

Rape Seed Gene Flow and Models for Landscape Effects in Northern Germany

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Oilseed Rape

- Previous studies:
 - Australia
 - Canada
 - Denmark
 - UK
- Preliminary Findings for Northern Germany
(Schleswig Holstein)

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Australia



- Pollen-Mediated Movement of Herbicide Resistance Between Commercial Canola Fields
Mary A. Rieger, Michael Lamond, Christopher Preston, Stephen B. Powles, and Richard T. Roush (2002)
Science 296: 2386-2388

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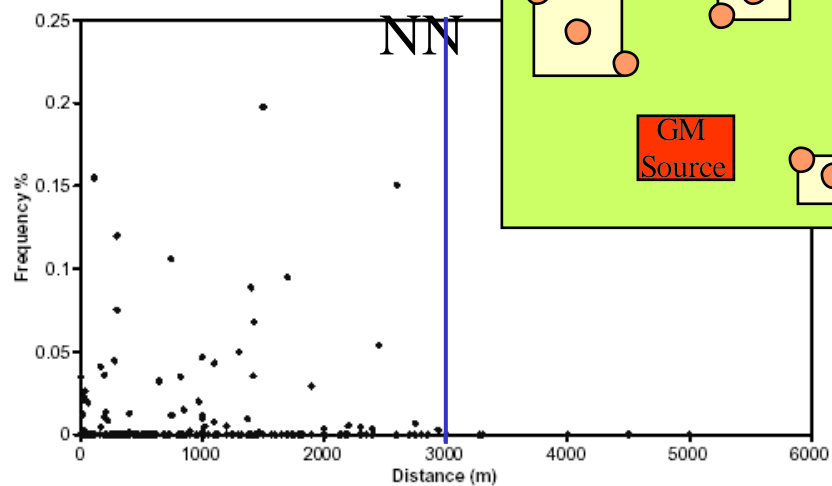


Fig. 1. Percentage of ALS herbicide-resistant individuals in seed from nonresistant varieties in relation to distance from the source field. Three individual samples were collected per field, with 190 individual collection locations.

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Canola Council of Canada (2005)

- Lists problems with herbicide resistant GM oilseed rape volunteers
- Recommends isolation distance of 175 m

Figure 18. Estimated Yield Loss in Wheat and Barley from Volunteer Canola

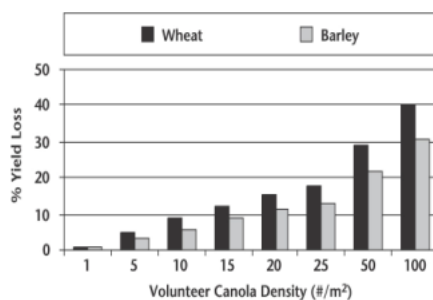
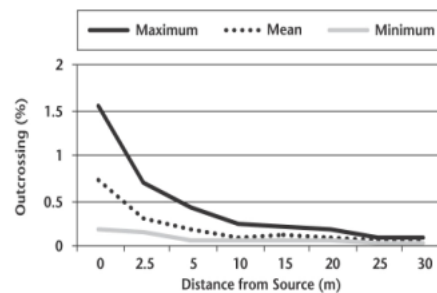


Figure 19. Per cent Outcrossing by Distance from Source in Small Fields



<http://www.canola-council.org/volunteercan.aspx>

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A Meta-Analysis from Danish authors

- **Pollen dispersal between fields of GM and non-GM oilseed rape: meta-analysis of a available data and the possibilities for co-existence**

C. Damgaard & G. Kjellsson

The National Environmental Research Institute (NERI)
Denmark

http://www.agrsci.dk/gmcc-03/abs_5.htm#1

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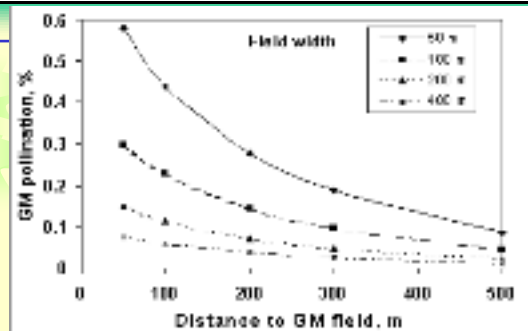


Figure 1. Total percentage of GM-containing oilseed rape seeds in an organic field in relation to isolation distance and the width of the field. Model results are shown for the upper 95% credibility level (in 5% of the fields, the average GM-content is expected to be higher than the shown value).

The results indicate that a critical level of 0.1% GM content in the organic crop of oilseed rape can be obtained by an isolation distance above 100 m if the field is at least 200 m wide (Figure 1). For small organic fields (width = 50 m), a low level of GM pollen dispersal (up to approx. 0.3%) may be expected even with an isolation distance of 200 m.

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A meta Analysis from UK authors

Spatial distribution characteristics of out-crossing probability

P.J. Walklate & J.B. Sweet

http://www.agisci.dk/gmcc-03/abs_5.htm#1

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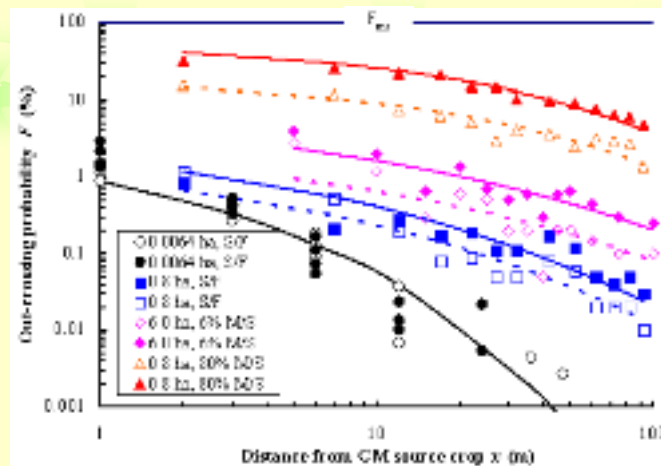


Figure 1. Comparison between measurements and predictions of out-crossing probability for a range of different field experiments based on GM source crops of different size and target crops of different fertility.

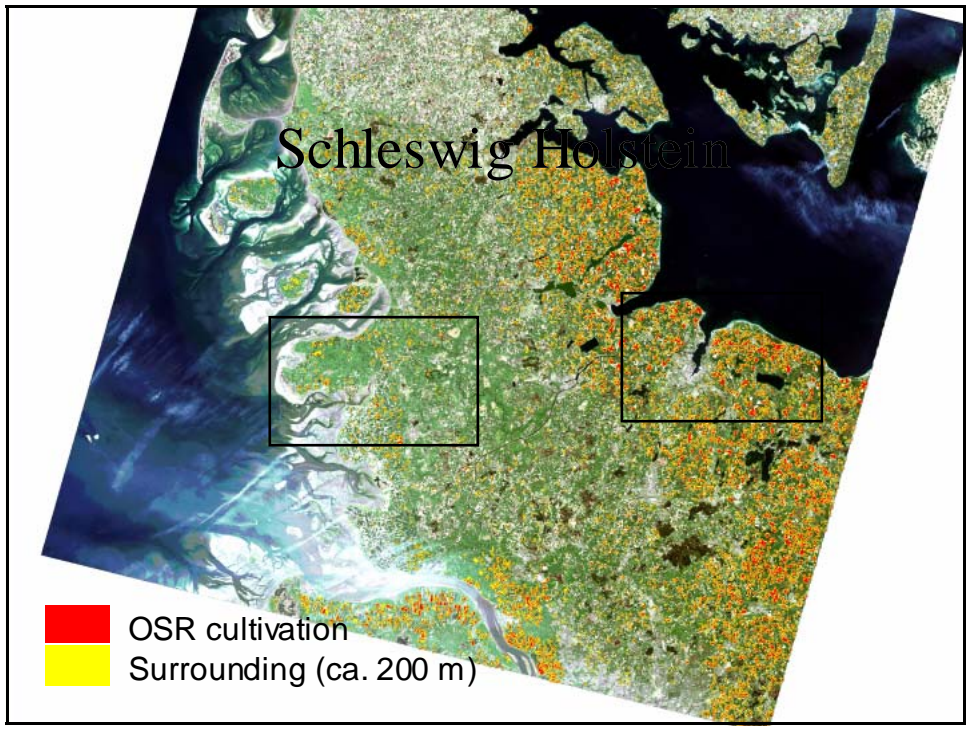
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Northern Germany

- Combination of
 - Small-Scale modelling
 - Cultivation measures
 - Spatially explicit
 - Individual-based for feral plants
 - Regional data sets
 - Climate (wind, sunshine, rain, temperature)
 - Crop rotation pattern on county level



In cooperation with
 Ulrike Middelhoff, Gunther Schmidt, Winfried Schröder, Hendrik Laue, Hauke Reuter, Gertud Menzel, Angelika Wuubs, Michael Glennitz u.a.

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Schleswig Holstein

- Average distance to nearest neighbour field:
~ 300 m, high variability

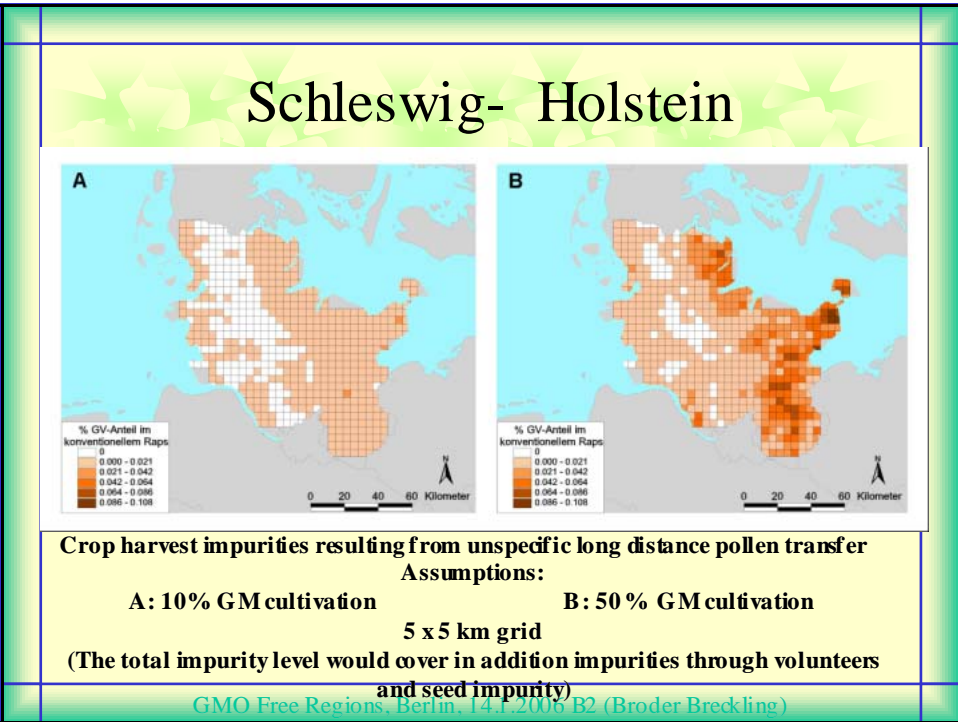
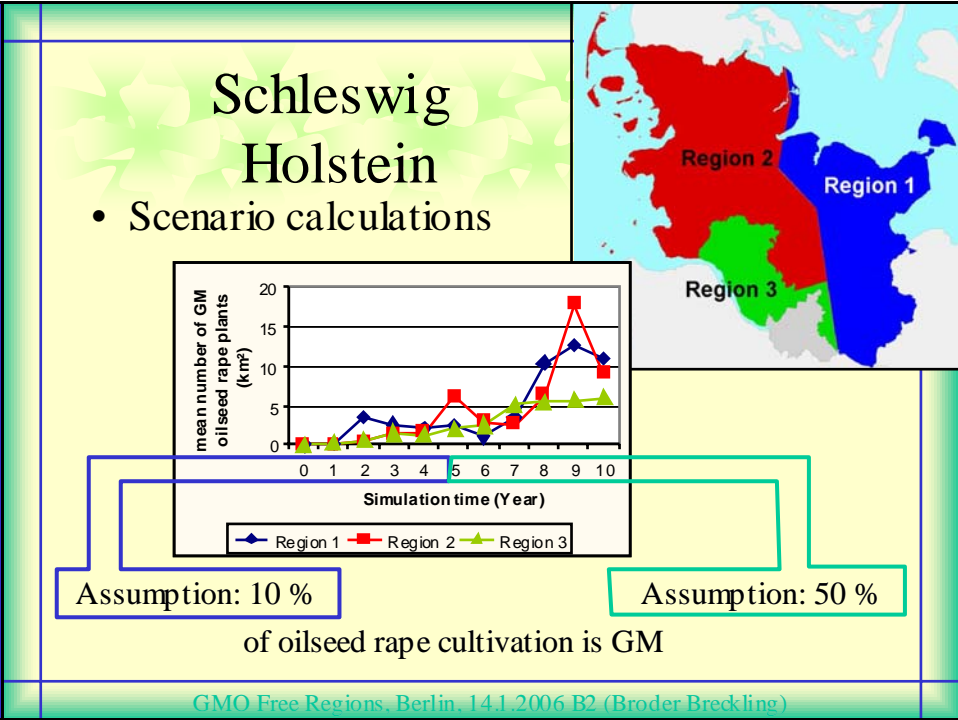



Dithmarschen Kiel

OSR cultivation
Surrounding (ca. 200 m)

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This complex block contains a title, a bullet point, two inset maps, a legend, and a footer. The title 'Schleswig Holstein' is centered at the top. Below it is a bullet point stating 'Average distance to nearest neighbour field: ~ 300 m, high variability'. Two inset maps are shown side-by-side: the left one is labeled 'Dithmarschen' and the right one is labeled 'Kiel'. Both inset maps use the same red and yellow color scheme as the main map above. A legend at the bottom left of the block defines the colors: red for 'OSR cultivation' and yellow for 'Surrounding (ca. 200 m)'. The footer text 'GMO Free Regions, Berlin, 14.1.2006 B2 (Broder Breckling)' is centered at the bottom.

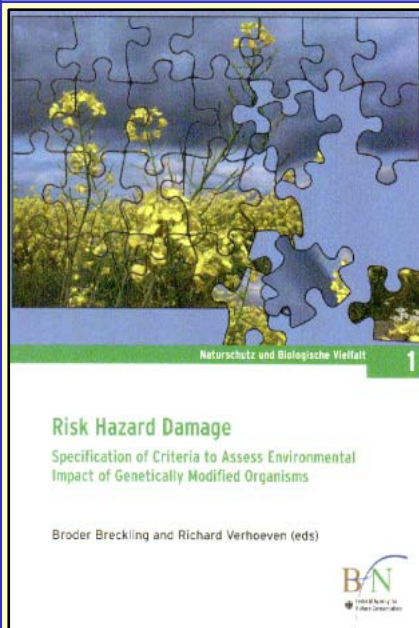


Preliminary conclusions

- There is a high variability of all processes involved.
- Larger area averages combining different impurity traits may still be below the 0.9 % threshold.
- However, seed reproduction requiring higher purity may become difficult in Schleswig Holstein.

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Further Reading



Breckling, B.; Verhoeven, R. (Eds.) 2004:

Risk, hazard, damage.
Specification of criteria to assess environmental impact of genetically modified organisms.

Bundamt für
Naturschutz, Bonn

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**Contribution to the session on
Outcrossing, contamination
and co-existence
- state of science and experience**

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- Study of oilseed rape and hybridisation partner frequency in and around Bremen

(Dissertation of
Gertrud Menzel)

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Cultivated Oilseed Rape



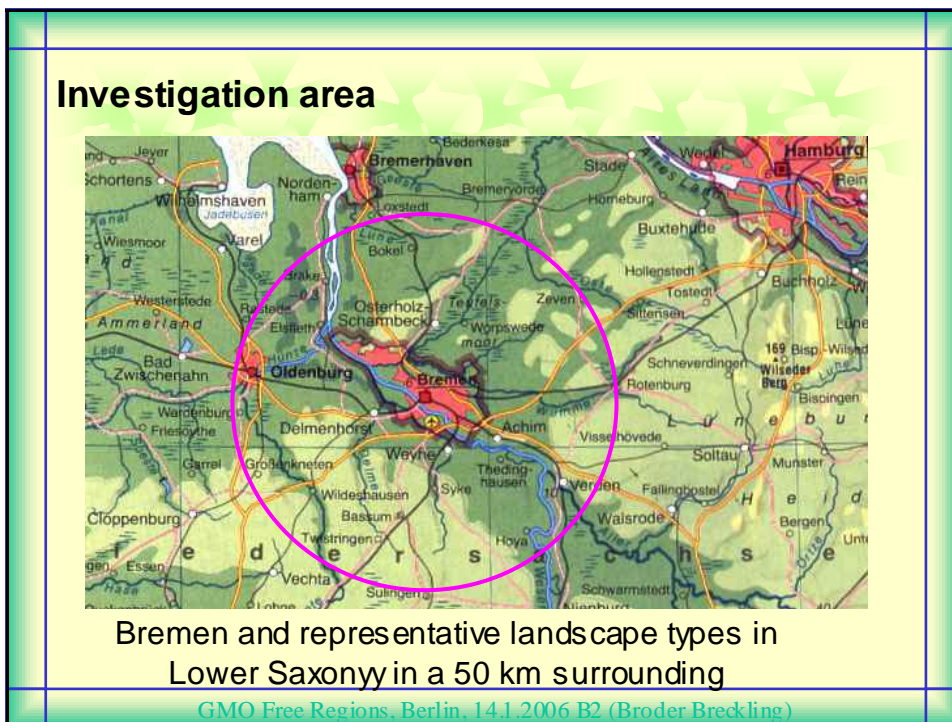
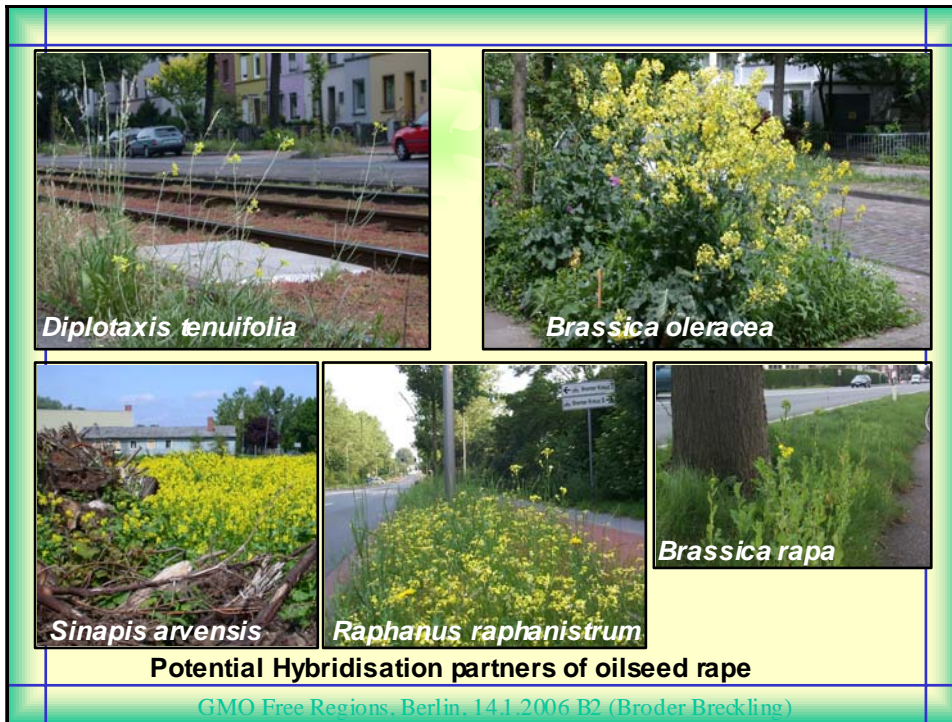
Volunteer Oilseed RApe

Feral oilseed rape



*Brassica
napus*

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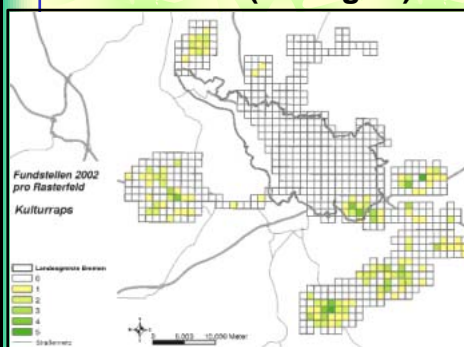


Outcrossing Potential

Very frequent species
<i>Brassica napus</i> (Raps)
<i>Sinapis arvensis</i> (Ackersenf)
Frequent species
<i>Brassica rapa</i> (Rübsen)
<i>Diploaxis tenuifolia</i> (Schmalblättriger Doppelsame)
<i>Brassica oleracea</i> (Gemüse-Kohl)
Common species
<i>Raphanus raphanistrum</i> (Hederich)
<i>Raphanus sativus</i> (Garten Rettich)
<i>Sinapis alba</i> (Weißer Senf)
Rare species
<i>Brassica nigra</i> (Schwarzer Senf)
<i>Descurainia sophia</i> (Gemeine Besenrauke)
<i>Diploaxis muralis</i> (Mauer doppelsame)
<i>Rapistrum rugosum</i> (Runzeliger Rapsdotter)
<i>Hirschfeldia incana</i> (Grausenf)
Not found in our study
<i>Brassica elongata</i> (Langrispiger Kohl)
<i>Diploaxis viminea</i> (Ruten-Doppelsame)
<i>Erucastrium gallicum</i> (Französische Hundsräuke)

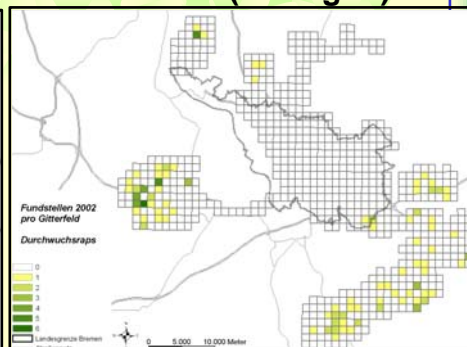
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Cultivation (1 km grid)



- Oilseed rape cultivation on about 13 % of the fields

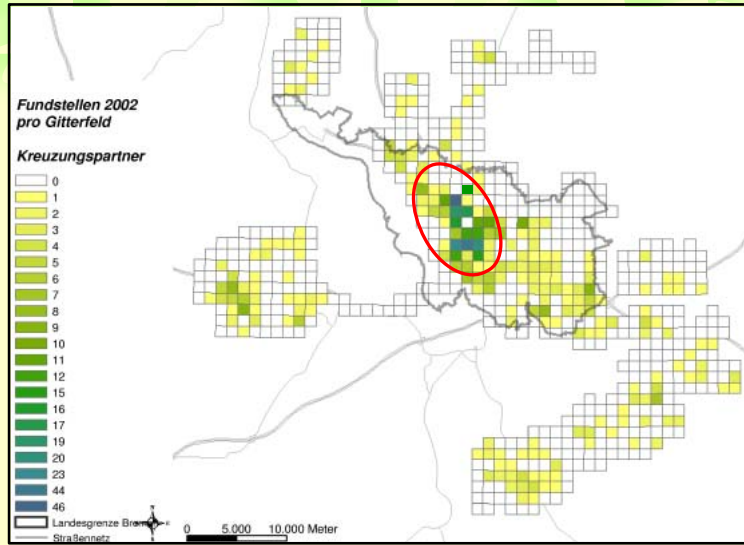
Volunteers (1 km grid)



- Volunteer growth on about ca. 7 % of the fields

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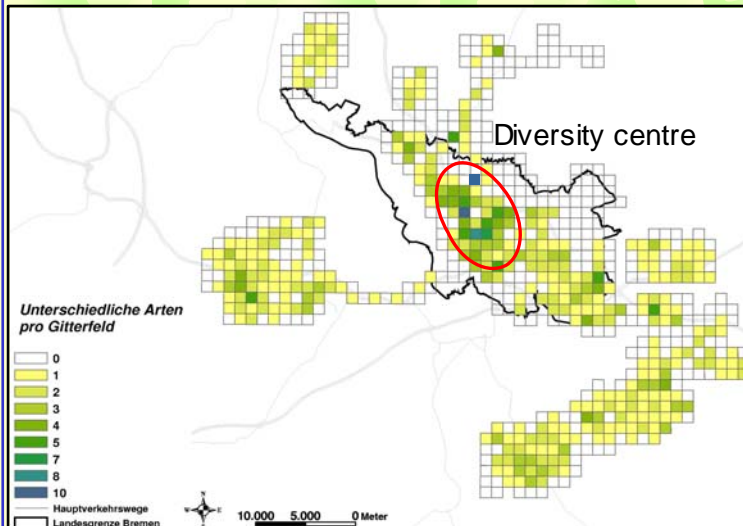
Potential hybridisation partners of OSR (# of locations)



Ø 1,4 Locations per km²

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Different species per grid element (1 km²)



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Flowering phase

Art	April '01	Mai '01	Juni '01	Juli '01	August '01	September '01	Oktober '01	November '01	Dezember '01	Januar '02	Februar '02	März '02	April '02	Mai '02	Juni '02	Juli '02	August '02	September '02	Oktober '02	November '02	Dezember '02	Januar '03	Februar '03	März '03	April '03	Mai '03	Juni '03	
Kulturraps																												
Ruderalraps	■	■	■	■	■	■	■	■				■	■	■	■	■	■	■	■	■					■	■	■	
<i>Brassica nigra</i>																												
<i>Brassica oleracea</i>																												
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<i>Sinapis alba</i>																												
<i>Sinapis arvensis</i>																												

- Oilseed rape has deviating flowering phase when growing outside cultivation
- Flowering OSR plants were found during the entire vegetation phase from March to November
- Flowering phase of OSR and potential hybridisation partners are largely overlapping

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Preliminary Conclusions

- There is a previously unrecognised biotic diversity centre of OSR and hybridisation partners in urban areas.
- OSR and hybridisation partner flowering phase largely overlap
- Frequent occurrences along transport axes (road, railways) may facilitate rapid displacements of new genotype combinations.

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Further Reading (in German)

Gentechnisch veränderte Pflanzen und Schutzgebiete - Wirksamkeit von Abstandsregelungen

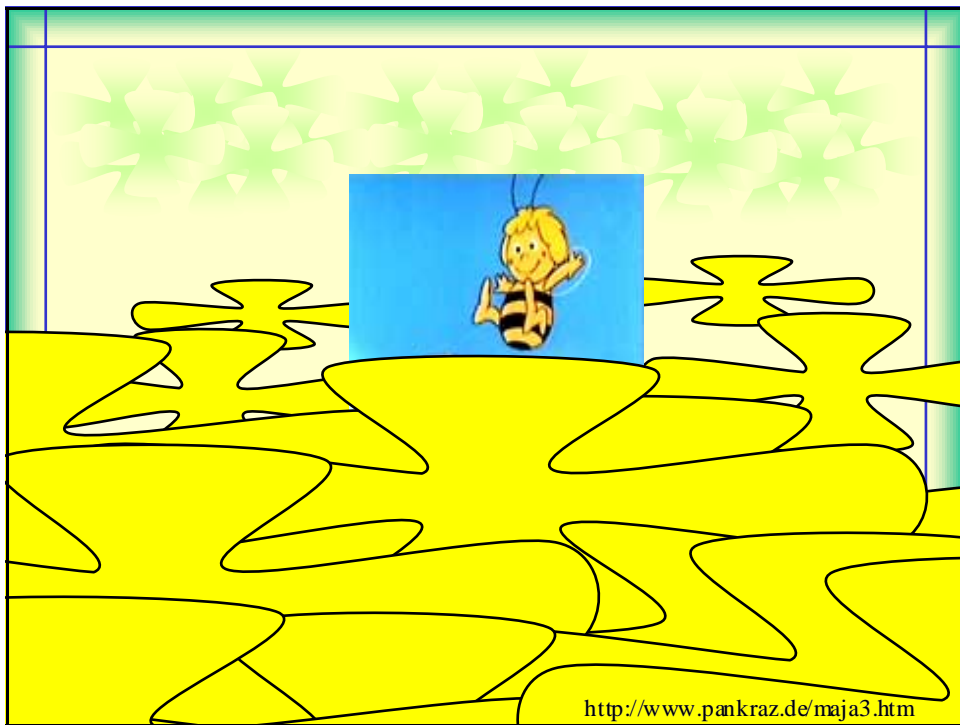
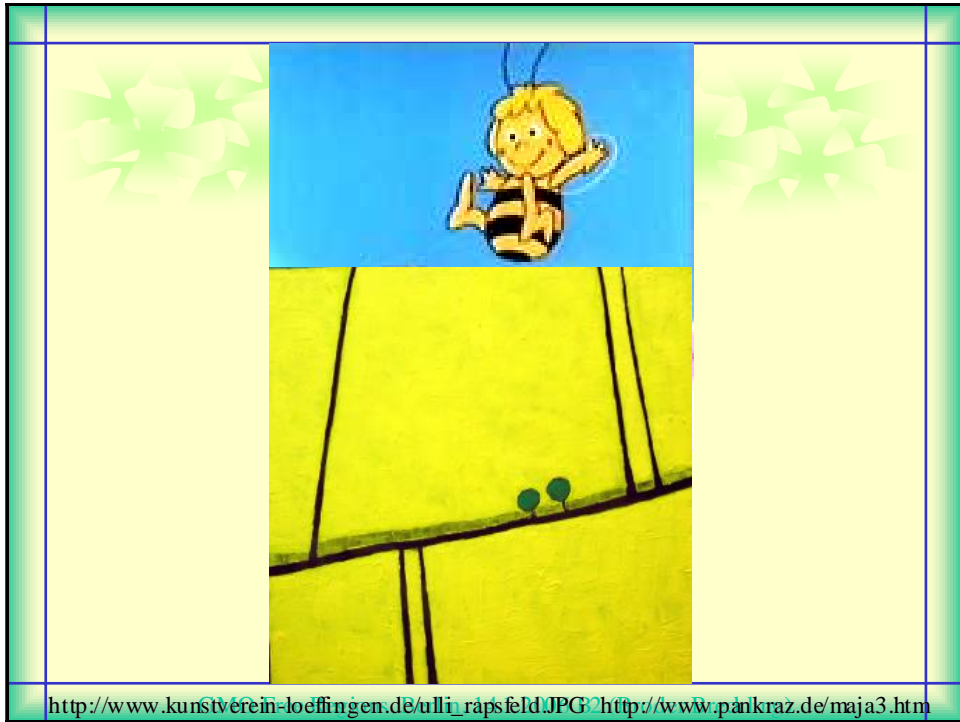
Gertrud Menzel, Ingo Lünsmann, Ulrike Middelhoff,
Broder Breckling, Gunther Schmidt, Jörg Tillmann,
Wilhelm Windhorst, Winfried Schröder,
Juliane Filser und Hauke Reuter
Bundesamt für Naturschutz, Bonn, 2004

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**Thank you
for your attention**

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Humm...



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<http://www.biene-bea.de/home>
<http://www.binex-shop.de/Rettet%20die%20Bienen.htm>

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