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Spatial planning of GMO monitoring

„Analysis of agricultural production and
potentials in Brandenburg as a basis for deriving
regional concepts of surveying GMOs"

Basic questions for designing a flexible GM crop monitoring

why? (which potential effects)
what? (which variables)
how? (which field and lab methods)
when? (how often, which period)
where? (number and location of sites)

systematic scheme !

with diverse...

- GM crop traits
- agro-ecological sites
- potential agro-environmental effects
- cropping systems

Information layers for GM crop monitoring

site ecology + CORINE land cover
(CLC class "arable land", overlay)

crop species distribution

Anbaukonzentration von Mais innerhalb der Landkreise

Monitoring networks
- LSM
- FOPV
- IEM
- EMBR

GIS analysis scheme for determining GM crop monitoring sites

area information

determine high ranked layers (land cover, site ecology)

specify relevant classes (arable land, six ecoregions)

create max. class Nr, overlay (six classes)

optimise class Nr. a) verify if all classes are relevant
(not relevant with our data) b) reduce to 95% largest areas

network (point) information

append and rank networks (IEM>EMBR>LSM>FOPV)

specify site Nr. / class (three, six)

specify network composition
a) LSM
b) LSM,FOPV
c) LSM, FOPV,IEM,EMBR

area + point information

1. all crops: append network to area layers
2. all crops: overlay crop cultiv. systems (not avail. → farm survey)
3. maize: overlay present infestation (relevant class: Oder valley)
3. canola: apply „max. distance <2000 m to potential crossing partner sites" (urban areas, forest, arableland inland cover layer)
4. all crops, maize: overlay crop spec. distribution (relevant classes: medium, high) overlay potential infestation (relevant classes: medium, high)
a) apply site reduction in networks only if site Nr. > specified Nr.
b) reduce among low ranked networks
5. canola overlay crossing partners (not relevant: ubiquitous or not existing)

site reduction and optimisation rules on area information

present optimum monitoring sites for GM crops

1. multiple overlay of area layers
2. select largest areas in classes

additional site areas (visualisation)

Determining potential sites and additional areas

HR-canola, all networks, six sites per class

Potential monitoring areas for HR-canola (eight largest areas per landscape)

landscape nr.

Summary

- systematic network planning approach, that integrates the agro-environmental variability
- based on expert knowledge, semi quantitative and quantitative data (state of knowledge)
  → assessments, rankings and optimisation rules
- transferable framework
- functional (data required, CPU time, PC programme)

Preliminary variables for _case specific monitoring_ of Bt-Maize in Brandenburg / assessment and ranking of spatial information layers

Assessment of environmental monitoring networks in Brandenburg

monitoring network[1]	LSM	IEM	EMBR	FOPV	PPA	GMO-relevance[2]
site No. in BB	31	12	89	23	20-30, flexible	-
arable land sites in BB	24	3	36	23	20-30, flexible	-
site No. in Germany	672	-	-	815	-	-
spatial representativeness[3]	high	low	low	high	medium	-
variable groups and no. of measured variables						
soil characteristics	3	7	5	4		1
soil analyses	8	11	9	3	1	2
climate factors	0	3	2	6	1	2
fauna	3	4	1	0	1	3
flora	3	4	7	8	8	2
agricultural management	4	4	7	8	8	2
total No. of variables	19	33	30	17	13	
overall suitability assessment[4]	27	46	42	25	24	
ranking	medium	high	high	medium	medium	