
779	578859.4244	180864.7387	0	0.042658
780	578728.3002	180864.909	0	0.053361
781	578615.786	180866.1975	0	0.019827
782	578816.691	180866.6288	0	0.056923
783	578857.7046	180866.7892	0	0.042658
784	578996.916	180867.0389	0	0.010613
785	578591.4442	180867.3881	0	0.016177
786	578918.9653	180867.6747	0	0.024214
787	578617.5719	180868.9095	0	0.019827
788	578729.7554	180868.9439	0	0.053361
789	578971.6836	180869.0637	0	0.013074
790	578993.2472	180870.1882	0	0.010148
791	579050.7919	180870.8291	0	0.005473
792	578619.2256	180871.2246	0	0.018664
793	578593.3625	180871.2246	0	0.015315
794	578944.8945	180871.8419	0	0.016855
795	578564.2569	180873.6614	0	0.011329
796	578768.2788	180874.9632	0	0.057292
797	578998.0405	180875.4064	0	0.010148
798	578809.5473	180878.3367	0	0.05289
799	578707.2658	180878.9981	0	0.041644
800	578702.7017	180879.0643	0	0.041644
801	578798.3024	180879.395	0	0.054834
802	578795.3259	180881.0487	0	0.048284
803	578801.6759	180882.5039	0	0.046746
804	578522.3753	180885.5745	0	0.007222

805	578848.5	180887.3039	0	0.037705
806	578882.8513	180887.3599	0	0.027612
807	578847.6269	180889.3676	0	0.037705
808	578963.4815	180890.032	0	0.01229
809	578807.3199	180890.7705	0	0.041342
810	578804.801	180891.1515	0	0.041342
811	578548.2231	180892.0765	0	0.008387
812	578507.0955	180892.4537	0	0.005657
813	578797.4139	180892.485	0	0.042552
814	578793.4345	180892.866	0	0.042552
815	578792.2492	180893.12	0	0.042552
816	578987.8366	180893.8197	0	0.010123
817	578788.4498	180893.9667	0	0.043371
818	578508.8815	180894.3719	0	0.005657
819	578675.6219	180894.6591	0	0.027348
820	578733.0108	180894.9683	0	0.039881
821	578984.7807	180895.1294	0	0.010123
822	578782.8406	180895.2705	0	0.043371
823	578783.8142	180895.66	0	0.043371
824	578846.595	180895.9558	0	0.033934
825	578610.0313	180896.757	0	0.016352
826	578765.177	180897.4507	0	0.043512
827	578570.7213	180899.7937	0	0.01122
828	578866.4696	180900.0011	0	0.026824
829	578779.3858	180914.7319	0	0.033857
830	578597.2651	180915.2778	0	0.011875
831	578699.4311	180915.5732	0	0.025829
832	579010.7802	180915.9472	0	0.006777
833	579007.8963	180916.3706	0	0.007453
834	578779.3196	180916.5575	0	0.033857
835	578697.0816	180917.7534	0	0.025829
836	578534.2881	180917.8515	0	0.006839
837	578779.055	180918.5749	0	0.033857
838	578704.4053	180919.1081	0	0.027377
839	578779.3858	180921.5846	0	0.029903
840	578767.581	181016.5716	0	0.010383
841	578921.2473	181018.7157	0	0.006415
842	578698.6473	181019.8678	0	0.008984
843	578935.5348	181020.7795	0	0.005511
844	578977.0646	181020.8946	0	0.004269
845	578765.6958	181021.0275	0	0.009278
846	578770.1517	181022.57	0	0.009299
847	578893.8309	181033.4557	0	0.00619
848	578888.0762	181035.4401	0	0.006474
849	578981.7973	181041.417	0	0.003369
850	578813.4547	181043.3642	0	0.007195
851	578817.4234	181044.7401	0	0.007195
852	578815.9418	181051.1959	0	0.006449
853	578920.2831	181052.5601	0	0.004393
854	578779.8157	180924.2436	0	0.029903
855	578702.331	180924.8654	0	0.024586
856	578657.994	180924.9871	0	0.017909
857	578978.1264	180926.8795	0	0.00924
858	578659.2507	180928.8566	0	0.017909

859	578984.6351	180929.4195	0	0.008442
860	578796.1149	180929.5043	0	0.029376
861	578778.4046	180929.8661	0	0.029903
862	578704.6381	180932.0409	0	0.022069
863	578712.1311	180933.0146	0	0.023106
864	578696.4466	180933.4379	0	0.020967
865	578710.1838	180933.5861	0	0.023106
866	578691.2654	180933.9168	0	0.020967
867	579005.5944	180935.8704	0	0.006605
868	579003.2089	180937.8861	0	0.006605
869	578675.8534	180938.2163	0	0.01866
870	578713.509	180938.571	0	0.023106
871	578683.5263	180939.1754	0	0.019823
872	578680.1859	180939.4069	0	0.019823
873	578894.9455	180942.0909	0	0.014899
874	578876.0939	180944.4721	0	0.016907
875	578777.8525	180944.9939	0	0.023453
876	578774.2806	180945.1194	0	0.023453
877	578768.7905	180945.6486	0	0.02337
878	578878.6074	180946.0596	0	0.016907
879	578713.9886	180946.707	0	0.020676
880	578717.2959	180947.3684	0	0.020676
881	578761.6468	180947.6397	0	0.02337
882	578705.7865	180947.9704	0	0.019804
883	578774.9421	180948.1027	0	0.023453
884	578716.436	180948.4996	0	0.020676
885	578725.1011	180948.4996	0	0.021464
886	578742.9771	180949.6835	0	0.022705
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894	578709.8921	180956.4868	0	0.01777
895	578704.2829	180957.9684	0	0.01777
896	578641.0209	180960.3364	0	0.011579
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898	578777.8638	180963.615	0	0.018499
899	578657.7691	180967.3214	0	0.012326
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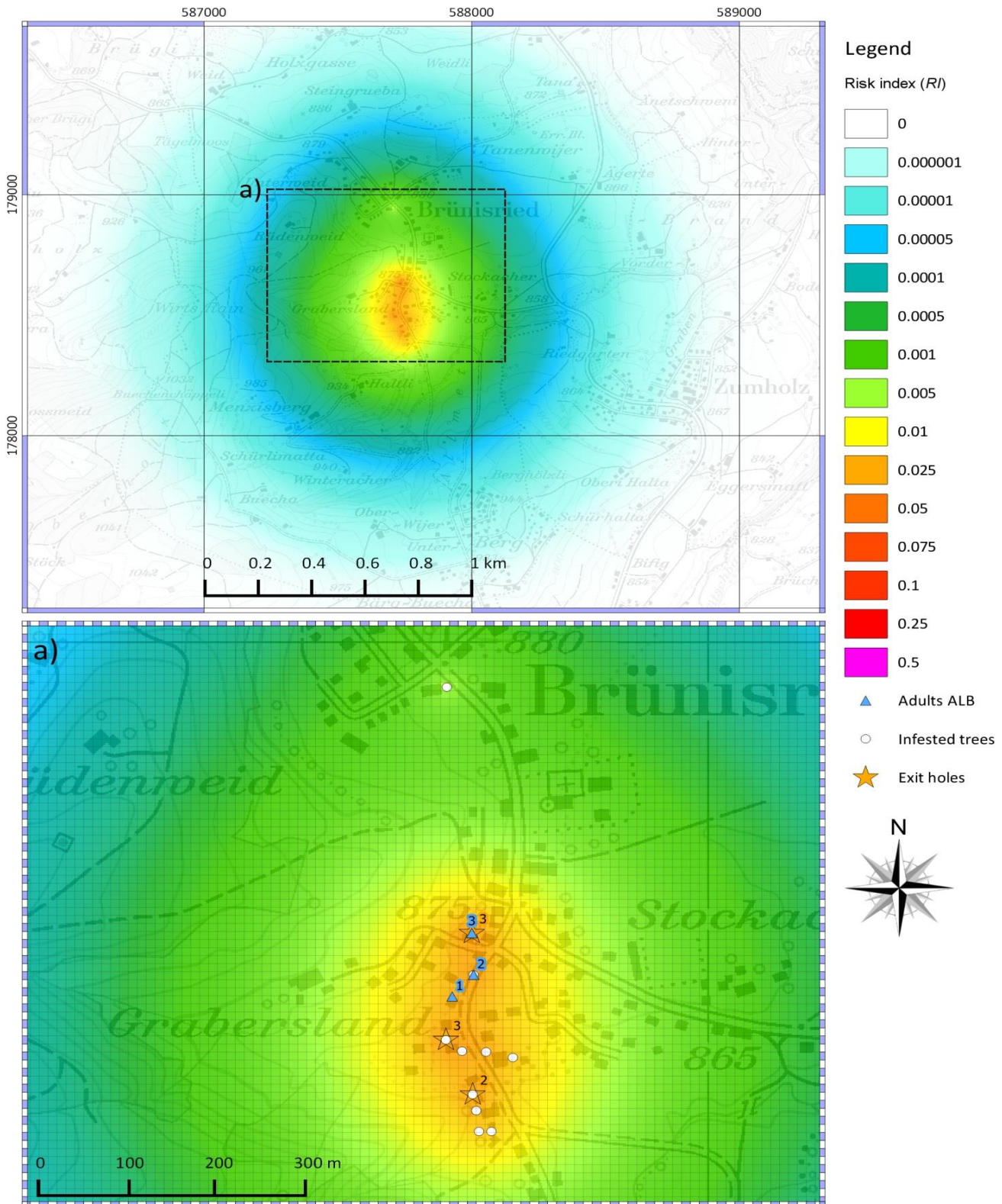
A local risk map using field observations of the Asian longhorned beetle to optimize monitoring activities

Appendix S4

Brünisried and Winterthur infestations (Switzerland), risk maps and data

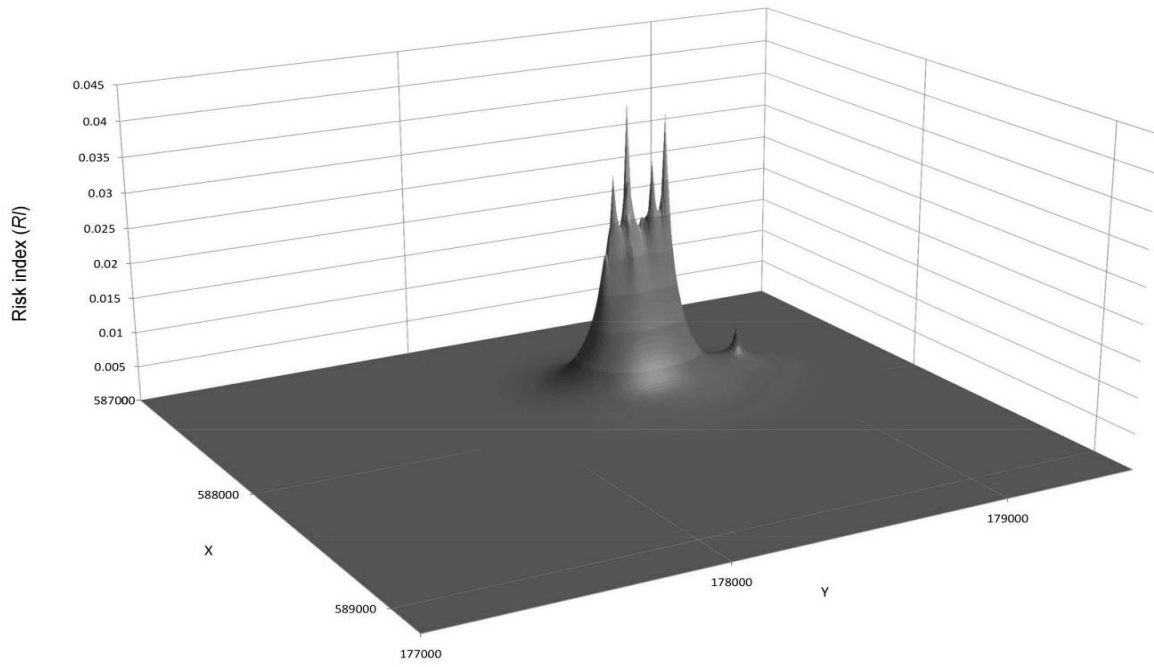
Brünisried

Canton of Fribourg, 46° 45' 32" N, 7° 16' 43" E

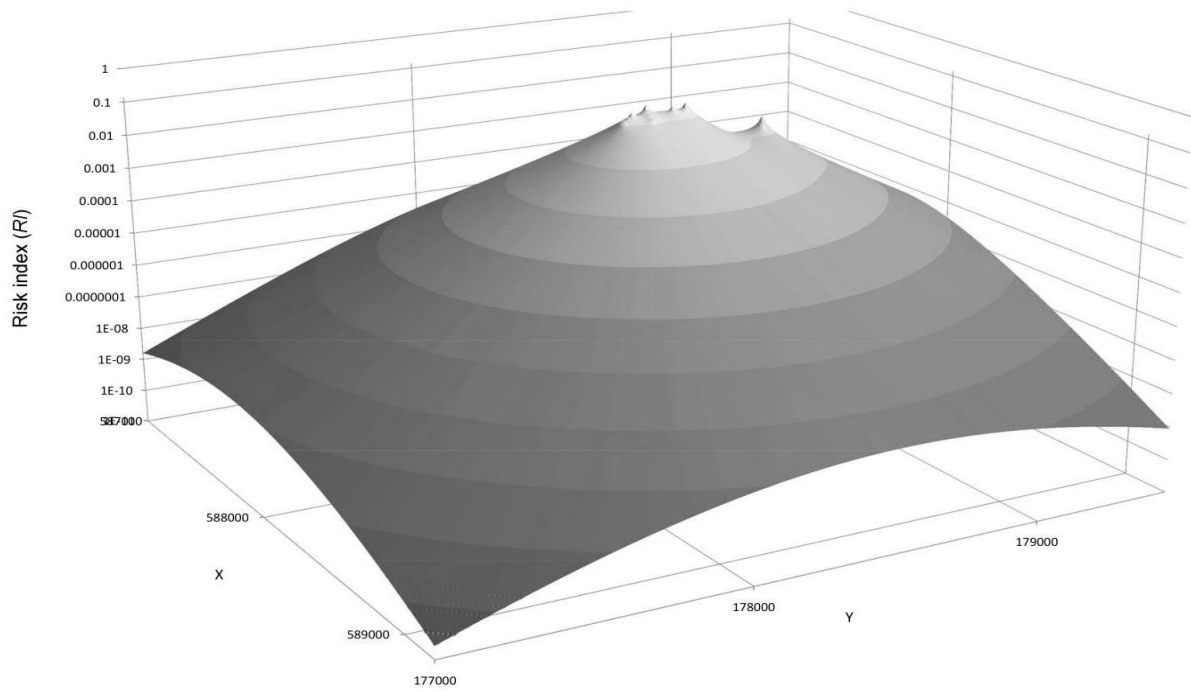


Risk map for the Brünisried infestation (Switzerland). The color gradient indicates the risk index (RI), from purple (RI > 0.5) to white (RI < 10⁻⁶). The upper map gives an overall view of the two main infested spots (X-Y Swiss coordinate system, CH1903 LV03). The areas in the black dashed rectangles a) and b) are zoomed below, with positions of all observed O-points. White dots = position of infested trees (observation of larvae, eggs or oviposition marks); blue triangles = position and number of ALB adults; orange stars = position and number of exit holes

a)



b)



3D plot of the risk index (RI), for the Brünisried infestation (Switzerland). X and Y in Swiss coordinate system CH1903 LV03 (1 unit corresponds to 1 meter). a) linear scale, b) logarithmic scale

Data Brünisried

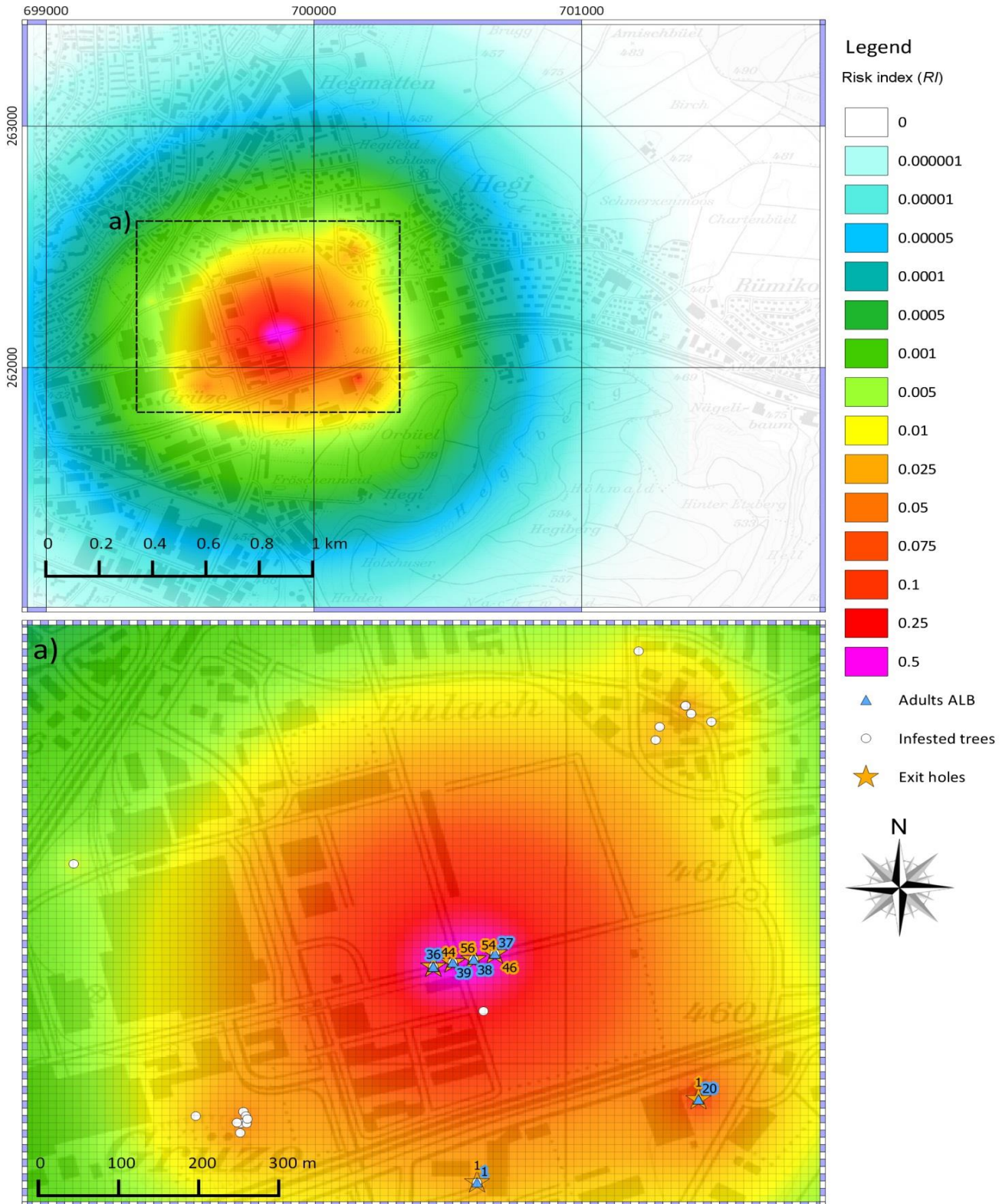
Situation: 2016

X-Y : Swiss coordinate system CH1903 LV03

	X	Y	O-point type	Date of observation	Tree species
1	587713	178559	adult ALB	2011	
2	587737	178586	adult ALB	2011	Acer pseudoplatanus
3	587737	178586	adult ALB	2011	Acer pseudoplatanus
4	587737	178586	infested tree	2011	Acer pseudoplatanus
5	587735	178638	adult ALB	2013	Acer pseudoplatanus
6	587735	178638	adult ALB	2013	Acer pseudoplatanus
7	587735	178638	adult ALB	2013	Acer pseudoplatanus
8	587735	178638	exit hole	2013	Acer pseudoplatanus
9	587735	178638	exit hole	2013	Acer pseudoplatanus
10	587735	178638	exit hole	2013	Acer pseudoplatanus
11	587707	178944	infested tree	2013	Acer pseudoplatanus
12	587757	178391	infested tree	2013	Acer pseudoplatanus
13	587724	178491	infested tree	2013	Salix sp.
14	587781	178483	infested tree	2014	Acer pseudoplatanus
15	587736	178437	exit hole	2014	Acer campestre
16	587736	178437	exit hole	2014	Acer campestre
17	587736	178437	infested tree	2014	Acer campestre
18	587706	178505	exit hole	2011	Betula sp.
19	587706	178505	exit hole	2012	Betula sp.
20	587706	178505	exit hole	2013	Betula sp.
21	587706	178505	infested tree	2014	Betula sp.
22	587740	178417	infested tree	2014	Betula sp.
23	587751	178490	infested tree	2011	Acer campestre
24	587743	178391	infested tree	2011	Acer pseudoplatanus

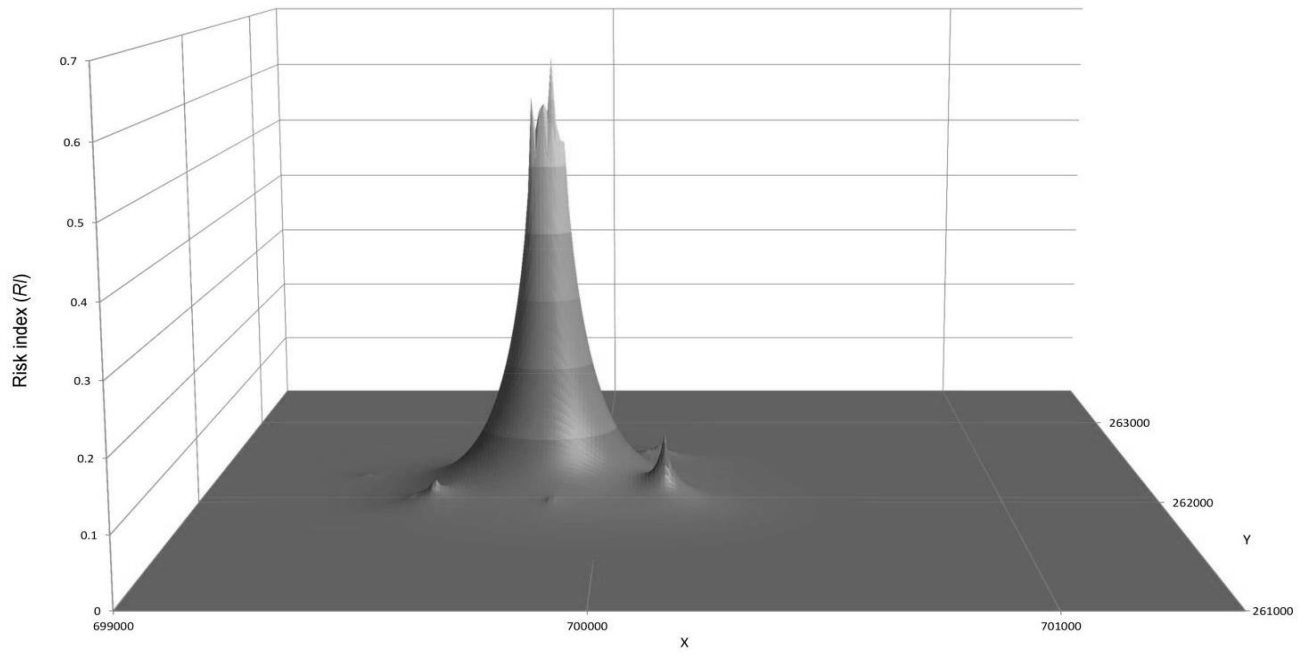
Winterthur

Canton of Zürich, 47° 30' 10" N, 8° 45' 50" E

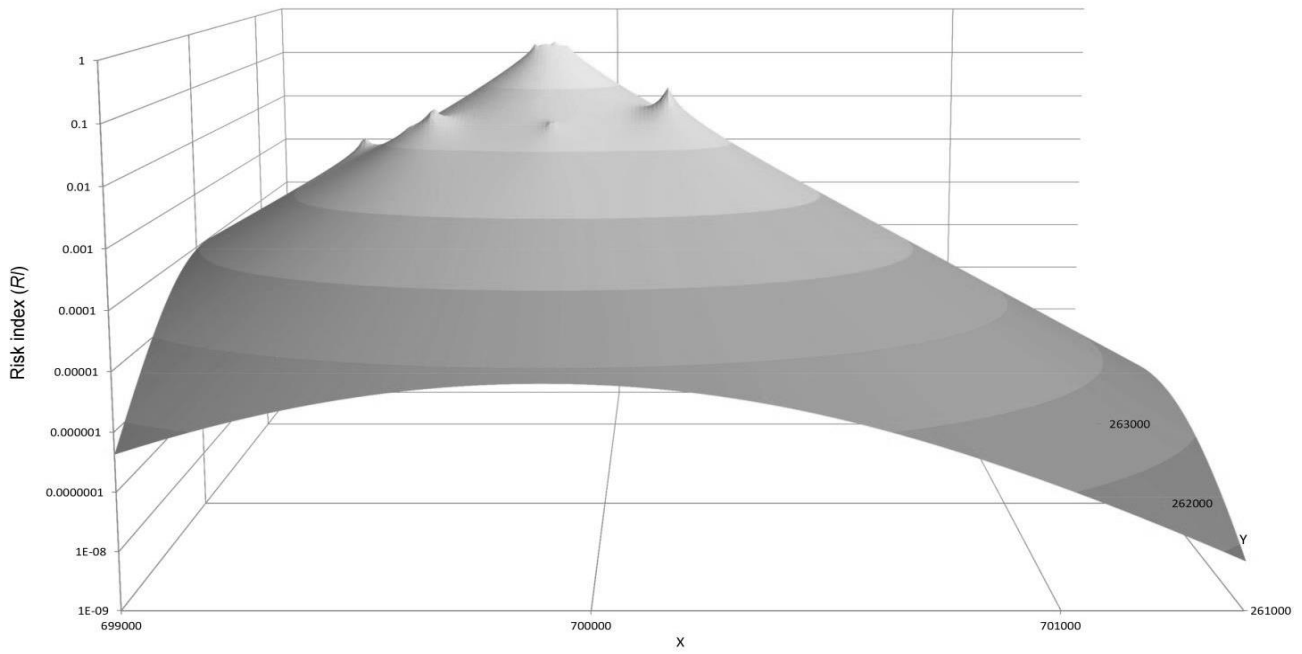


Risk map for the Winterthur infestation (Switzerland). The color gradient indicates the risk index (RI), from purple (RI > 0.5) to white (RI < 10⁻⁶). The upper map gives an overall view of the two main infested spots (X-Y Swiss coordinate system, CH1903 LV03). The areas in the black dashed rectangles a) and b) are zoomed below, with positions of all observed O-points. White dots = position of infested trees (observation of larvae, eggs or oviposition marks); blue triangles = position and number of ALB adults; orange stars = position and number of exit holes

a)



b)



3D plot of the risk index (RI), for the Winterthur infestation (Switzerland). X and Y in Swiss coordinate system CH1903 LV03 (1 unit corresponds to 1 meter). a) linear scale, b) logarithmic scale

Data Winterthur

Situation: 2016

X-Y : Swiss coordinate system CH1903 LV03

	X	Y	O-point type	Date of observation	Tree species
1	699836	262134	adult ALB	2012	Acer pseudoplatanus
2	699836	262134	adult ALB	2012	Acer pseudoplatanus
3	699836	262134	adult ALB	2012	Acer pseudoplatanus
4	699836	262134	adult ALB	2012	Acer pseudoplatanus
5	699836	262134	adult ALB	2012	Acer pseudoplatanus
6	699836	262134	adult ALB	2012	Acer pseudoplatanus
7	699836	262134	adult ALB	2012	Acer pseudoplatanus
8	699836	262134	adult ALB	2012	Acer pseudoplatanus
9	699836	262134	adult ALB	2012	Acer pseudoplatanus
10	699836	262134	adult ALB	2012	Acer pseudoplatanus
11	699836	262134	adult ALB	2012	Acer pseudoplatanus
12	699836	262134	adult ALB	2012	Acer pseudoplatanus
13	699836	262134	adult ALB	2012	Acer pseudoplatanus
14	699836	262134	adult ALB	2012	Acer pseudoplatanus
15	699836	262134	adult ALB	2012	Acer pseudoplatanus
16	699836	262134	adult ALB	2012	Acer pseudoplatanus
17	699836	262134	adult ALB	2012	Acer pseudoplatanus
18	699836	262134	adult ALB	2012	Acer pseudoplatanus
19	699836	262134	adult ALB	2012	Acer pseudoplatanus
20	699836	262134	adult ALB	2012	Acer pseudoplatanus
21	699836	262134	adult ALB	2012	Acer pseudoplatanus
22	699836	262134	adult ALB	2012	Acer pseudoplatanus
23	699836	262134	adult ALB	2012	Acer pseudoplatanus
24	699836	262134	adult ALB	2012	Acer pseudoplatanus
25	699836	262134	adult ALB	2012	Acer pseudoplatanus
26	699836	262134	adult ALB	2012	Acer pseudoplatanus
27	699836	262134	adult ALB	2012	Acer pseudoplatanus
28	699836	262134	adult ALB	2012	Acer pseudoplatanus
29	699836	262134	adult ALB	2012	Acer pseudoplatanus
30	699836	262134	adult ALB	2012	Acer pseudoplatanus
31	699836	262134	adult ALB	2012	Acer pseudoplatanus
32	699836	262134	adult ALB	2012	Acer pseudoplatanus
33	699836	262134	adult ALB	2012	Acer pseudoplatanus
34	699836	262134	adult ALB	2012	Acer pseudoplatanus
35	699836	262134	adult ALB	2012	Acer pseudoplatanus
36	699836	262134	adult ALB	2012	Acer pseudoplatanus
37	699836	262134	exit hole	2012	Acer pseudoplatanus
38	699836	262134	exit hole	2012	Acer pseudoplatanus
39	699836	262134	exit hole	2012	Acer pseudoplatanus
40	699836	262134	exit hole	2012	Acer pseudoplatanus
41	699836	262134	exit hole	2012	Acer pseudoplatanus
42	699836	262134	exit hole	2012	Acer pseudoplatanus
43	699836	262134	exit hole	2012	Acer pseudoplatanus
44	699836	262134	exit hole	2012	Acer pseudoplatanus
45	699836	262134	exit hole	2012	Acer pseudoplatanus
46	699836	262134	exit hole	2012	Acer pseudoplatanus
47	699836	262134	exit hole	2012	Acer pseudoplatanus
48	699836	262134	exit hole	2012	Acer pseudoplatanus
49	699836	262134	exit hole	2012	Acer pseudoplatanus

315	699912	262152	exit hole	2012	Acer pseudoplatanus
316	699912	262152	exit hole	2012	Acer pseudoplatanus
317	699912	262152	exit hole	2012	Acer pseudoplatanus
318	699912	262152	exit hole	2012	Acer pseudoplatanus
319	699912	262152	exit hole	2012	Acer pseudoplatanus
320	699912	262152	exit hole	2012	Acer pseudoplatanus
321	699912	262152	exit hole	2012	Acer pseudoplatanus
322	699912	262152	exit hole	2012	Acer pseudoplatanus
323	699912	262152	exit hole	2012	Acer pseudoplatanus
324	699912	262152	exit hole	2012	Acer pseudoplatanus
325	699912	262152	exit hole	2012	Acer pseudoplatanus
326	699912	262152	exit hole	2012	Acer pseudoplatanus
327	699912	262152	exit hole	2012	Acer pseudoplatanus
328	699912	262152	exit hole	2012	Acer pseudoplatanus
329	699912	262152	exit hole	2012	Acer pseudoplatanus
330	699912	262152	exit hole	2012	Acer pseudoplatanus
331	699912	262152	exit hole	2012	Acer pseudoplatanus
332	699912	262152	exit hole	2012	Acer pseudoplatanus
333	699912	262152	exit hole	2012	Acer pseudoplatanus
334	699912	262152	exit hole	2012	Acer pseudoplatanus
335	699912	262152	exit hole	2012	Acer pseudoplatanus
336	699912	262152	exit hole	2012	Acer pseudoplatanus
337	699912	262152	exit hole	2012	Acer pseudoplatanus
338	699912	262152	exit hole	2012	Acer pseudoplatanus
339	699912	262152	exit hole	2012	Acer pseudoplatanus
340	699912	262152	exit hole	2012	Acer pseudoplatanus
341	699912	262152	exit hole	2012	Acer pseudoplatanus
342	699912	262152	exit hole	2012	Acer pseudoplatanus
343	699912	262152	exit hole	2012	Acer pseudoplatanus
344	699912	262152	exit hole	2012	Acer pseudoplatanus
345	699912	262152	exit hole	2012	Acer pseudoplatanus
346	699912	262152	exit hole	2012	Acer pseudoplatanus
347	699912	262152	exit hole	2012	Acer pseudoplatanus
348	699912	262152	exit hole	2012	Acer pseudoplatanus
349	699912	262152	exit hole	2012	Acer pseudoplatanus
350	699912	262152	exit hole	2012	Acer pseudoplatanus
351	699912	262152	exit hole	2012	Acer pseudoplatanus
352	699912	262152	exit hole	2012	Acer pseudoplatanus
353	699912	262152	exit hole	2012	Acer pseudoplatanus
354	699912	262152	infested tree	2012	Acer pseudoplatanus
355	700111	262445	infested tree	2012	Acer campestre
356	699601	261935	infested tree	2012	Salix caprea
357	699599	261928	infested tree	2012	Salix caprea
358	699598	261919	infested tree	2012	Salix caprea
359	699604	261929	infested tree	2012	Salix sp.
360	699605	261919	infested tree	2012	Salix sp.
361	699593	261920	infested tree	2012	Populus nigra
362	699606	261925	infested tree	2012	Betula sp.
363	699542	261929	infested tree	2013	Betula sp.
364	700148	262492	infested tree	2013	Salix sp.
365	699597	261906	infested tree	2013	Salix caprea
366	700180	262470	infested tree	2013	Acer campestre
367	700116	262463	infested tree	2013	Acer campestre

368	700148	262492	infested tree	2013	Salix sp.
369	700155	262481	infested tree	2013	Salix caprea
370	700148	262492	infested tree	2013	Salix sp.
371	700090	262567	infested tree	2013	Acer campestre
372	699391	262275	infested tree	2012	Populus sp.
373	699898	262073	infested tree	2013	Buddleja davidii
374	700164	261952	adult ALB	2012	Acer campestre
375	700164	261952	adult ALB	2012	Acer campestre
376	700164	261952	adult ALB	2012	Acer campestre
377	700164	261952	adult ALB	2012	Acer campestre
378	700164	261952	adult ALB	2012	Acer campestre
379	700164	261952	adult ALB	2012	Acer campestre
380	700164	261952	adult ALB	2012	Acer campestre
381	700164	261952	adult ALB	2012	Acer campestre
382	700164	261952	adult ALB	2012	Acer campestre
383	700164	261952	adult ALB	2012	Acer campestre
384	700164	261952	adult ALB	2012	Acer campestre
385	700164	261952	adult ALB	2012	Acer campestre
386	700164	261952	adult ALB	2012	Acer campestre
387	700164	261952	adult ALB	2012	Acer campestre
388	700164	261952	adult ALB	2012	Acer campestre
389	700164	261952	adult ALB	2012	Acer campestre
390	700164	261952	adult ALB	2012	Acer campestre
391	700164	261952	adult ALB	2012	Acer campestre
392	700164	261952	adult ALB	2012	Acer campestre
393	700164	261952	adult ALB	2012	Acer campestre
394	700164	261952	exit hole	2012	Acer campestre
395	699890	261838	infested tree	2012	Acer pseudoplatanus
396	699890	261838	exit hole	2012	Acer pseudoplatanus

Appendix S5
List of O-points, Marly, Switzerland

Situation: 2016

X-Y : Swiss coordinate system CH1903 LV03

	X	Y	O-point type	Date of observation	Tree species
1	577907.2013	181754.5822	adult ALB	03/07/2014	
2	577819.8329	181607.6444	adult ALB	08/07/2014	
3	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
4	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
5	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
6	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
7	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
8	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
9	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
10	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
11	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
12	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
13	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
14	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
15	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
16	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
17	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
18	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
19	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
20	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
21	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
22	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
23	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
24	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
25	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
26	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
27	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
28	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
29	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
30	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
31	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
32	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
33	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
34	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
35	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
36	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
37	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
38	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
39	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
40	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
41	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
42	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
43	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
44	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
45	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
46	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
47	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum
48	577847.2248	181660.858	exit hole	09/07/2014	Aesculus hippocastanum

247	577847.3462	181660.6908	adult ALB	14/07/2014	
248	577847.3462	181660.6908	adult ALB	14/07/2014	
249	577847.3462	181660.6908	adult ALB	14/07/2014	
250	577847.3462	181660.6908	adult ALB	14/07/2014	
251	577847.3462	181660.6908	adult ALB	14/07/2014	
252	577847.3462	181660.6908	adult ALB	14/07/2014	
253	577847.3462	181660.6908	adult ALB	14/07/2014	
254	577847.3462	181660.6908	adult ALB	14/07/2014	
255	577847.3462	181660.6908	adult ALB	14/07/2014	
256	577847.3462	181660.6908	adult ALB	14/07/2014	
257	577847.3462	181660.6908	adult ALB	14/07/2014	
258	577847.3462	181660.6908	adult ALB	14/07/2014	
259	577847.3462	181660.6908	adult ALB	14/07/2014	
260	577847.3462	181660.6908	adult ALB	14/07/2014	
261	577847.3462	181660.6908	adult ALB	14/07/2014	
262	577847.3462	181660.6908	adult ALB	14/07/2014	
263	577847.3462	181660.6908	adult ALB	14/07/2014	
264	577847.3462	181660.6908	adult ALB	14/07/2014	
265	577847.3462	181660.6908	adult ALB	14/07/2014	
266	577847.3462	181660.6908	adult ALB	14/07/2014	
267	577847.3462	181660.6908	adult ALB	14/07/2014	
268	577847.3462	181660.6908	adult ALB	14/07/2014	
269	577847.3462	181660.6908	adult ALB	14/07/2014	
270	577847.3462	181660.6908	adult ALB	14/07/2014	
271	577847.3462	181660.6908	adult ALB	14/07/2014	
272	577847.3462	181660.6908	adult ALB	14/07/2014	
273	577847.3462	181660.6908	adult ALB	14/07/2014	
274	577847.3462	181660.6908	adult ALB	14/07/2014	
275	577871.9515	181696.2001	exit hole	14/07/2014	Acer negundo
276	577871.9515	181696.2001	exit hole	14/07/2014	Acer negundo
277	577871.9515	181696.2001	infested tree	14/07/2014	Acer negundo
278	577865.334	181557.2599	adult ALB	15/07/2014	
279	577865.334	181557.2599	adult ALB	15/07/2014	
280	577865.334	181557.2599	adult ALB	15/07/2014	
281	577865.334	181557.2599	adult ALB	15/07/2014	
282	577864.2108	181557.3271	exit hole	15/07/2014	Acer platanoides
283	577864.2108	181557.3271	exit hole	15/07/2014	Acer platanoides
284	577864.2108	181557.3271	exit hole	15/07/2014	Acer platanoides
285	577875.1824	181558.6833	exit hole	15/07/2014	Acer pseudoplatanus
286	577864.2108	181557.3271	infested tree	15/07/2014	Acer platanoides
287	577875.1824	181558.6833	infested tree	15/07/2014	Acer pseudoplatanus
288	577816.9276	181540.176	infested tree	15/07/2014	Aesculus hippocastanum
289	577822.2193	181537.8477	infested tree	15/07/2014	Aesculus hippocastanum
290	577829.2043	181538.906	infested tree	15/07/2014	Aesculus hippocastanum
291	577826.7817	181538.2162	adult ALB	16/07/2014	
292	577826.7817	181538.2162	adult ALB	16/07/2014	
293	578794.5251	180776.0801	adult ALB	16/07/2014	
294	577851.641	181612.1429	infested tree	16/07/2014	Betula pendula
295	577762.7959	181570.0758	adult ALB	17/07/2014	
296	577762.7959	181570.0758	adult ALB	17/07/2014	
297	577762.7959	181570.0758	adult ALB	17/07/2014	
298	577743.3425	181587.1994	adult ALB	17/07/2014	
299	577743.3425	181587.1994	adult ALB	17/07/2014	
300	577858.7743	181667.9646	infested tree	17/07/2014	Corylus colurna
301	577762.6776	181570.4359	infested tree	17/07/2014	Aesculus hippocastanum
302	577767.5998	181598.5347	infested tree	17/07/2014	Betula sp.
303	577756.1844	181601.3054	infested tree	17/07/2014	Salix babylonica
304	577858.7552	181667.9158	adult ALB	18/07/2014	
305	577858.7552	181667.9158	adult ALB	18/07/2014	
306	577858.7552	181667.9158	adult ALB	18/07/2014	
307	577858.7552	181667.9158	adult ALB	18/07/2014	
308	577858.7552	181667.9158	adult ALB	18/07/2014	
309	577838.725	181691.2905	adult ALB	18/07/2014	
310	577846.7627	181661.2162	adult ALB	20/07/2014	
311	578766.5366	180866.6529	adult ALB	21/07/2014	
312	577931.9277	181518.836	infested tree	21/07/2014	Aesculus hippocastanum

313	577988.5495	181735.9532	adult ALB	24/07/2014	
314	577989.4482	181736.0329	infested tree	24/07/2014	Acer pseudoplatanus
315	577842.7541	181744.607	adult ALB	25/07/2014	
316	577842.7541	181744.607	adult ALB	25/07/2014	
317	577842.7541	181744.607	adult ALB	25/07/2014	
318	577842.6934	181743.9724	infested tree	25/07/2014	Aesculus hippocastanum
319	577982.4041	181739.5551	adult ALB	28/07/2014	
320	578761.8598	180788.0442	exit hole	28/07/2014	Acer campestre
321	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
322	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
323	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
324	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
325	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
326	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
327	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
328	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
329	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
330	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
331	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
332	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
333	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
334	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
335	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
336	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
337	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
338	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
339	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
340	578769.7413	180785.4979	exit hole	28/07/2014	Acer campestre
341	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
342	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
343	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
344	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
345	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
346	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
347	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
348	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
349	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
350	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
351	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
352	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
353	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
354	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
355	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
356	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
357	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
358	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
359	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
360	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
361	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
362	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
363	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
364	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
365	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
366	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
367	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
368	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
369	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
370	578781.3815	180782.9516	exit hole	28/07/2014	Acer campestre
371	578794.7193	180779.9203	exit hole	28/07/2014	Acer campestre
372	578761.8598	180788.0442	infested tree	28/07/2014	Acer campestre
373	578769.7413	180785.4979	infested tree	28/07/2014	Acer campestre
374	578787.0804	180781.9816	infested tree	28/07/2014	Populus tremula
375	577844.3413	181694.2862	infested tree	28/07/2014	Fraxinus excelsior
376	578790.6538	180747.2202	exit hole	30/07/2014	Acer pseudoplatanus
377	578790.6538	180747.2202	exit hole	30/07/2014	Acer pseudoplatanus
378	578790.6538	180747.2202	exit hole	30/07/2014	Acer pseudoplatanus

379	578760.3553	180782.8533	infested tree	30/07/2014	Acer campestris
380	578789.8288	180759.0719	infested tree	30/07/2014	Acer pseudoplatanus
381	578788.4167	180756.5175	adult ALB	31/07/2014	
382	578792.2404	180768.8453	infested tree	31/07/2014	Acer pseudoplatanus
383	578790.4634	180751.0756	infested tree	31/07/2014	Acer pseuplatanus
384	577745.7631	181655.776	adult ALB	04/08/2014	
385	578782.9748	180752.7256	adult ALB	04/08/2014	
386	578786.3859	180758.2945	infested tree	04/08/2014	Acer pseudoplatanus
387	578786.9571	180750.0443	infested tree	04/08/2014	Acer pseudoplatanus
388	578791.9707	180754.7406	infested tree	04/08/2014	Acer pseudoplatanus
389	578787.6393	180754.3122	infested tree	04/08/2014	Acer pseudoplatanus
390	578777.866	180756.2161	infested tree	04/08/2014	Acer pseudoplatanus
391	578783.8315	180757.9931	infested tree	04/08/2014	Acer pseudoplatanus
392	578810.0577	180768.1948	adult ALB	05/08/2014	
393	578805.0441	180777.9681	adult ALB	05/08/2014	
394	578731.3633	180741.7941	exit hole	05/08/2014	Acer sacharinum
395	578731.3633	180741.7941	exit hole	05/08/2014	Acer sacharinum
396	578731.3633	180741.7941	exit hole	05/08/2014	Acer sacharinum
397	578731.3633	180741.7941	exit hole	05/08/2014	Acer sacharinum
398	578731.3633	180741.7941	exit hole	05/08/2014	Acer sacharinum
399	578731.3633	180741.7941	exit hole	05/08/2014	Acer sacharinum
400	578734.7903	180741.7306	exit hole	05/08/2014	Acer sacharinum
401	578762.9997	180752.8367	exit hole	05/08/2014	Acer pseudoplatanus
402	578795.5563	180740.969	exit hole	05/08/2014	Acer pseudoplatanus
403	578795.5563	180740.969	exit hole	05/08/2014	Acer pseudoplatanus
404	577851.2231	181629.645	infested tree	05/08/2014	Tilia cordata
405	578731.3633	180741.7941	infested tree	05/08/2014	Acer sacharinum
406	578734.7903	180741.7306	infested tree	05/08/2014	Acer sacharinum
407	578762.9997	180752.8367	infested tree	05/08/2014	Acer pseudoplatanus
408	578731.3767	180742.5835	adult ALB	06/08/2014	
409	578771.2316	180758.957	adult ALB	06/08/2014	
410	577671.3721	181477.4153	infested tree	13/08/2014	Acer campestris
411	577663.2165	181478.5803	infested tree	13/08/2014	Acer campestris
412	577813.0563	181437.1362	infested tree	14/08/2014	Acer platanoides
413	577816.6195	181693.2318	adult ALB	20/08/2014	
414	577871.3641	181631.243	infested tree	27/08/2014	Fagus sylvatica
415	577813.7114	181692.0972	infested tree	27/08/2014	Prunus serrulata
416	578054.5608	181325.4138	infested tree	08/09/2014	Acer pseudoplatanus
417	578046.7214	181305.673	infested tree	08/09/2014	Salix caprea
418	577995.1868	181280.9605	infested tree	09/09/2014	Acer campestre
419	577993.0772	181284.577	infested tree	09/09/2014	Acer campestre
420	577994.9574	181276.537	infested tree	09/09/2014	Acer campestre
421	577981.3699	181738.7526	infested tree	01/04/2015	Fagus sylvatica
422	577846.9982	181661.0814	infested tree	27/07/2015	Acer campestris
423	577859.8875	181589.2636	infested tree	02/09/2015	Acer campestris
424	577915.8717	181686.5882	exit hole	?	Acer pseudoplatanus

A local risk map using field observations of the Asian longhorned beetle to optimize monitoring activities

Appendix S6

Extra graphs

1. Risk map with other parameter values (σ)P. 2

Marly, Brünisried and Winterthur

σ : 100, 150, 200, 300

For more details about the map, see the manuscript

2. Laplace and normal distributionP. 14

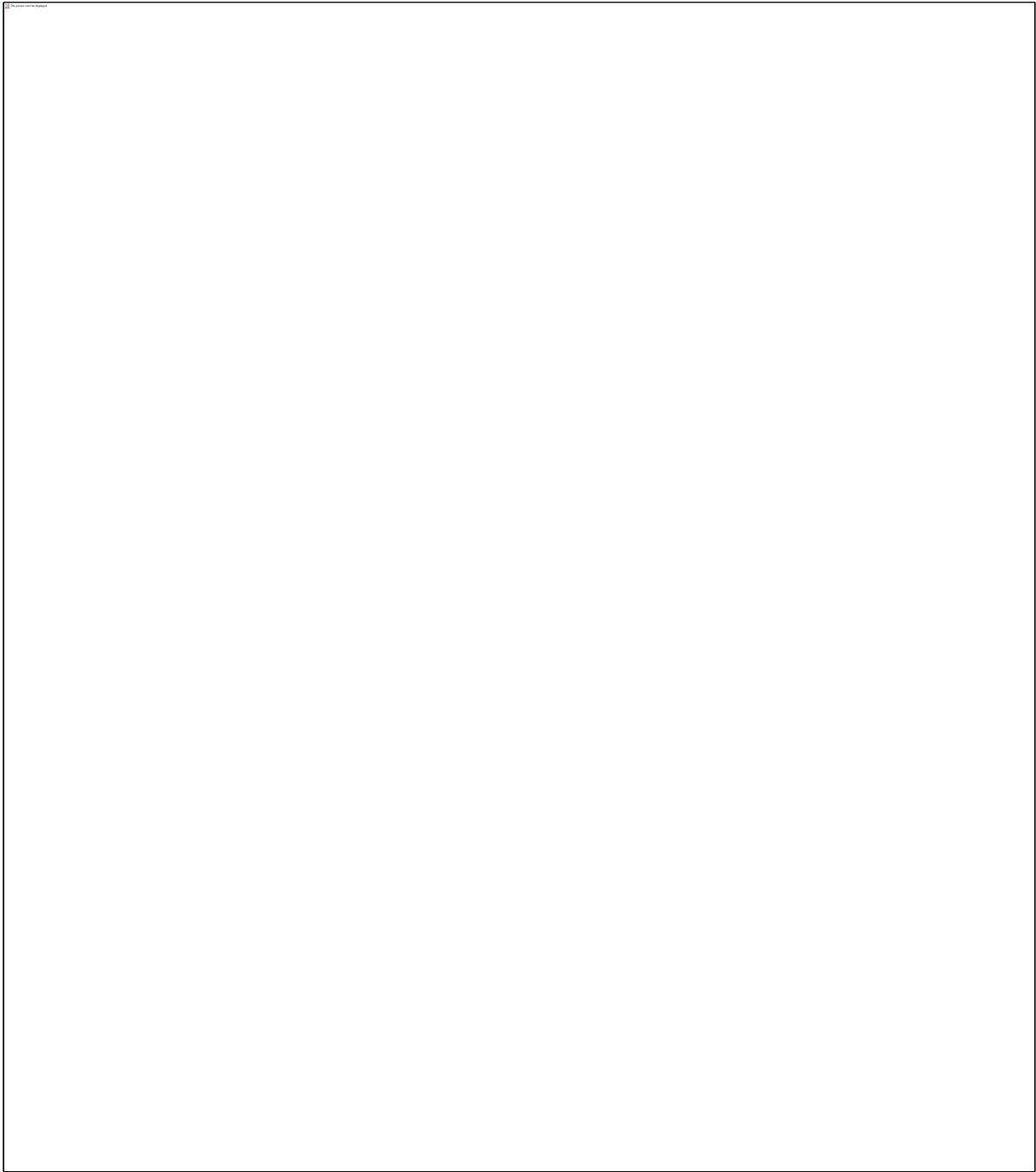
Comparison when the normal distribution is used instead of the Laplace distribution.

1. Risk map with other parameter values (σ)

1.1

Marly

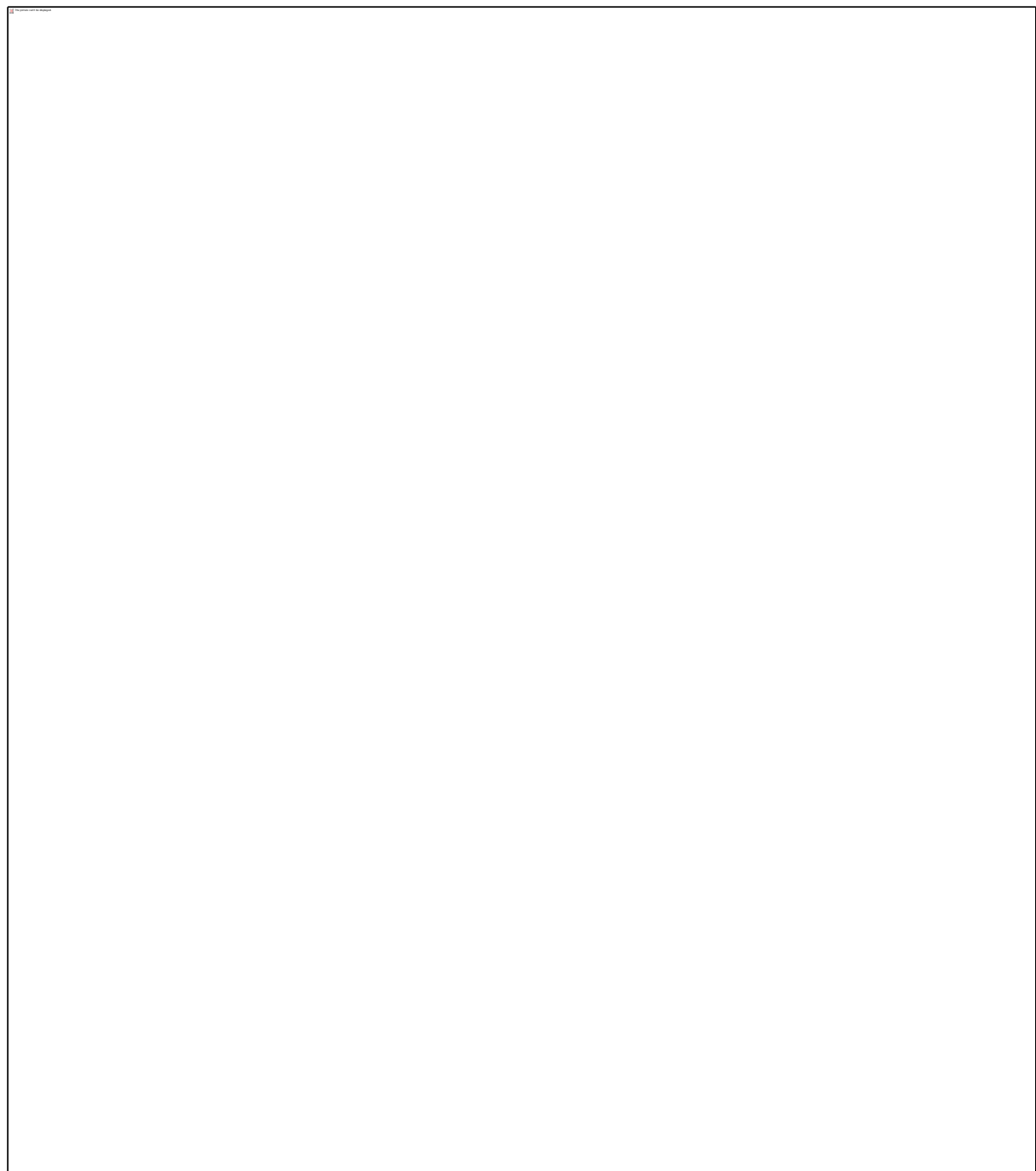
$\sigma = 100$



1.2

Marly

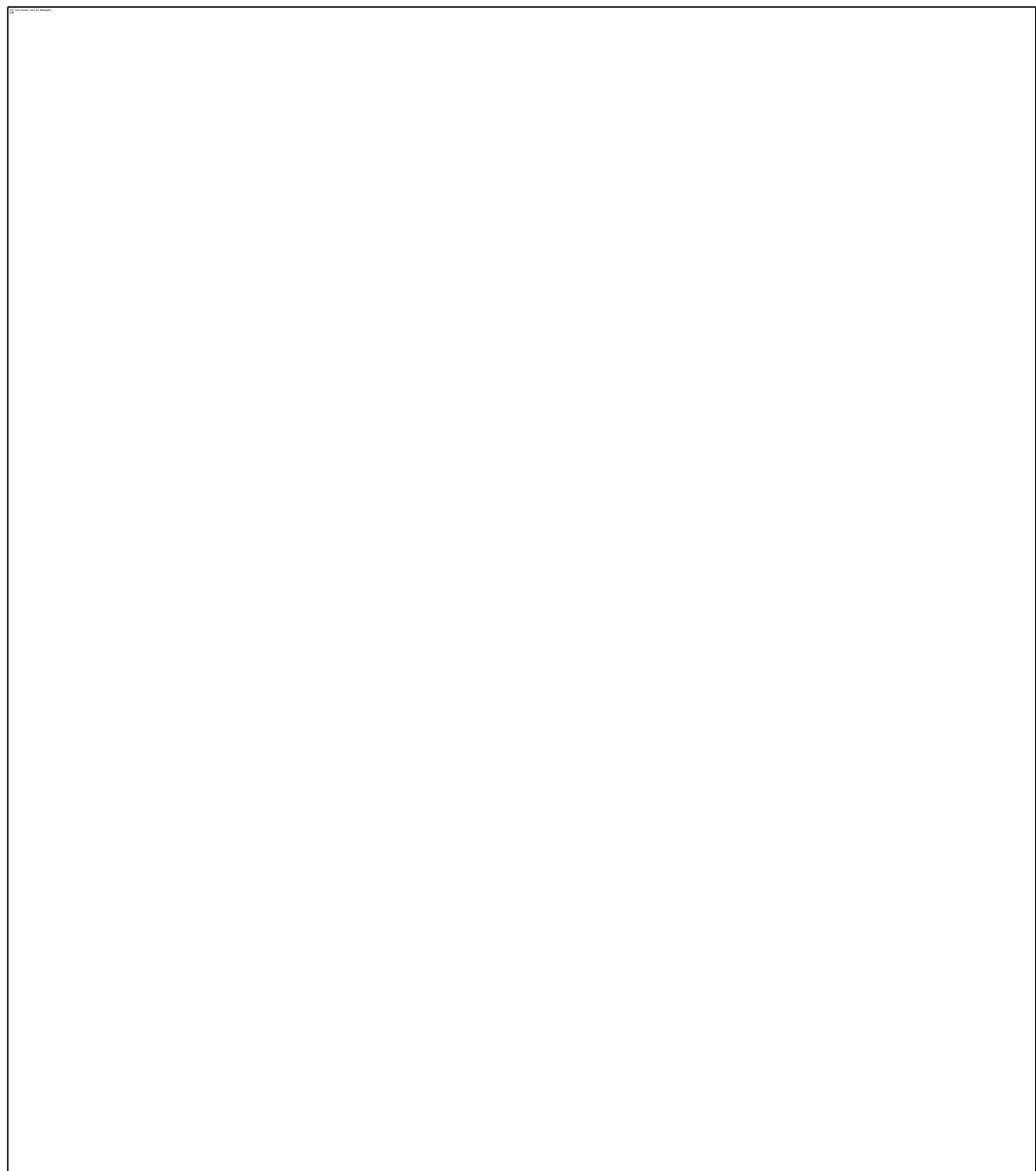
$\sigma = 150$



1.3

Marly

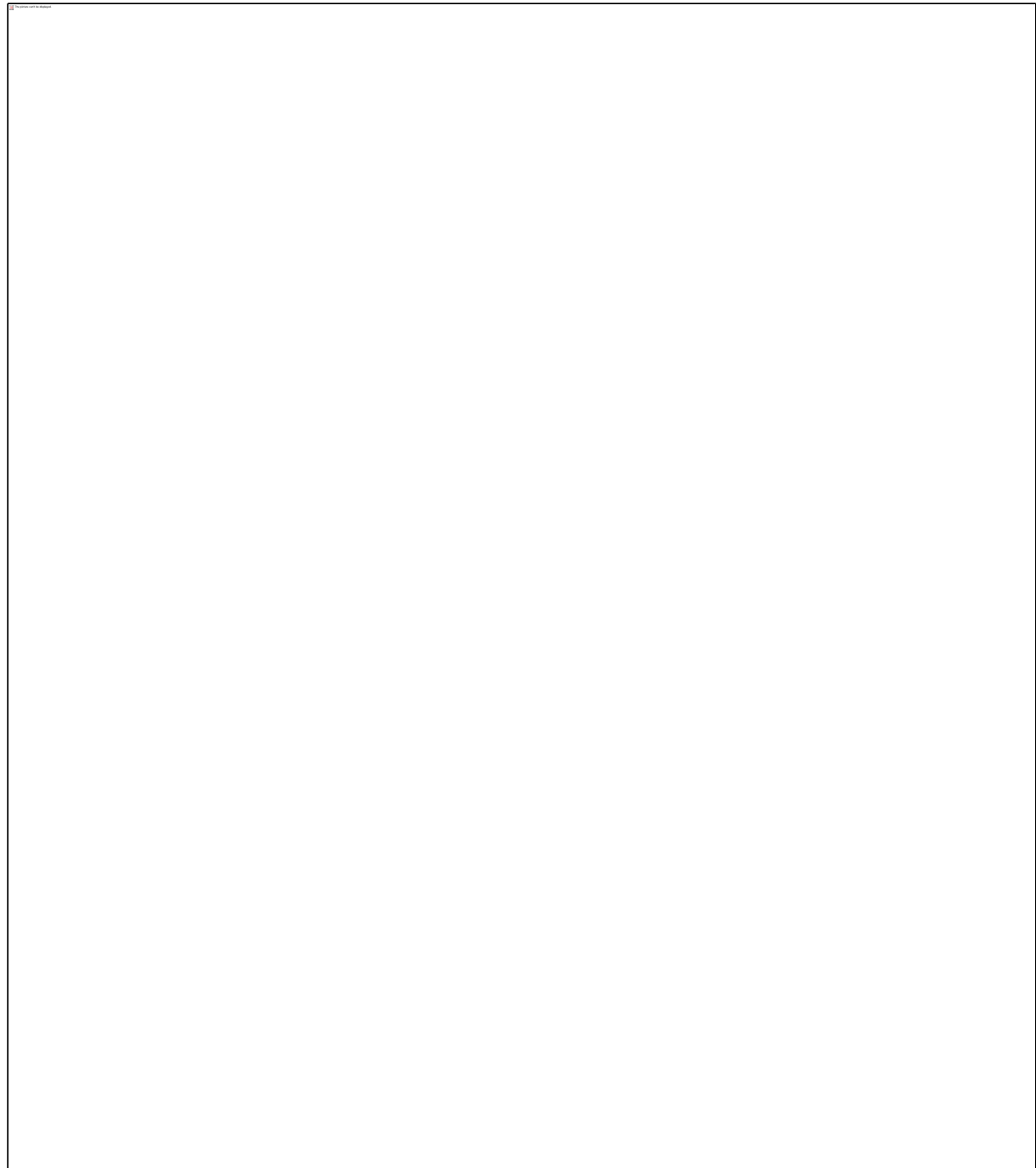
$\sigma = 200$



1.4

Marly

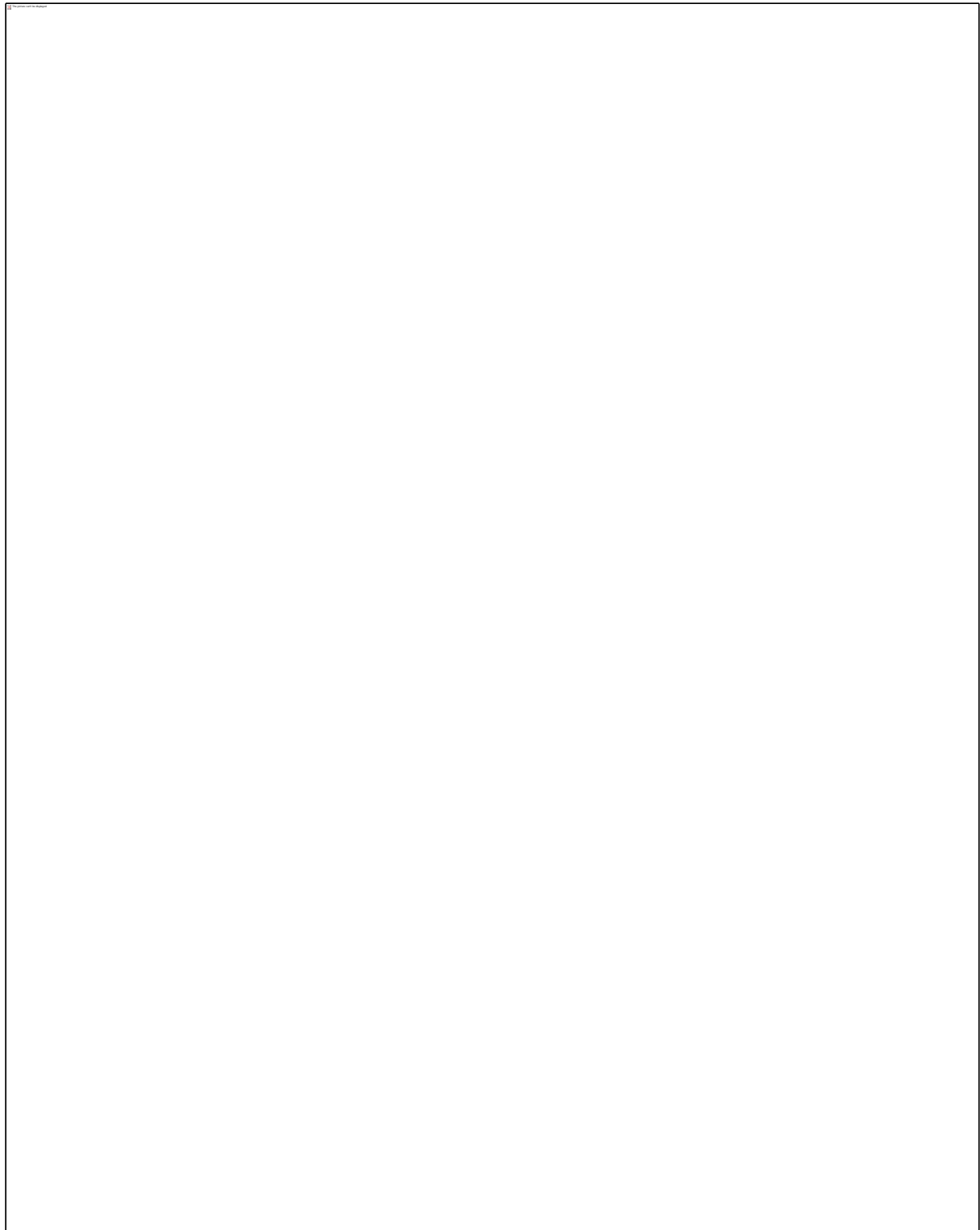
$\sigma = 300$



1.5

Brünisried

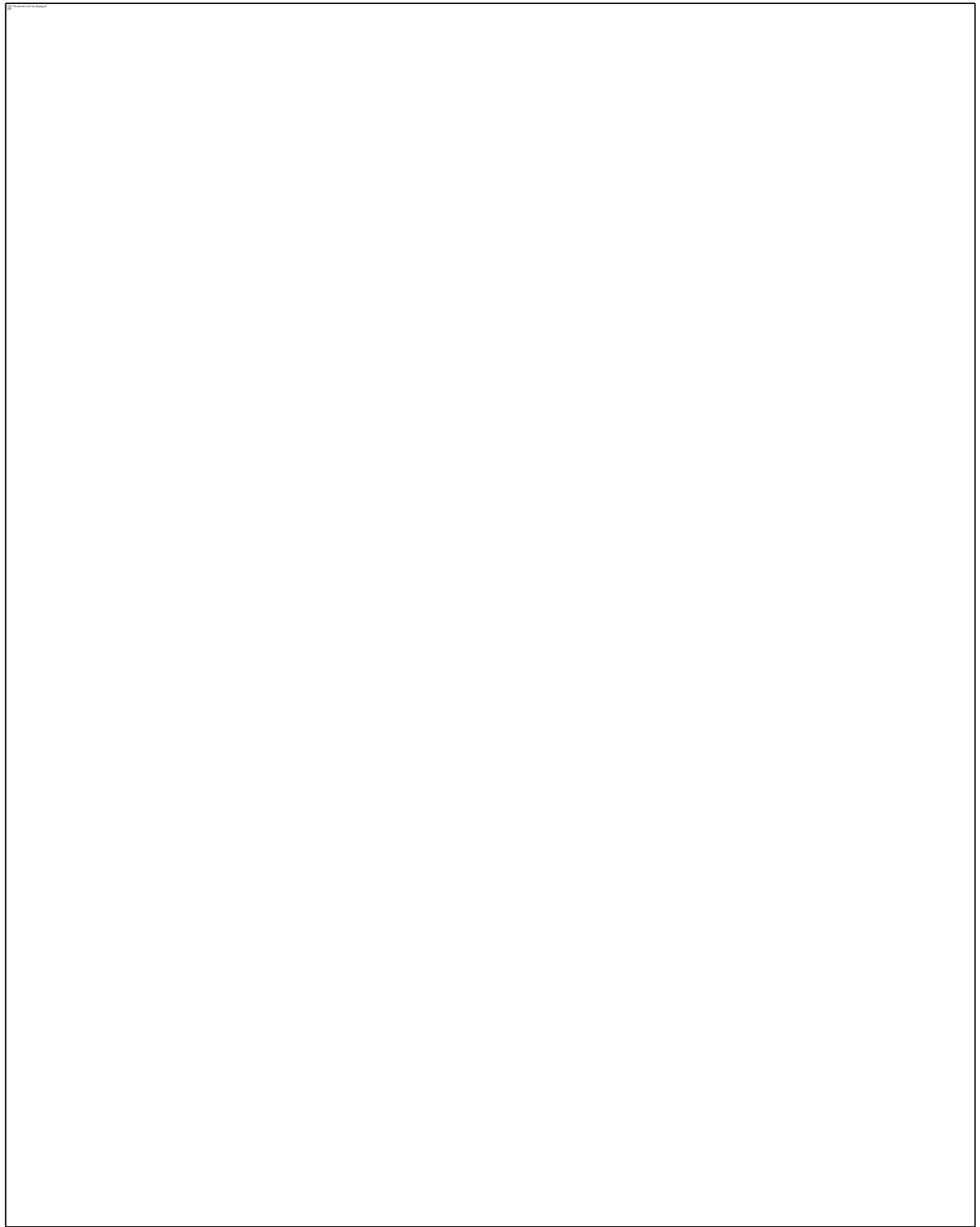
$\sigma = 100$



1.6

Brünisried

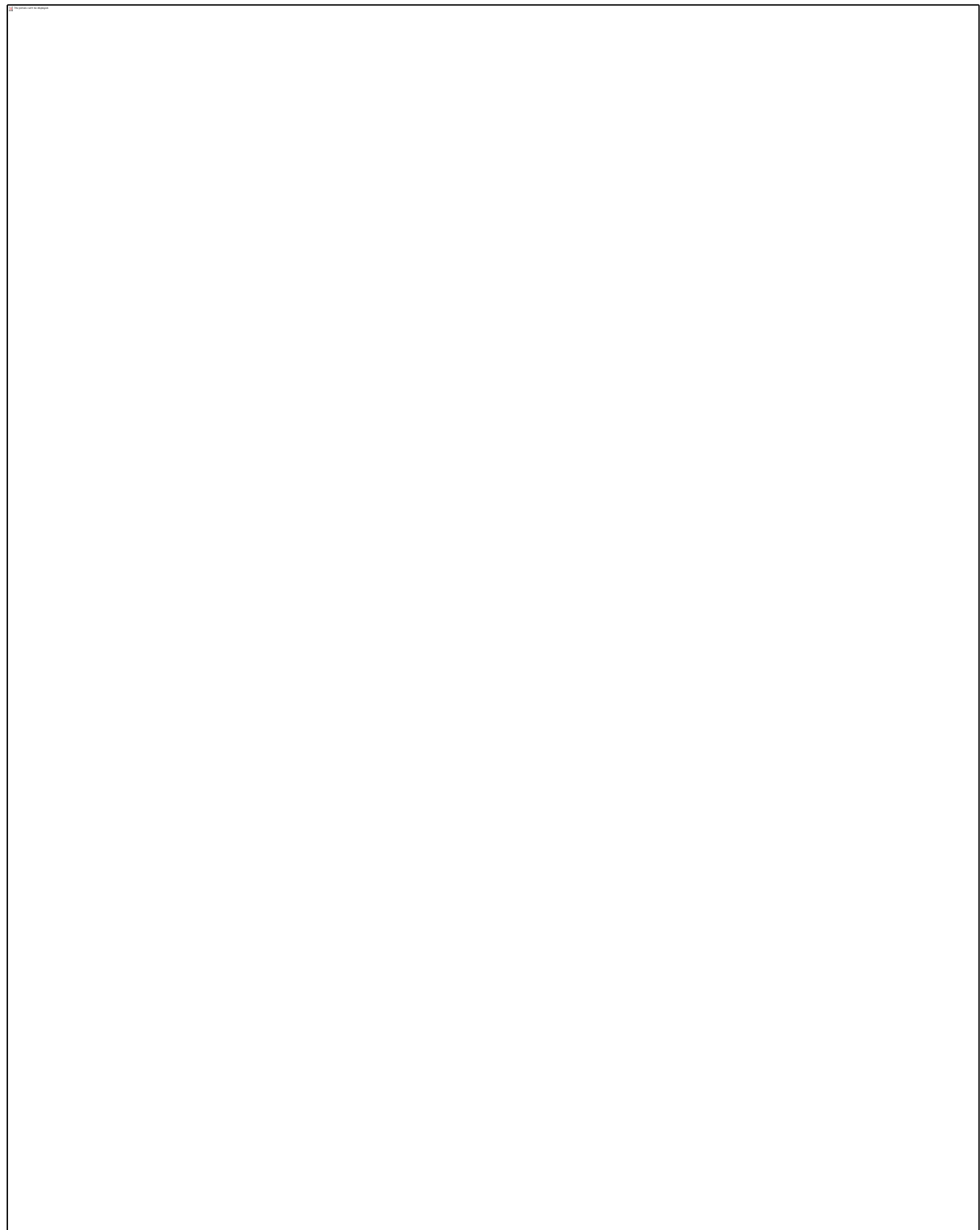
$\sigma = 150$



1.7

Brünisried

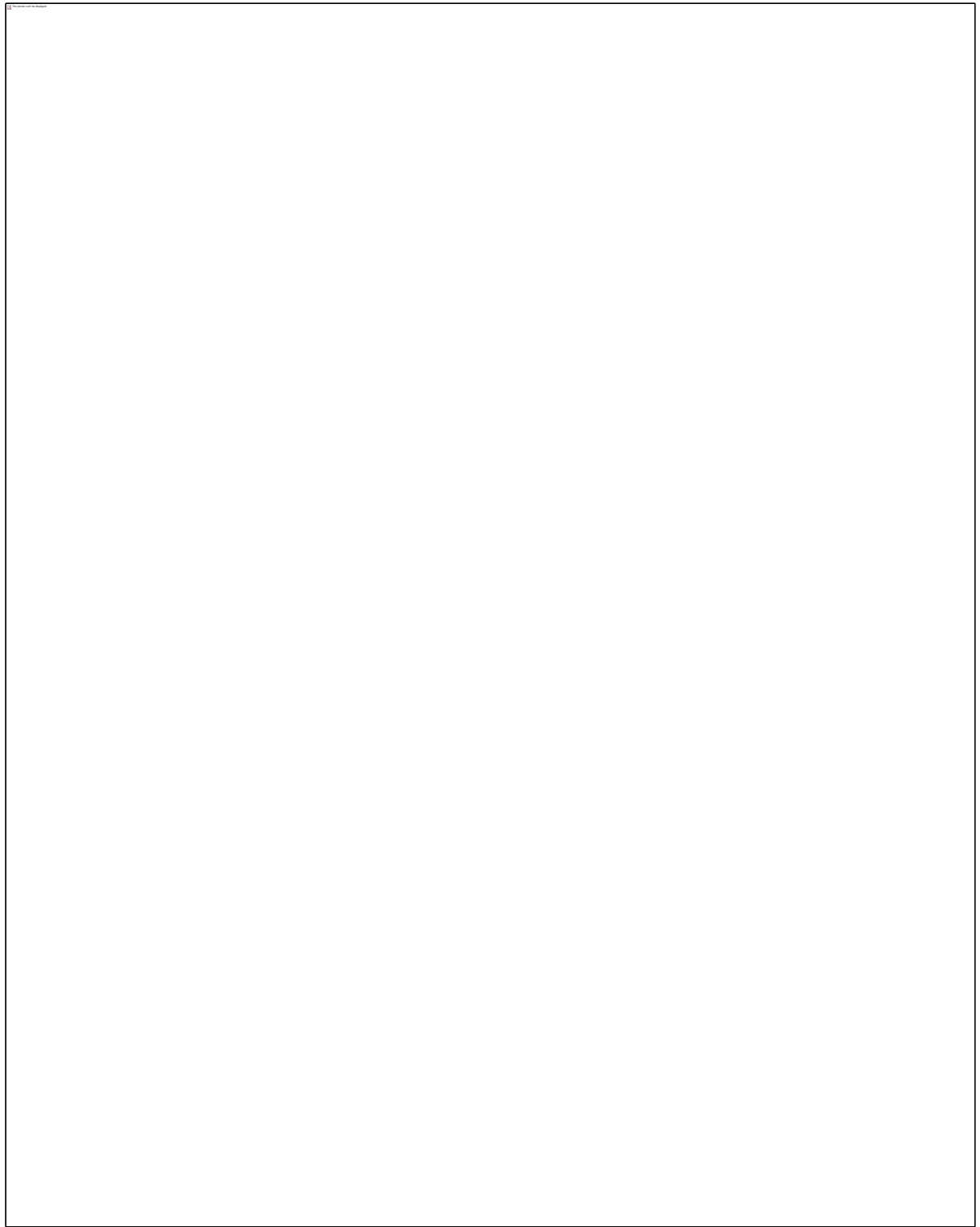
$\sigma = 200$



1.8

Brünisried

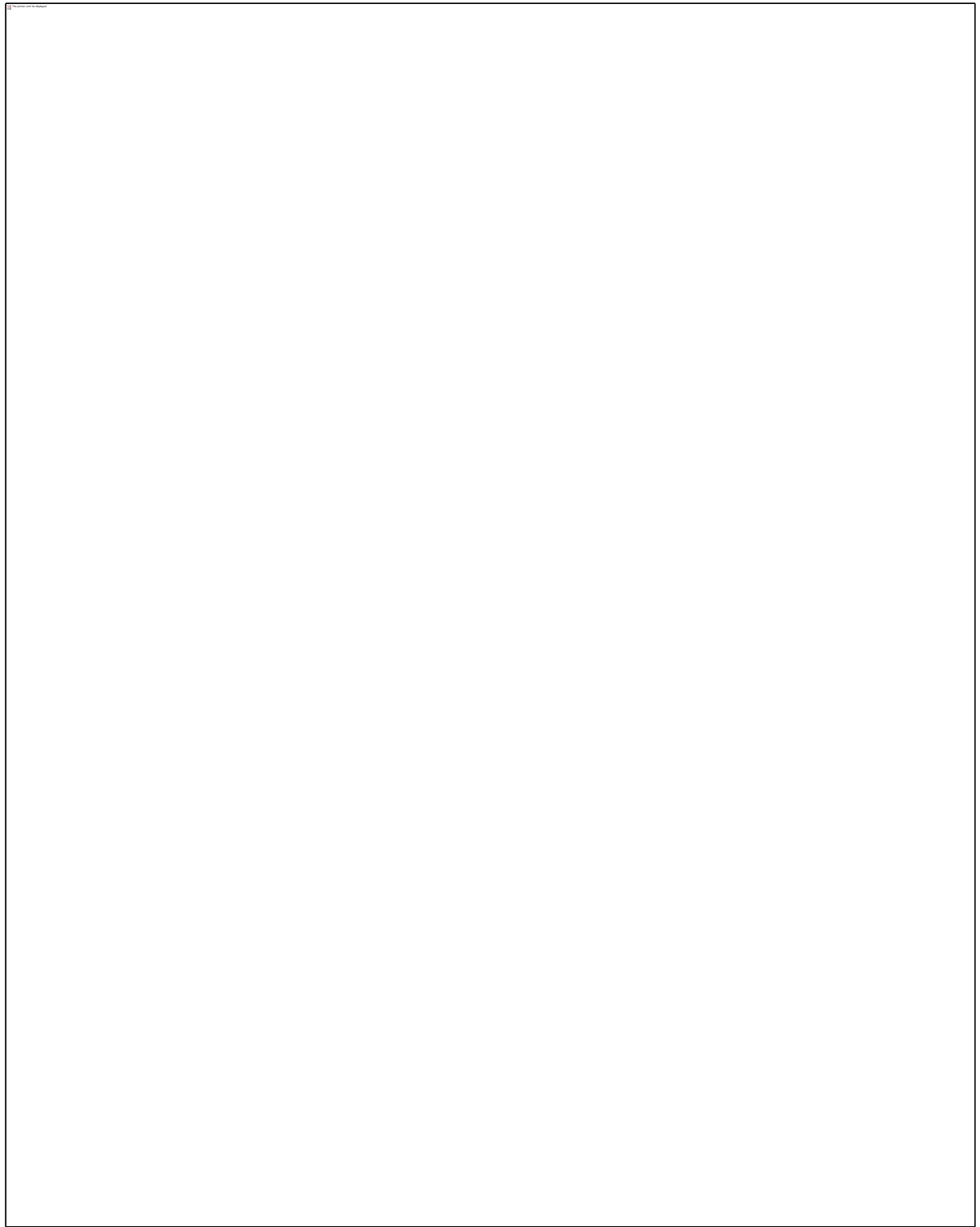
$\sigma = 300$



1.9

Winterthur

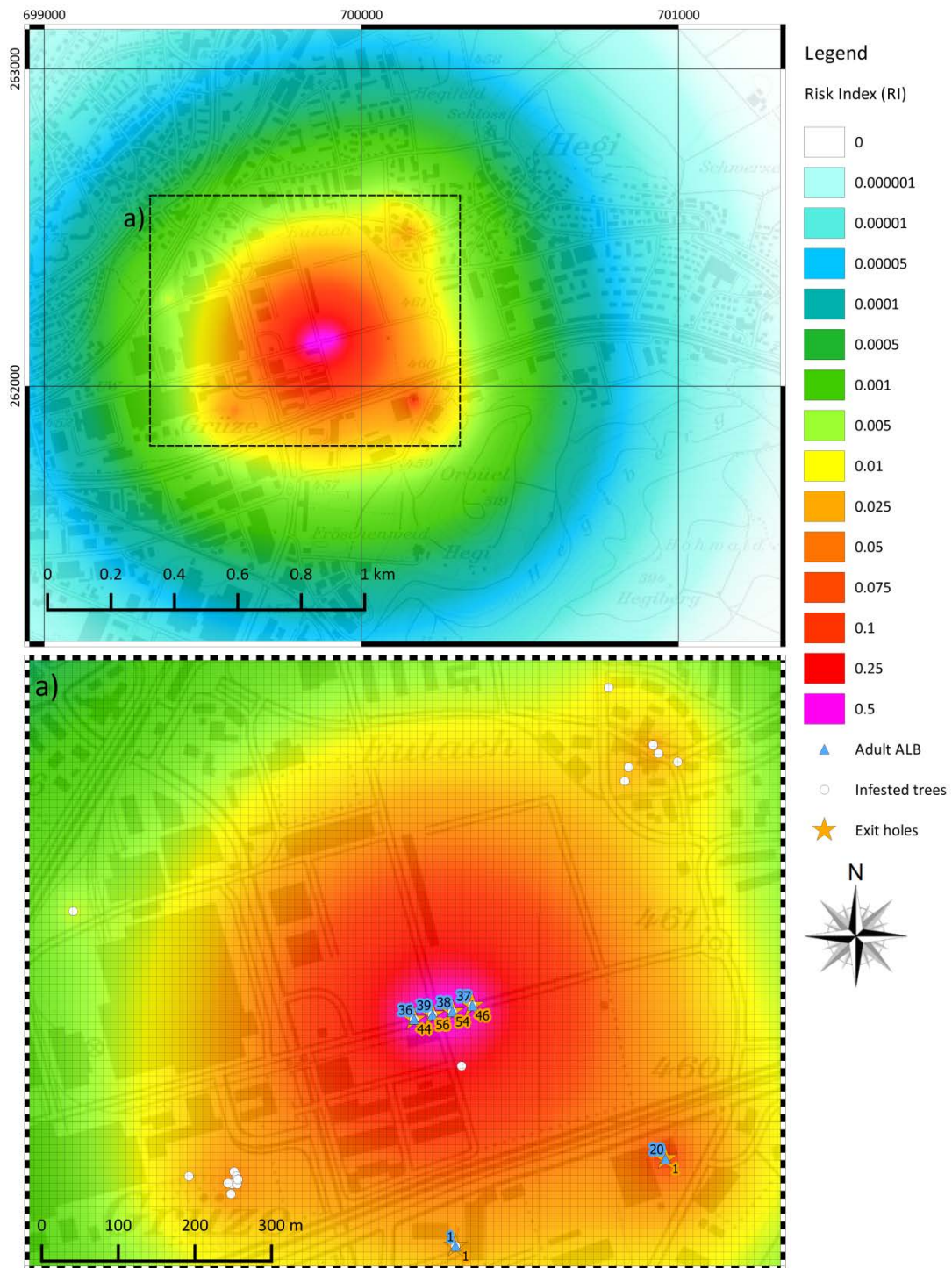
$\sigma = 100$



1.10

Winterthur

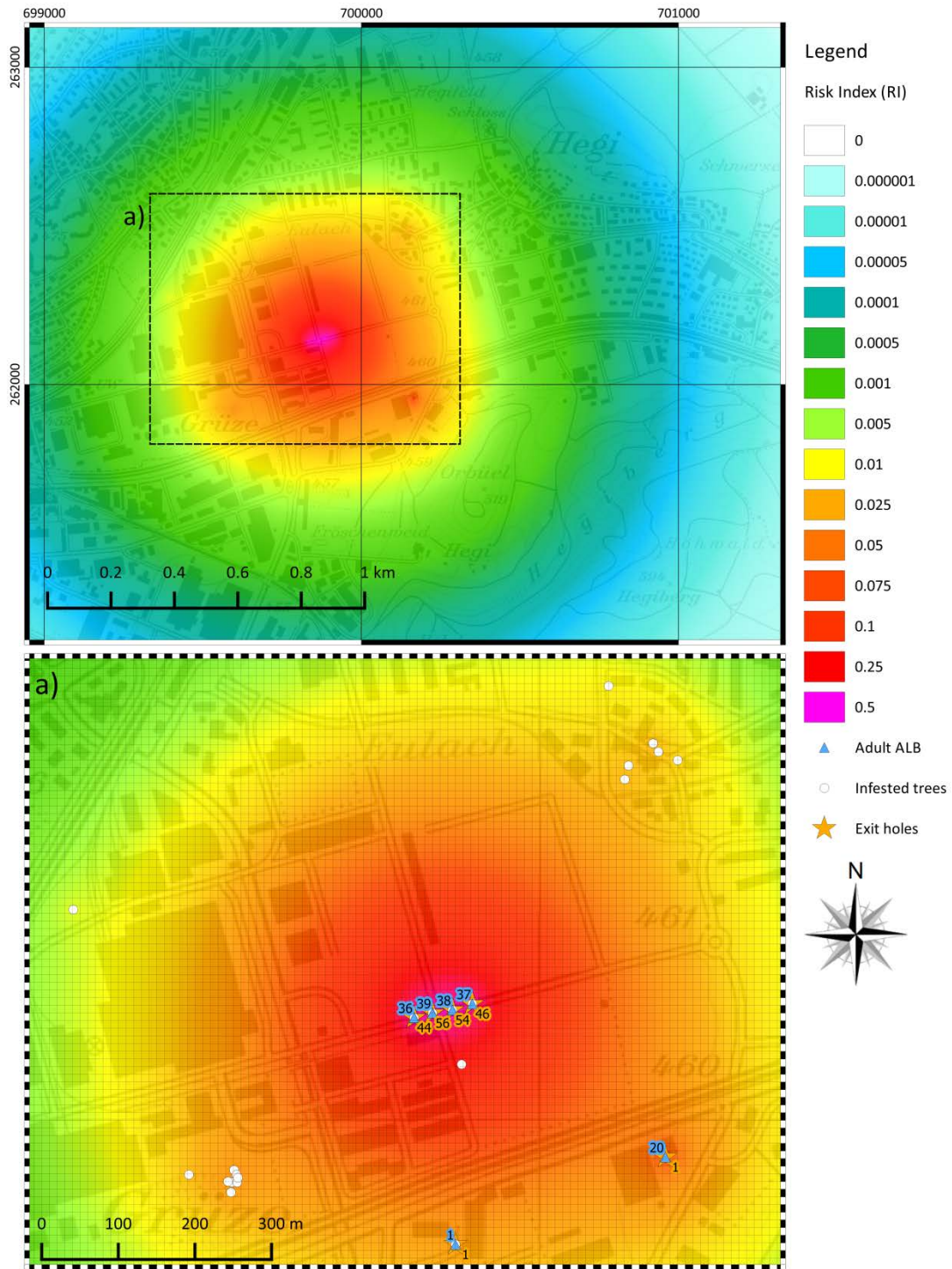
$\sigma = 150$



1.11

Winterthur

$\sigma = 200$



1.12

Winterthur

$\sigma = 300$

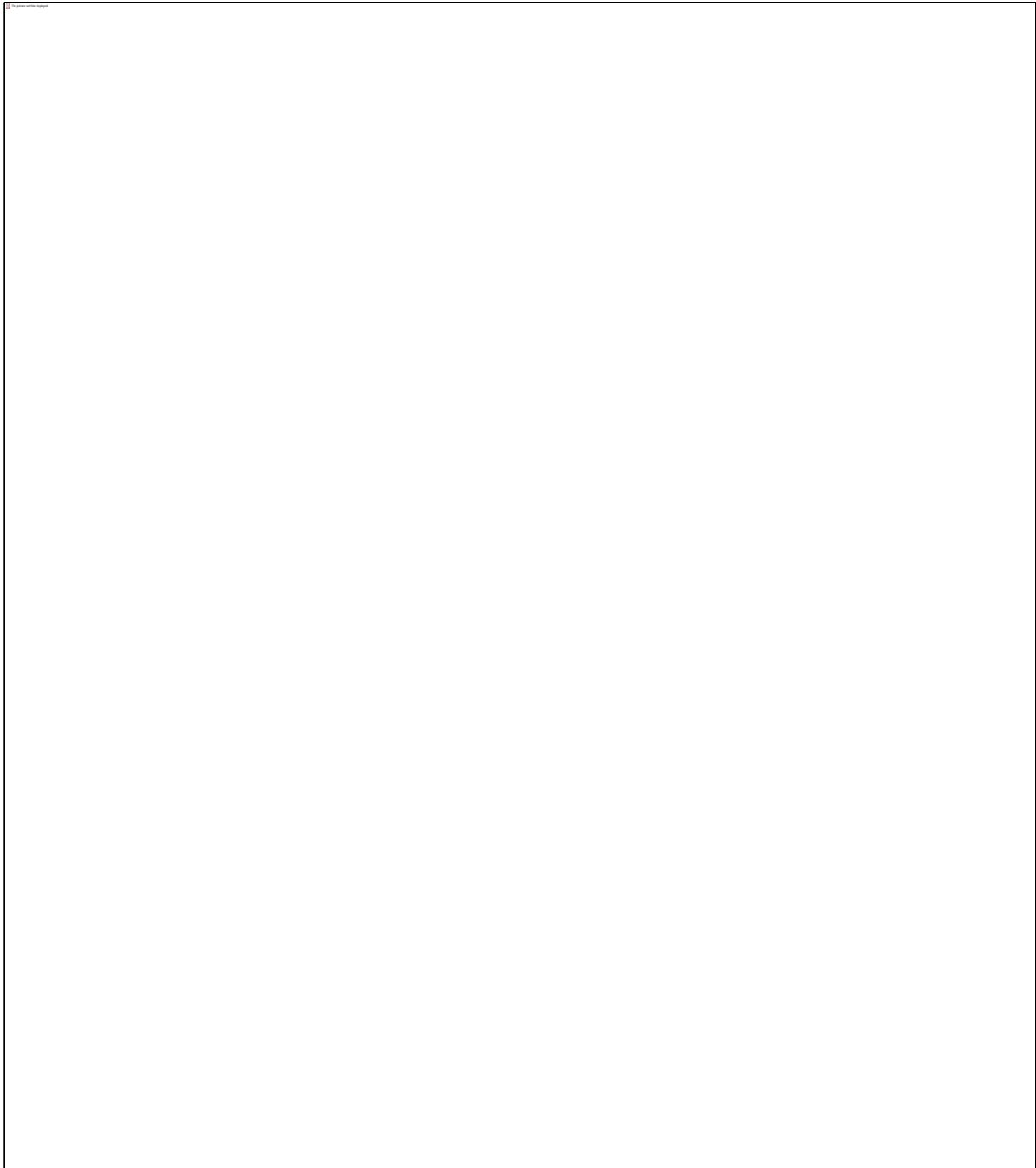
2. Laplace and normal distributionP. 14

2.1

Risk map

Marly

Bivariate Laplace distribution, $\sigma = 150$

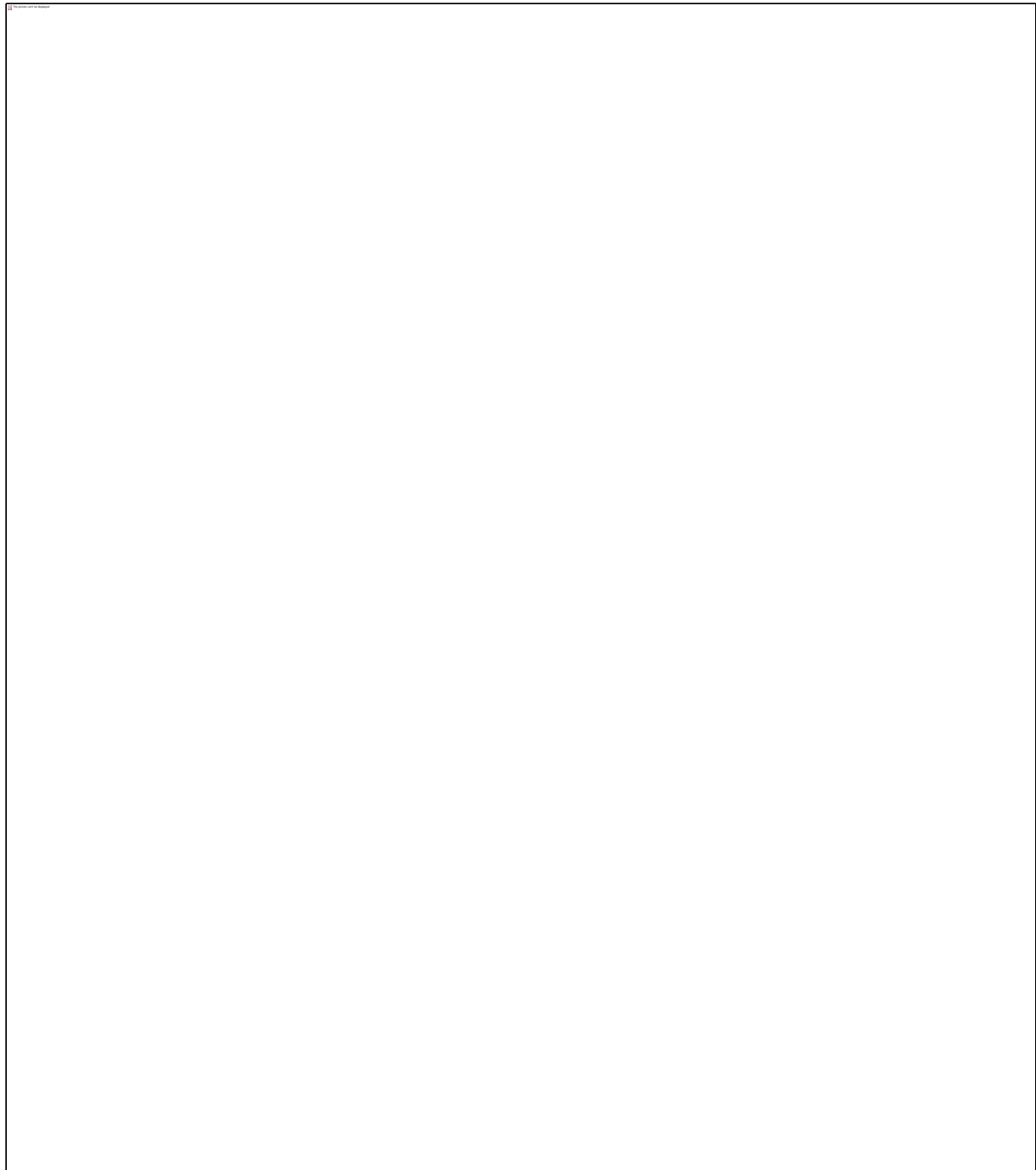


2.2

Risk map

Marly

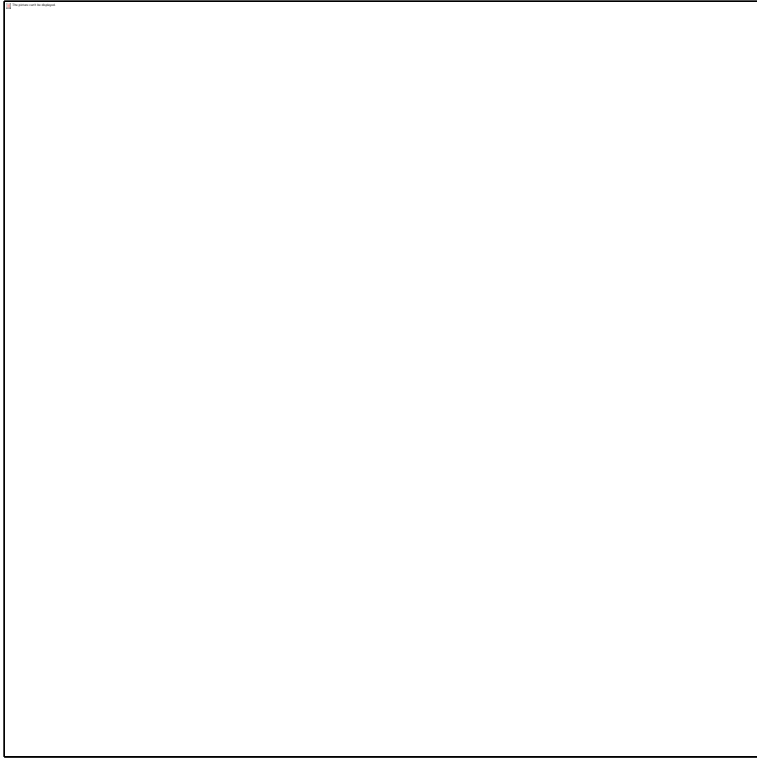
Bivariate normal distribution, $\sigma = 150$



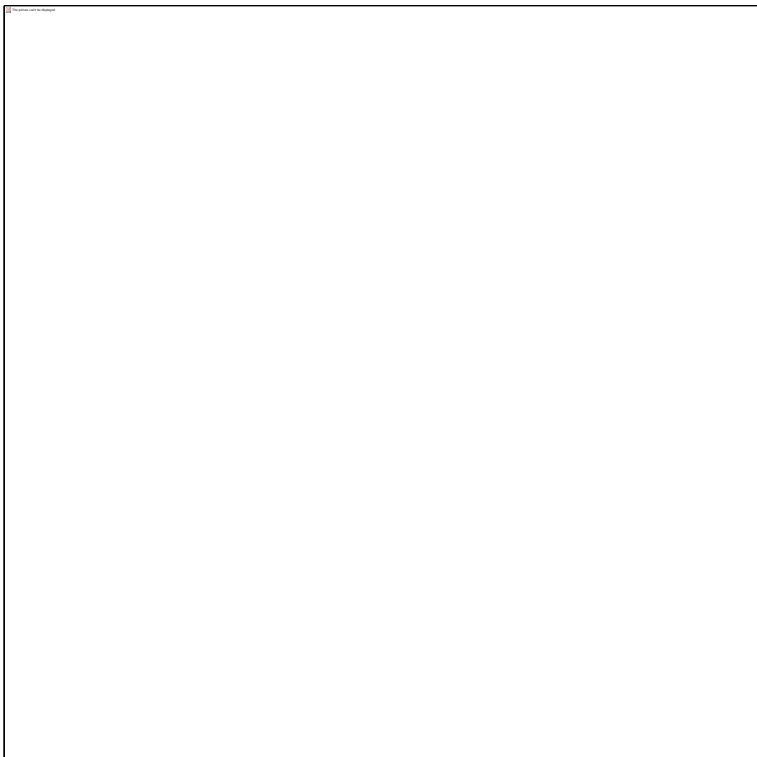
Logistic generalized linear model (GLM) fit of the calculated risk index (RI) against infested/uninfested host trees (n = 1203), for the Marly infestation. For more details, see the manuscript.

2.3

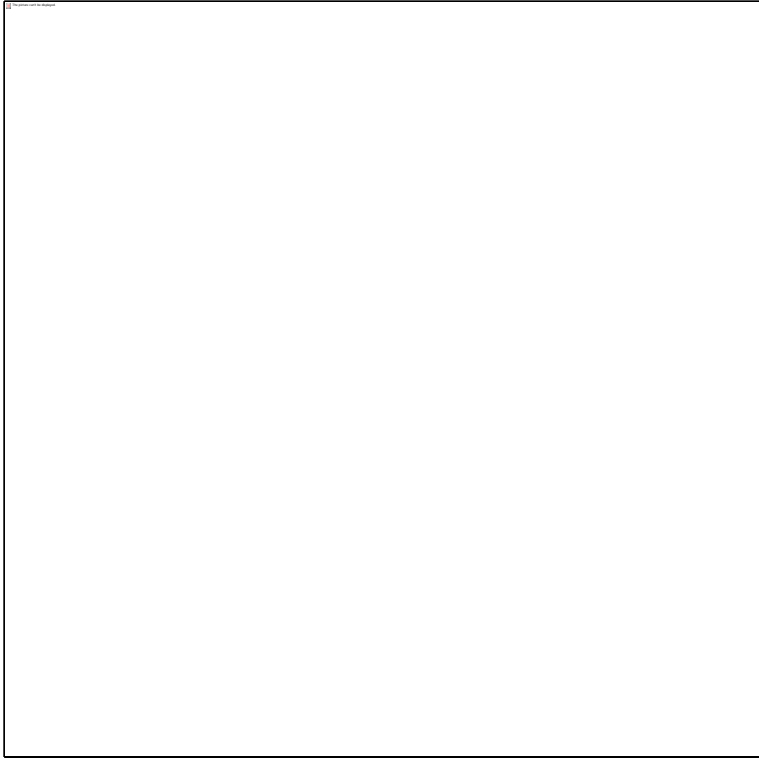
Laplace distribution, linear scale



2.4
Laplace distribution, log-log scale



2.5
Normal distribution, linear scale



2.6

Normal distribution, log-log scale

