a MILE ahead: the number one trade programme in the world
est. 1999

Klaus Ammann, prof. em. University of Bern, Switzerland

klaus.ammann@ips.unibe.ch
www.botanischergarten.ch/Curriculum/Links.pdf

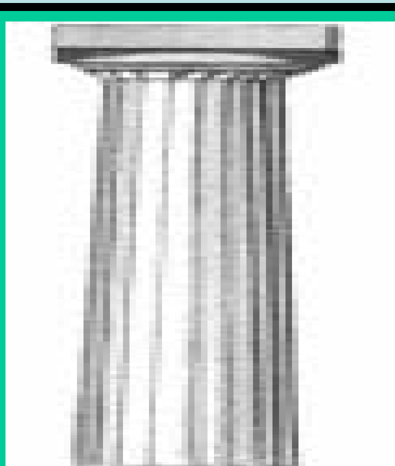
www.botanischergarten.ch/ASK-FORCE-Summary/ASK-FORCE-Summary.pdf

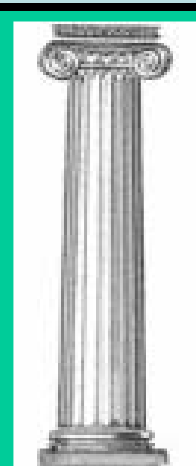
Biodiversity and Biotechnology: Myths and Good News that shape Trade Regulation

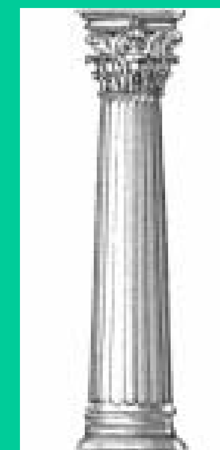
1 sustainability
2 Genomics
3 bi0diversity
4 opportunities

1 sustainability

Sustainable World







Agriculture

Foster renewable natural resources, knowledge based agriculture: Organic Precision Biotech Ag, Balance local production with global trade

Socio-Economics

Equity: reconcile traditional knowledge with science, foster biomimetics, reduce agricultural subsidies, global dialogue including new creative capitalism

Technologies

Innovation supported by artificial intelligence, influence evolution, new technologies to process and use of housing, food, energy

before we can build
a sustainable world,
we must free agriculture
from ideology and myth

2 Genomics

Molecular processes

in Genetic Engineering

and Natural Mutation:

there is no difference

Werner Arber, Nobel Laureate 1978:

Interestingly, naturally occurring molecular evolution, i.e. the spontaneous generation of genetic variants has been seen to follow exactly the same three strategies as those used in genetic engineering14. These three strategies are
:

(a) small local changes in the nucleotide sequences,
(b) internal reshuffling of genomic DNA segments, and
(c) acquisition of usually rather small segments of DNA from another type of organism by horizontal gene transfer.

Arber, W. (2002)
Roots, strategies and prospects of functional genomics. Current Science, 83, 7, pp 826-828
http://www.botanischergarten.ch/Mutations/Arber-Comparison-2002.pdf

Arber, W. (2002)
Roots, strategies and prospects of functional genomics. Current Science, 83, 7, pp 826-828
http://www.botanischergarten.ch/Mutations/Arber-Comparison-2002.pdf

However, there is a principal difference between the procedures of genetic engineering and those serving in nature for biological evolution. While the genetic engineer pre-reflects his alteration and verifies its results, nature places its genetic variations more randomly and largely independent of an identified goal.
And after ca. 10 years of safety assessment transgenic crops are
distributed to the millions in a short time.

Arber, W. (2002)
Roots, strategies and prospects of functional genomics. Current Science, 83, 7, pp 826-828
http://www.botanischergarten.ch/Mutations/Arber-Comparison-2002.pdf

Arber, W. (2002)
Roots, strategies and prospects of functional genomics. Current Science, 83, 7, pp 826-828
http://www.botanischergarten.ch/Mutations/Arber-Comparison-2002.pdf

Scientifically incorrect molecular concepts in Organic Farming

Concepts of Intrinsic Value and Integrity of Plants in Organic Plant Breeding and Propagation

E. T. Lammerts van Bueren,* P. C. Struik, M. Tiemens-Hulscher, and E. Jacobsen

van Bueren, E.T.L., Struik, P.C., Tiemens-Hulscher, M., & Jacobsen, E. (2003)
Concepts of intrinsic value and integrity of plants in organic plant breeding and propagation.
Crop Science, 43, 6, pp 1922-1929
http://www.botanischergarten.ch/Organic/van-Bueren-Organicbreeding.pdf

The natural approach taken by organic agriculture obviates the use of synthetic agrochemicals and emphasizes farming in accordance with agroecological principles. Also implicit in this approach is an appreciation for the *integrity* of living farm organisms, with the integrity being evaluated from a biocentric perspective. The ethical value assigned to integrity of organisms has challenged us to develop criteria for evaluating both integrity and breeding techniques. For cultivated plants, integrity refers to their inherent nature, their wholeness, completeness, species-specific characteristics, and their being in balance with their (organically farmed) environment. We evaluate integrity using criteria derived from four different perspectives: integrity of life, plant-specific integrity, genotypic integrity, and phenotypic integrity.

Comparative microarray analysis demonstrates, that transcriptomic disturbances are more important in conventional crops when compared to isolines of transgenic crops

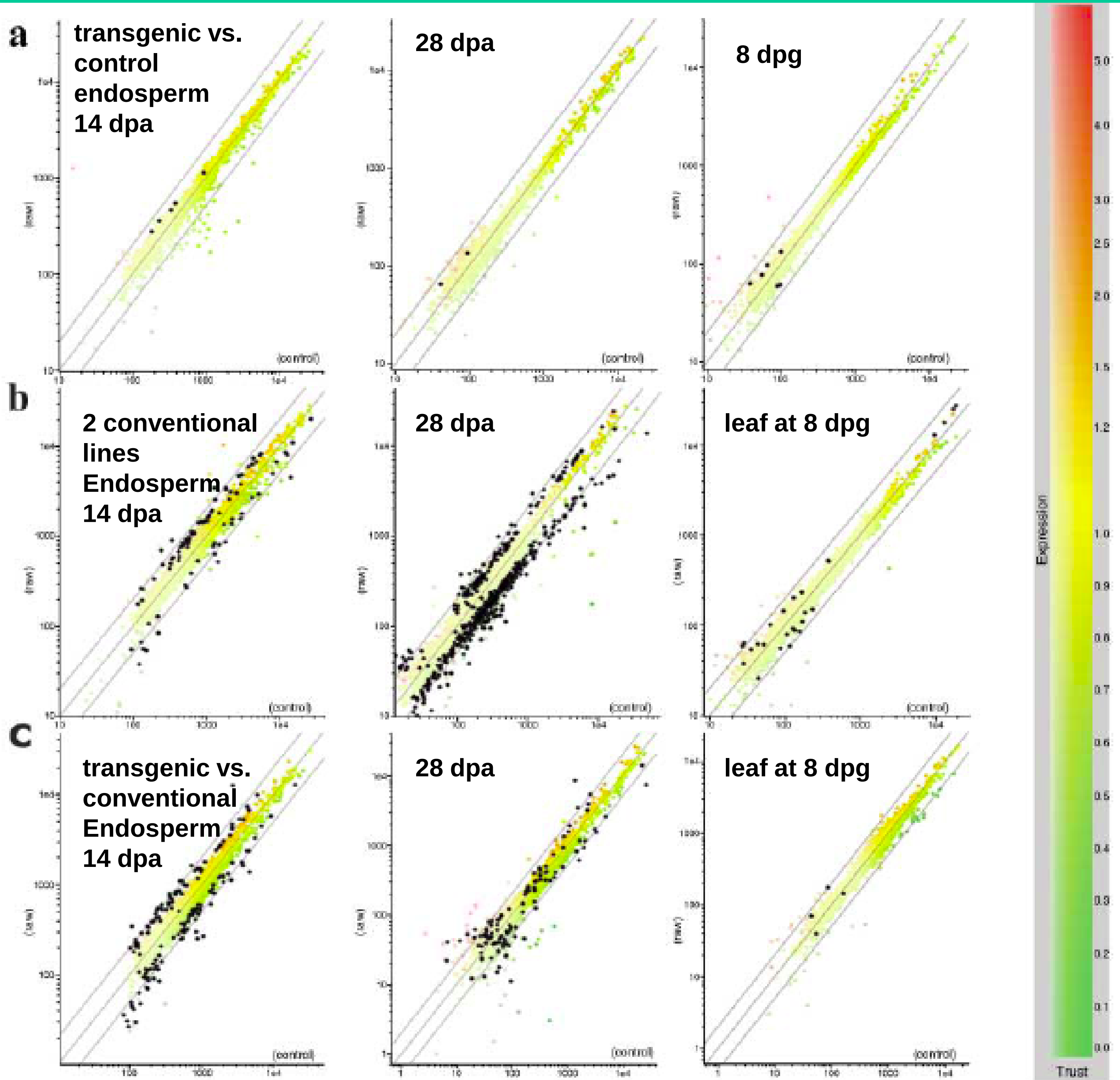
Barros, E., Lezar, S., Anttonen, M.J., Dijk, J.P.v., Röhlig, R.M., Kok, E.J., & Engel, K.-H. 2010
Comparison of two GM maize varieties with a near-isogenic non-GM variety using transcriptomics, proteomics and metabolomics. Plant Biotechnology Journal, 8, 4, pp 436-451
http://www.botanischergarten.ch/Genomics/Barros-Comparison-GM-crops-2010.pdf

Batista, R., Saibo, N., Lourenco, T., & Oliveira, M.M. (2008)
Microarray analyses reveal that plant mutagenesis may induce more transcriptomic changes than transgene insertion. Proceedings of the National Academy of Sciences of the United States of America, 105, 9, pp 3640-3645
http://www.botanischergarten.ch/Genomics/Batista-Microarray-Analysis-2008.pdf AND
http://www.botanischergarten.ch/Genomics/Transgenesis-Comparison-Slides.pdf A ND
Http://www.botanischergarten.ch/Genomics/Transgenesis-Comparison-Slides.ppt

Baudo, M.M., Lyons, R., Powers, S., Pastori, G.M., Edwards, K.J., Holdsworth, M.J., & Shewry, P.R. (2006)
Transgenesis has less impact on the transcriptome of wheat grain than conventional breeding. Plant Biotechnology Journal, 4, 4, pp 369-380
http://www.botanischergarten.ch/Organic/Baudo-Impact-2006.pdf AND
http://www.botanischergarten.ch/Genomics/Transgenesis-Comparison-Slides.pdf AND
http://www.botanischergarten.ch/Genomics/Transgenesis-Comparison-Slides.ppt

Shewry, P.R., Baudo, M., Lovegrove, A., & Powers, S. (2007)
Are GM and conventionally bred cereals really different? Trends in Food Science & Technology, 18, 4, pp 201-209
http://www.botanischergarten.ch/Wheat/Shewry-Are-GM-Convent-Cereals-different-2007.pdf

Scatter plot representation of transcriptome comparisons, Baudo et al. 2006

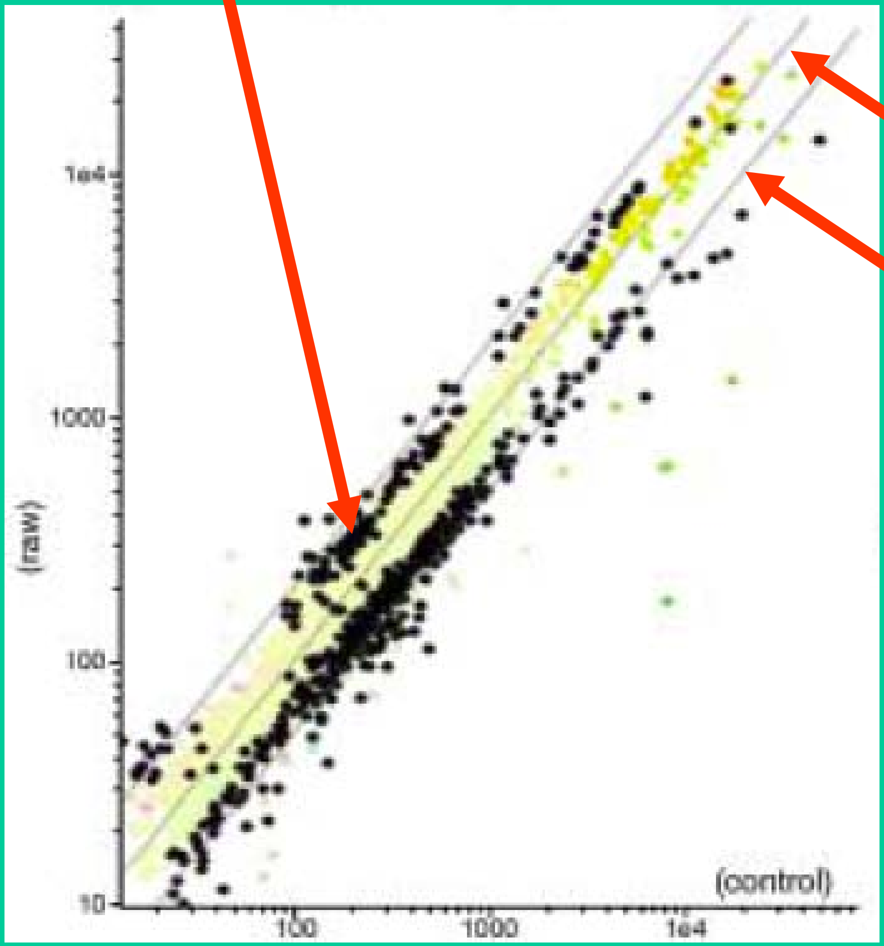


Baudo, M.M., Lyons, R., Powers, S., Pastori, G.M., Edwards, K.J., Holdsworth, M.J., & Shewry, P.R. (2006)
Transgenesis Has Less Impact on the Transcriptome of Wheat Grain Than Conventional Breeding.
Plant Biotechnology Journal, 4, 4, pp 369-380
http://www.botanischergarten.ch/Organic/Baudo-Impact-2006.pdf

Shewry, P.R. & Jones, H.D. (2005)
Transgenic Wheat: Where Do We Stand after the First 12 Years? Annals of Applied Biology, 147, 1, pp 1-14
http://www.botanischergarten.ch/Organic/Shewry-Performance-2006.pdf

Baudo: comparison in genomic disturbance: GM crops are less disturbed (black dots) than classic breed

Dots in black represent statistically significant, differentially expressed genes (
at an arbitrary cut off > 1.5.



The inner line on each graph represents no change in expression.

The offset dashed lines are set at a relative expression cut-off of twofold.

Coloured dots:
relative gene expression levels:
reds indicate overexpression,
yellows average expression,
greens under-expression.

Example b) middle in slide 6:
2 conventional lines compared in Endosperm at 28 dpa

Scatter plot representation of transcriptome comparisons

Dots represent the normalized relative expression level of each arrayed gene for the transcriptome comparisons described

Full caption of slide 6:
Scatter plot representation of transcriptome comparisons of:

(a) transgenic B102-1-1 line vs. control L88-31 line in endosperm at 14 dpa (left), 28 dpa (middle) or leaf at 8 dpg (right);

(b) conventionally bred L88-18 vs. L88-31 line in endosperm at 14 dpa (left), 28 dpa (middle), or leaf at 8 dpg (right);

(c) transgenic B102-1-1 line vs. conventionally bred L88-18 line in endosperm at 14 dpa (left), 28 dpa (middle), or leaf at 8 dpg (right).

Dots represent the normalized relative expression level of each arrayed gene for the transcriptome comparisons described.

Dots in black represent statistically significant, differentially expressed genes (DEG) at an arbitrary cut off > 1.5.

The inner line on each graph represents no change in expression. The offset dashed lines are set at a relative expression cut-off of twofold.

In the adjacent coloured bar (rectangle on the far right of the figure), the vertical axis represents relative gene expression levels: reds indicate overexpression, yellows average expression, and greens under-expression.

Values are expressed as *n*-fold changes. The horizontal axis of this bar represents the degree to which data can be trusted: dark or unsaturated colour represents low trust and bright or saturated colour represents high trust.

Plant Biotechnology Journal (2006) **4**, pp. 369–380 doi: 10.1111/j.1467-7652.2006.00193.x

Transgenesis has less impact on the transcriptome of wheat grain than conventional breeding

María Marcela Baudo[1], Rebecca Lyons[1], Stephen Powers[1], Gabriela M. Pastori[1,†], Keith J. Edwards[2], Michael J. Holdsworth[3] and Peter R. Shewry[1,*]

[1]*Rothamsted Research, Harpenden AL5 2JQ, UK*
[2]*School of Biological Sciences, University of Bristol, Woodland Road, Bristol BS8 1UG, UK*
[3]*Division of Agricultural and Environmental Sciences, School of Biosciences, University of Nottingham, Nottingham NG7 2RD, UK*

Differences observed in gene expression in the endosperm between conventionally bred material were much larger in comparison to differences between transgenic and untransformed lines exhibiting the same complements of gluten subunits. These results suggest that the presence of the transgenes did not significantly alter gene expression and that, at this level of investigation, transgenic plants could be considered substantially equivalent to untransformed parental lines.

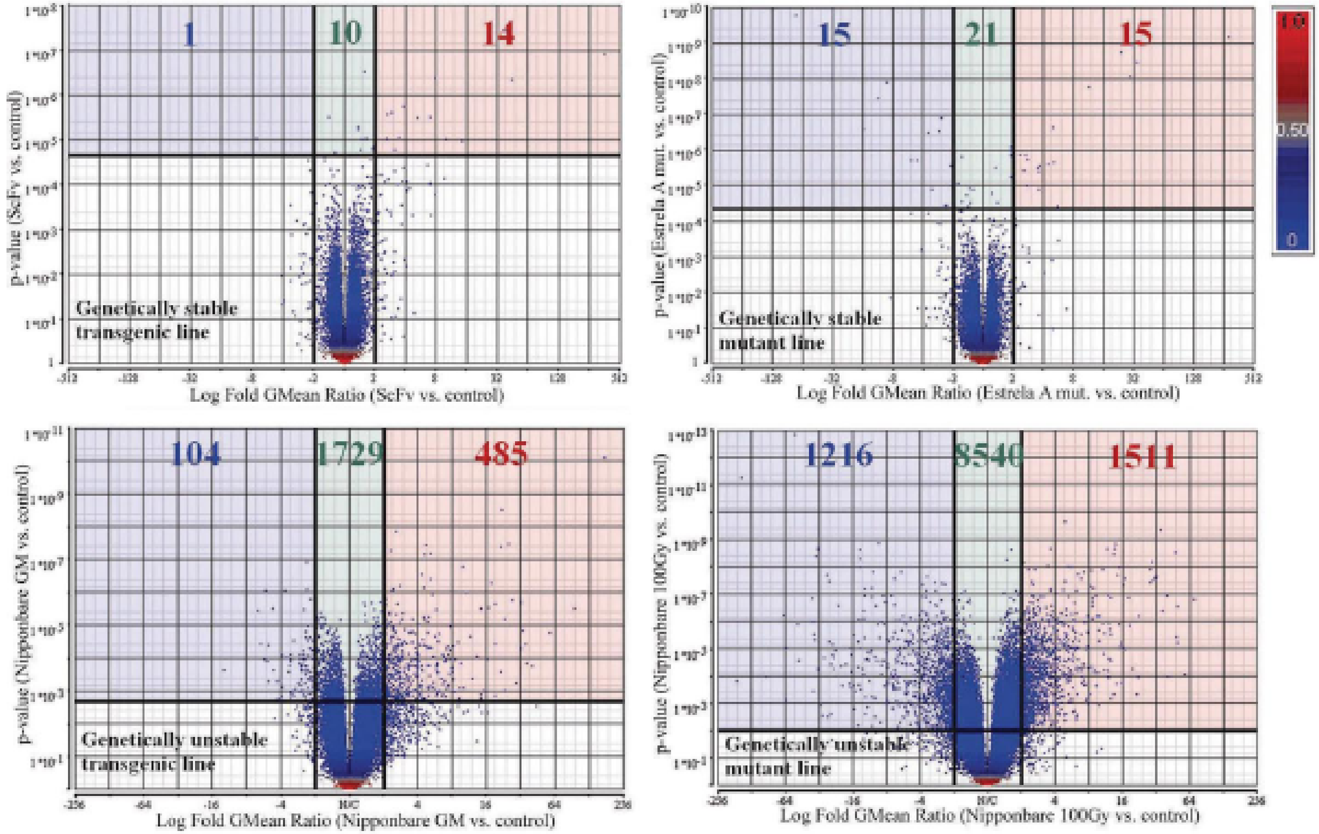
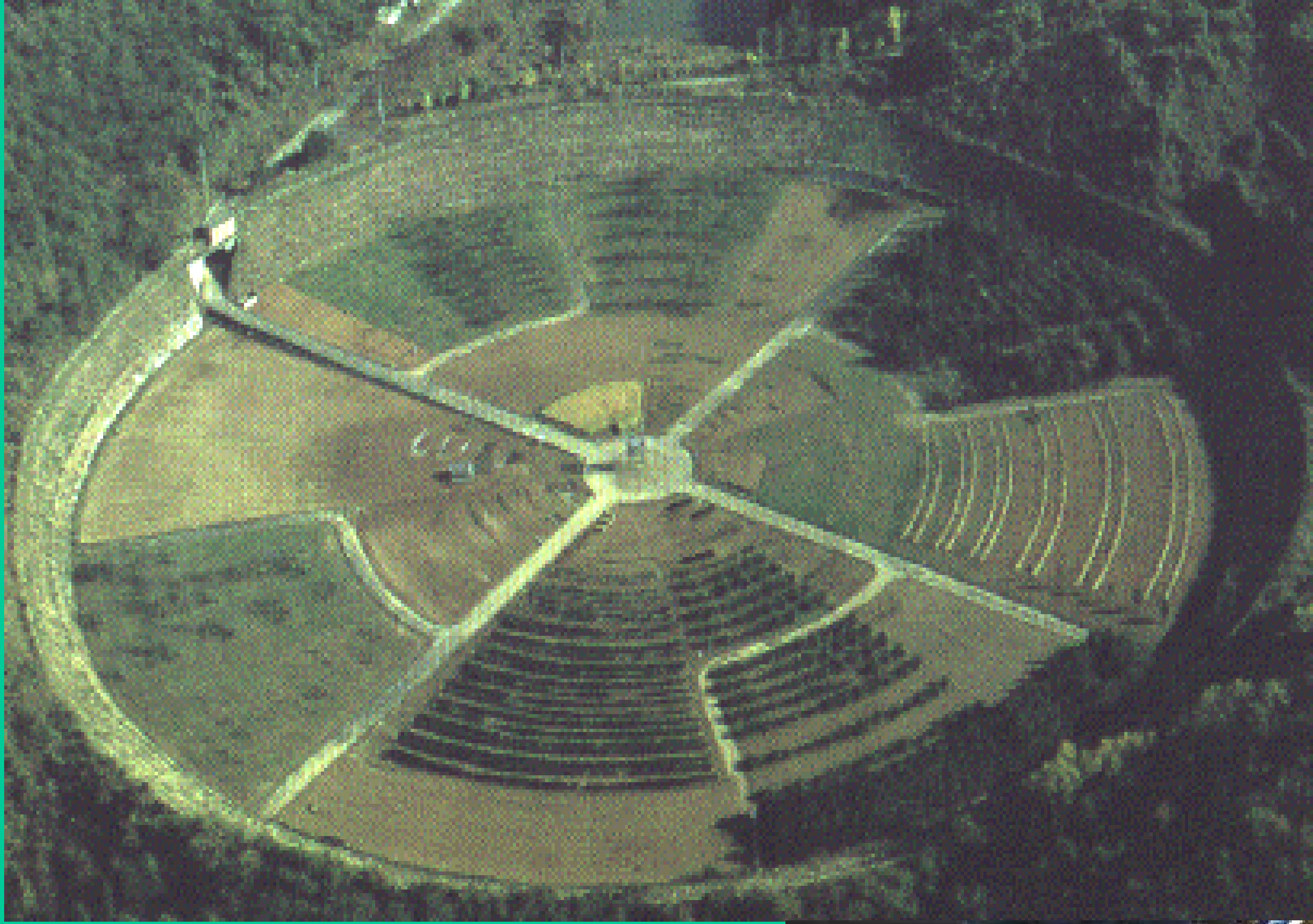


Fig. 2. Volcano plots for differentially expressed genes. Differentially expressed genes appear above the thick horizontal lines. Genes induced >2-fold are on the right of the right vertical lines, and the ones repressed >2-fold are on the left of the left vertical line. The numbers corresponding to the differentially expressed genes induced >2-fold for each experiment (red-shadowed area) are red, and those corresponding to the genes repressed >2-fold (blue-shadowed area) are blue. The green-shadowed area corresponds to differentially expressed genes that were up- or down-regulated <2-fold (green-colored numbers). Blue-colored genes are those with *P* between 0 and 0.5, and red-colored genes are those with *P* between 0.5 and 1.

Batista, R., Saibo, N., Lourenco, T., & Oliveira, M.M. (2008)
Microarray analyses reveal that plant mutagenesis may induce more transcriptomic changes than transgene insertion. Proceedings of the National Academy of Sciences of the United States of America, 105, 9, pp 3640-3645
http://www.botanischergarten.ch/Genomics/Batista-Microarray-Analysis-2008.pdf

Gamma Field for radiation breeding



100m radius

89 TBq Co-60 source at the center Shielding dike 8m high

Institute of Radiation Breeding Ibaraki-ken, JAPAN http://www.irb.affrc.go.jp/

Better spaghettis, whisky

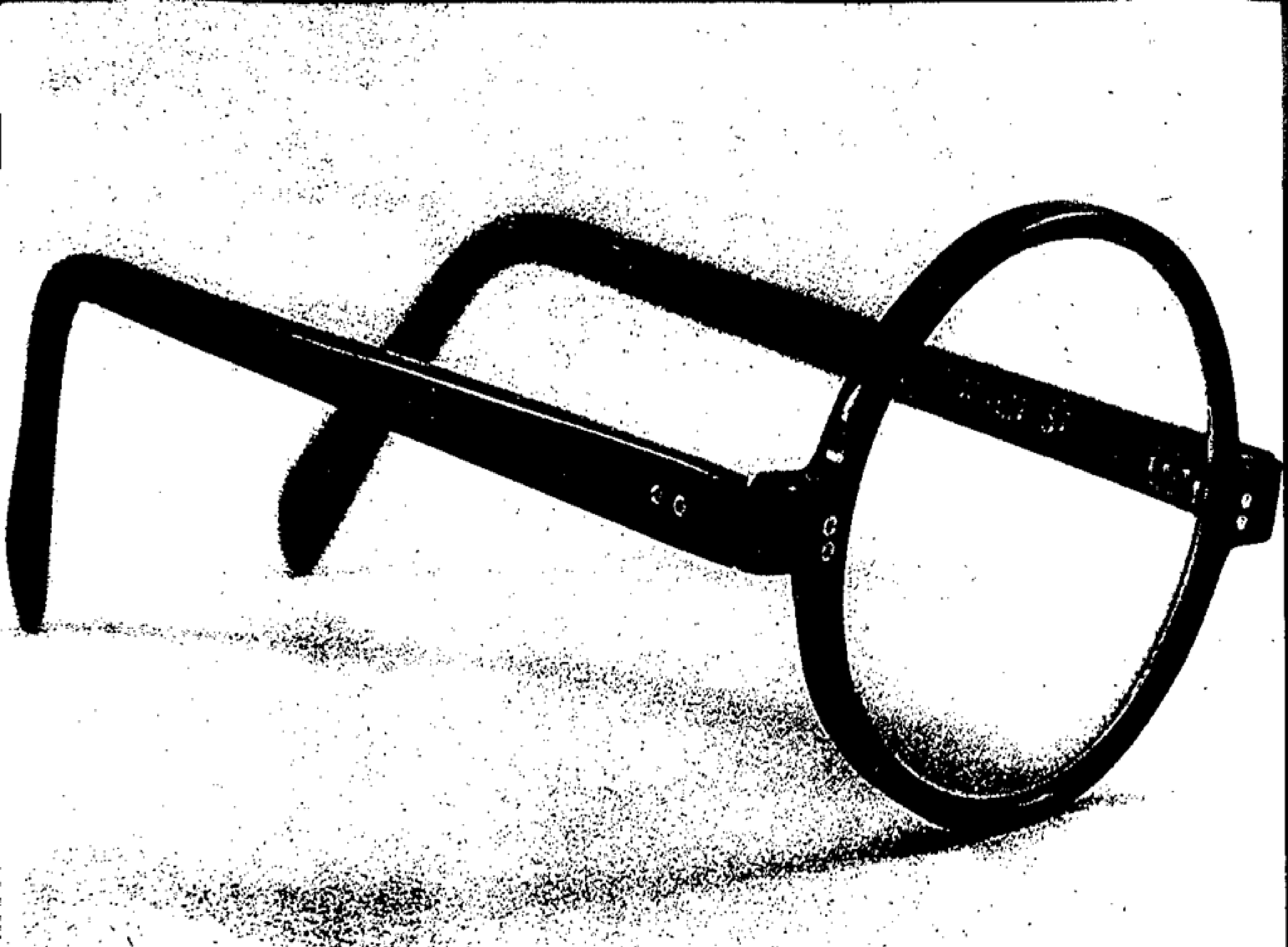
1800 new plants

Real Frankenfood

Worldwide:

all pasta is made from radiation mutated durum wheat Triticum durum

Photo-Cartoon Klaus Ammann

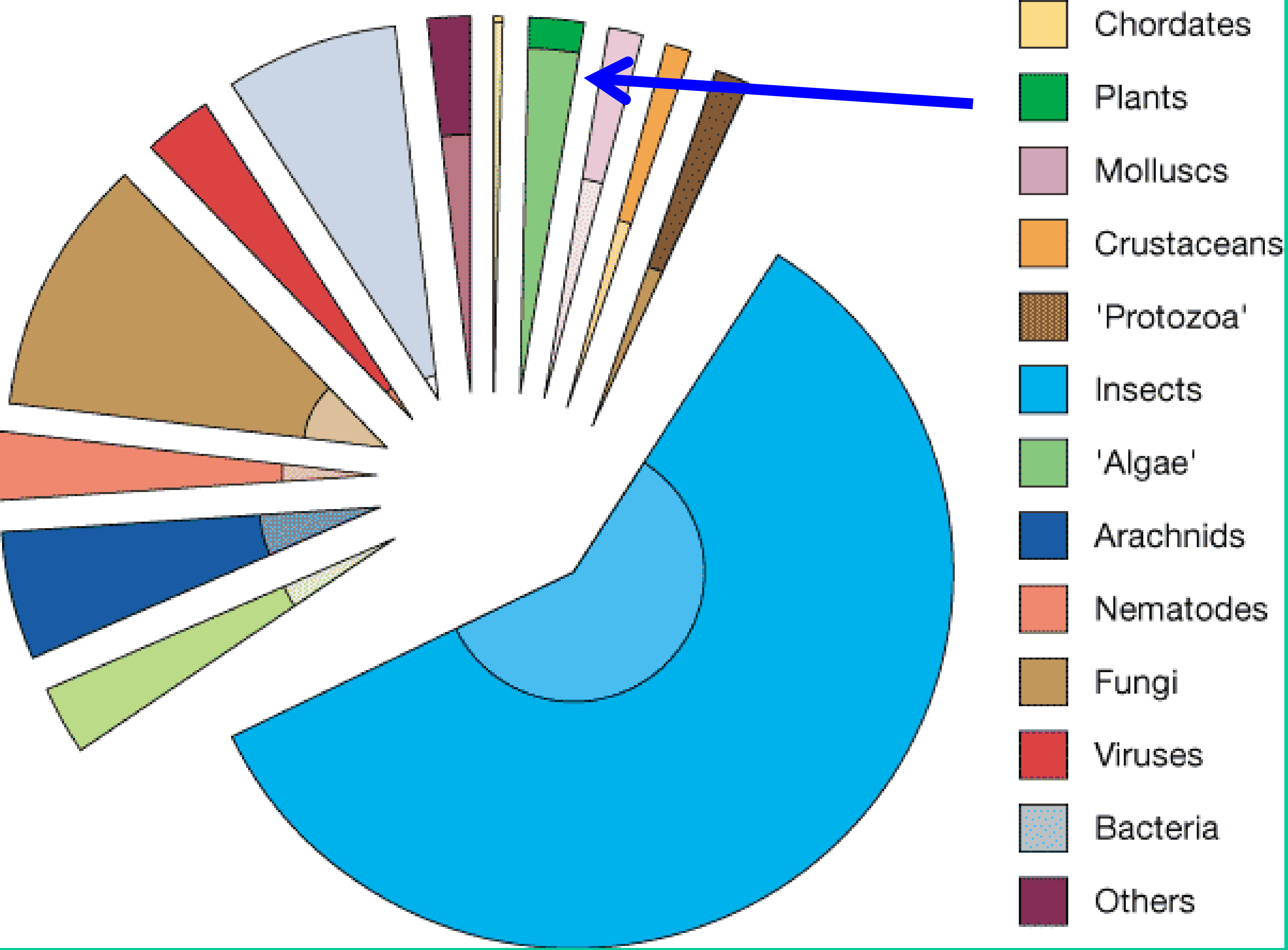


Monocle: onesided views should not be accepted

3 biOdiversity

The case of biodiversity and GM crops

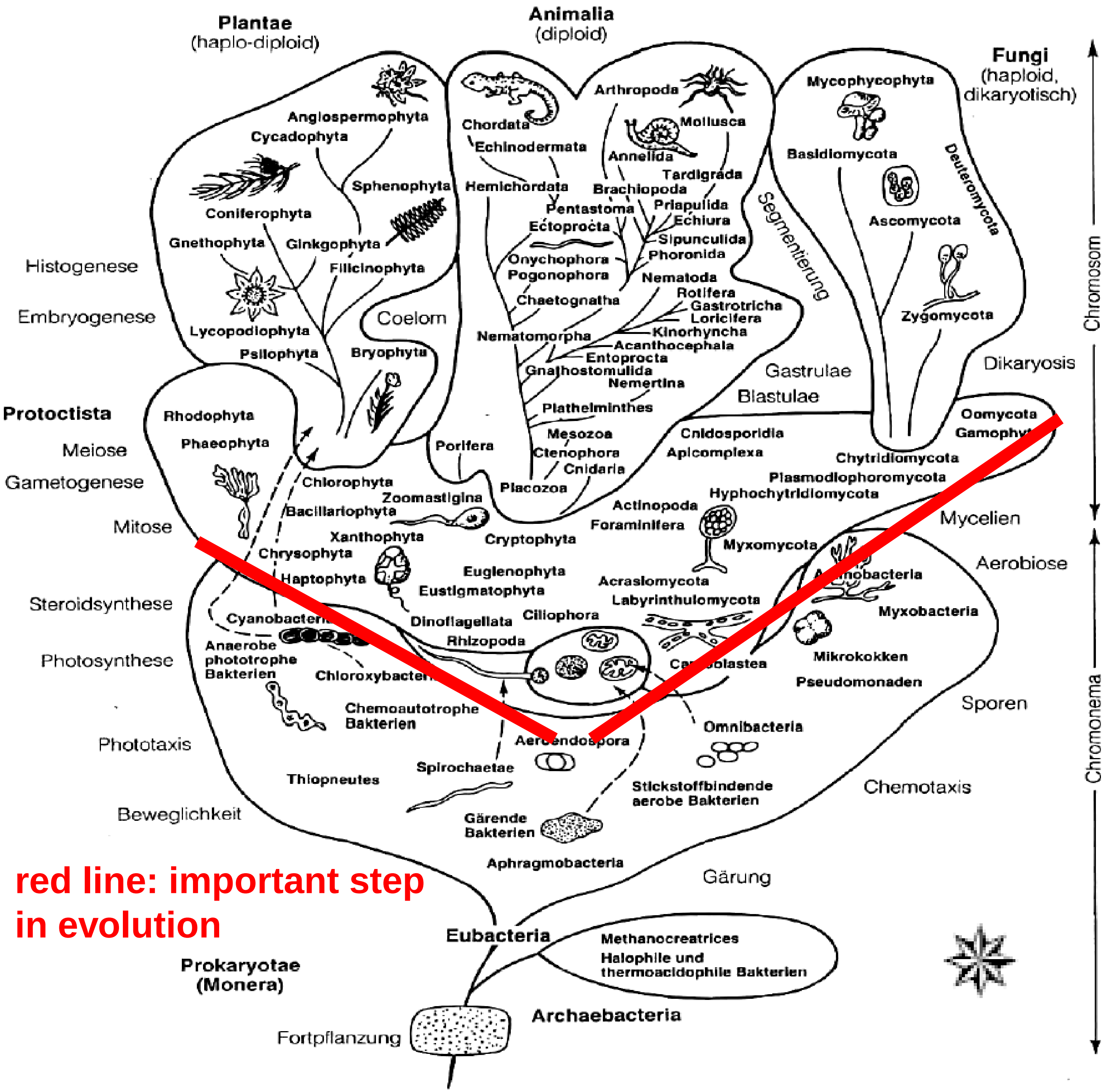
GM crops are beneficial for agrobiodiversity



Number of species:

Insects dominate

Nature Insight Biodiversity: Species richness in major groups of organisms
Purvis, A. & Hector, A. (2000)
Getting the measure of biodiversity. Nature, 405, 6783, pp 212-219
http://www.botanischergarten.ch/biodiversity/Purvis-Nature-Biodiv-Measure-2000.pdf



red line: important step in evolution

Evolution in perspective of the cell

Margulis, L. (1992) BIODIVERSITY - MOLECULAR BIOLOGICAL DOMAINS, SYMBIOSIS AND KINGDOM ORIGINS.

Biosystems, 27, 1, pp 39-51

Historical Evolution of Species Diversity, Inventories based on opinions of Diverse Experts, contradictions

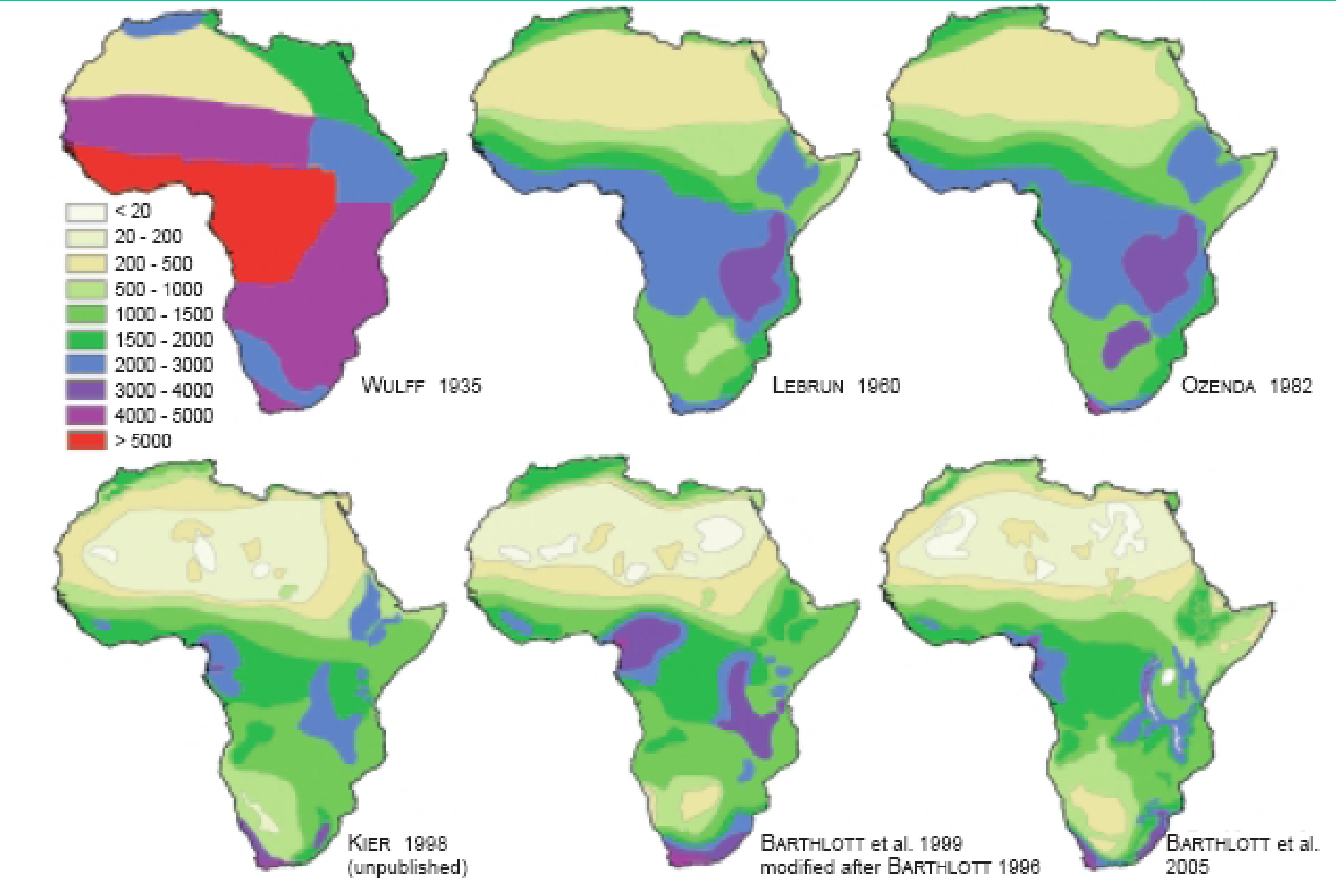
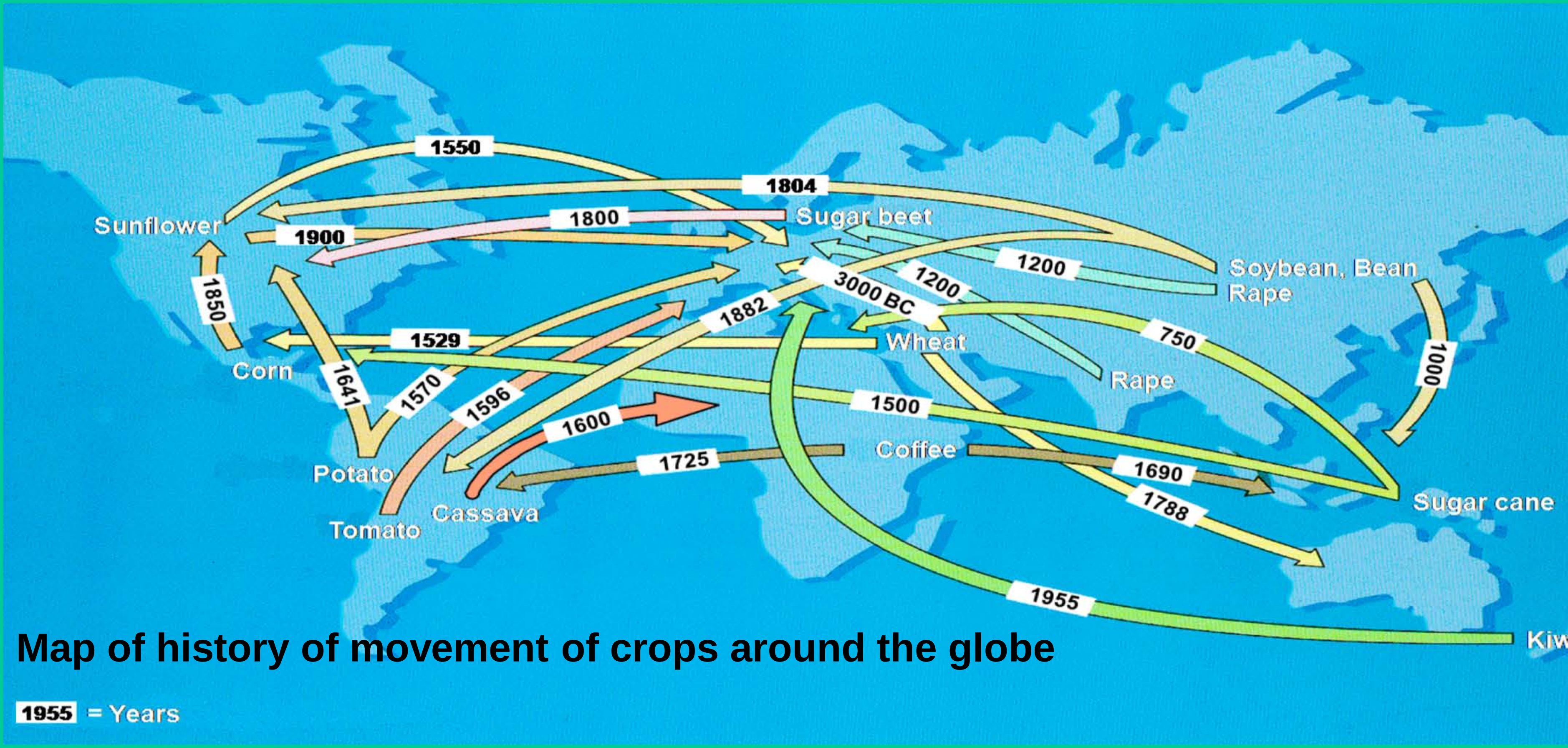


Fig. 1: Historical evolution of maps displaying plant species richness patterns in Africa. Apart from the map of WULFF (1935), which indicates the total species richness of the displayed areas, the maps show species richness per standard area of 10,000 km². All maps are inventory-based and to a varying degree rely on expert-opinion. The same legend of ten classes as displayed was applied to all maps

Barthlott, W., Hostert, A., Kier, G., Koper, W., Kreft, H., Mutke, J., Rafiqpoor, M.D., & Sommer, J.H. (2007) Geographic patterns of vascular plant diversity at continental to global scales. Erdkunde, 61, 4, pp 305-315
http://www.botanischergarten.ch/Biodiv-Systematik/Barthlott-Geographic-Patterns-2007.pdf AND
http://www.nees.uni-bonn.de/biomaps/biota.html



Map of history of movement of crops around the globe

There is no such thing as "indigenous landraces in places of origin" but lots of landraces to be preserved with traditional knowledge and modern technology

Dubock, A.C. (2009)
Crop conundrum. Nutrition Reviews, 67, 1, pp 17-20
http://www.botanischergarten.ch/Golden-Rice/Dubock-Crop-Conundrum-2009.pd f

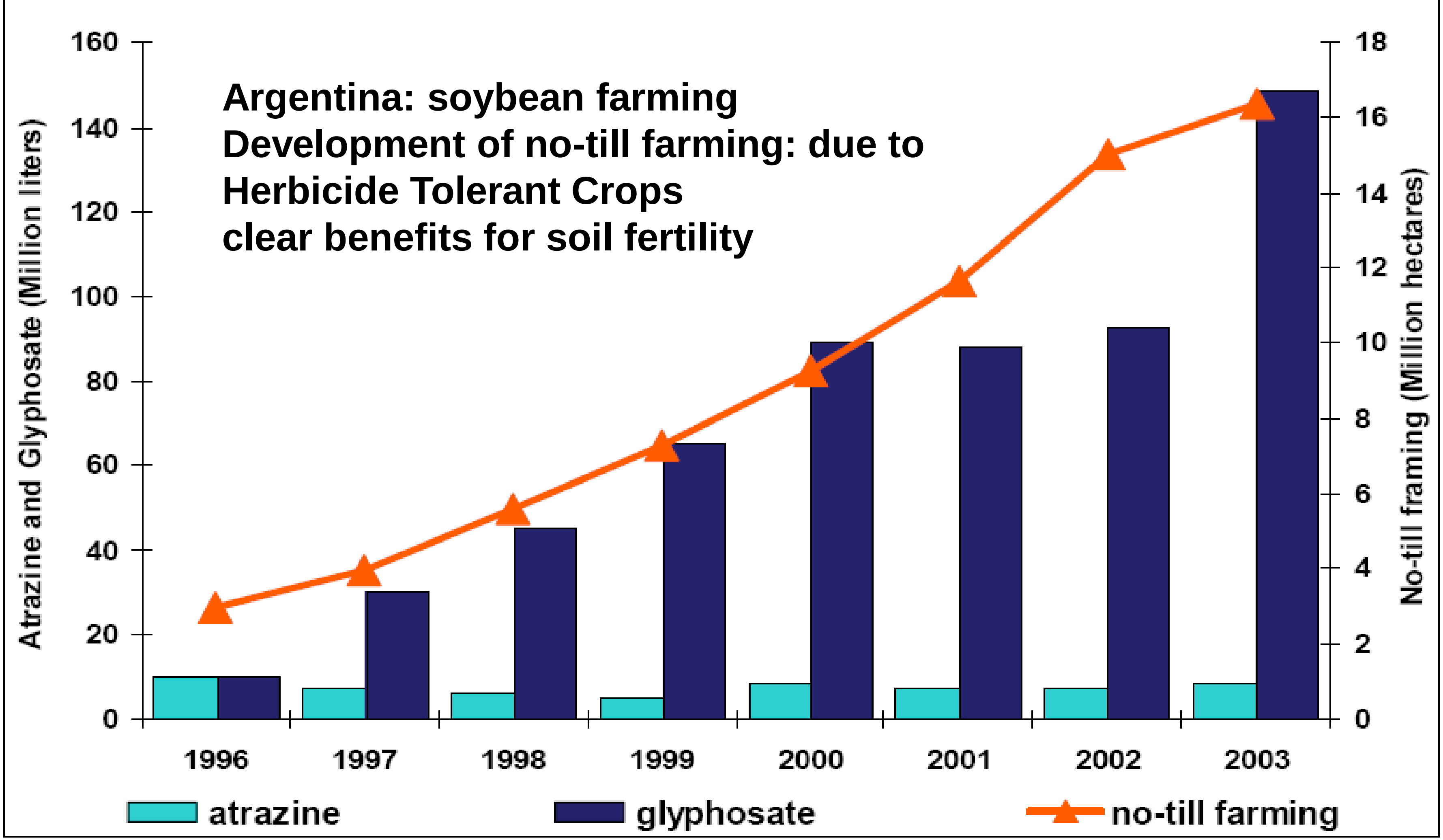
Nature's fields: a neglected model for increasing food production

D. Wood and J. Lenné

Ancestral farmers have choosen wheat, barley sorghum and rice because they were living in natural monodominant stands

Natural ecosystems can offer attractive models for sustainable crop production, but hitherto only relatively complex vegetation has been considered. This review focuses on simple vegetation with a single dominant species. There are many reports of wild relatives of rice, sorghum and wheat in simple, extensive, often annual and apparently stable natural stands. These 'wild fields' could provide appropriate models for the ecologically sound management of cereal fields. The authors suggest that early farmers had a working knowledge of the ecology of wild cereal vegetation: this was important during cereal domestication and subsequently in crop management.
There is a need for field research on monodominant wild cereal vegetation to confirm the value of simple natural models and to provide an ecological pedigree for the sustainable management of fields for food production.

Wood, D. & Lenne, J. (2001)
Nature's fields: a neglected model for increasing food production. Outlook on Agriculture, 30, 3, pp 161-170
http://www.botanischergarten.ch/Organic/Wood-Natures-Fields-2001.pdf



Sources: AAPRESID and CASAFE

Trigo, E. J. and E. J. Cap (2007).
Ten Years of Genetically Modified Crops in Argentine Agriculture, Argentine Council for Information and Development of Biotechnology – ArgenBio.: pp 52.
http://www.botanischergarten.ch/HerbizideTol/Trigo-10years-Argentina-2006.pdf

Evolution of the area planted with no-till farming and type of herbicide used: Tri

Replacement of other often problematic herbicides by bio-degradable glyphosate

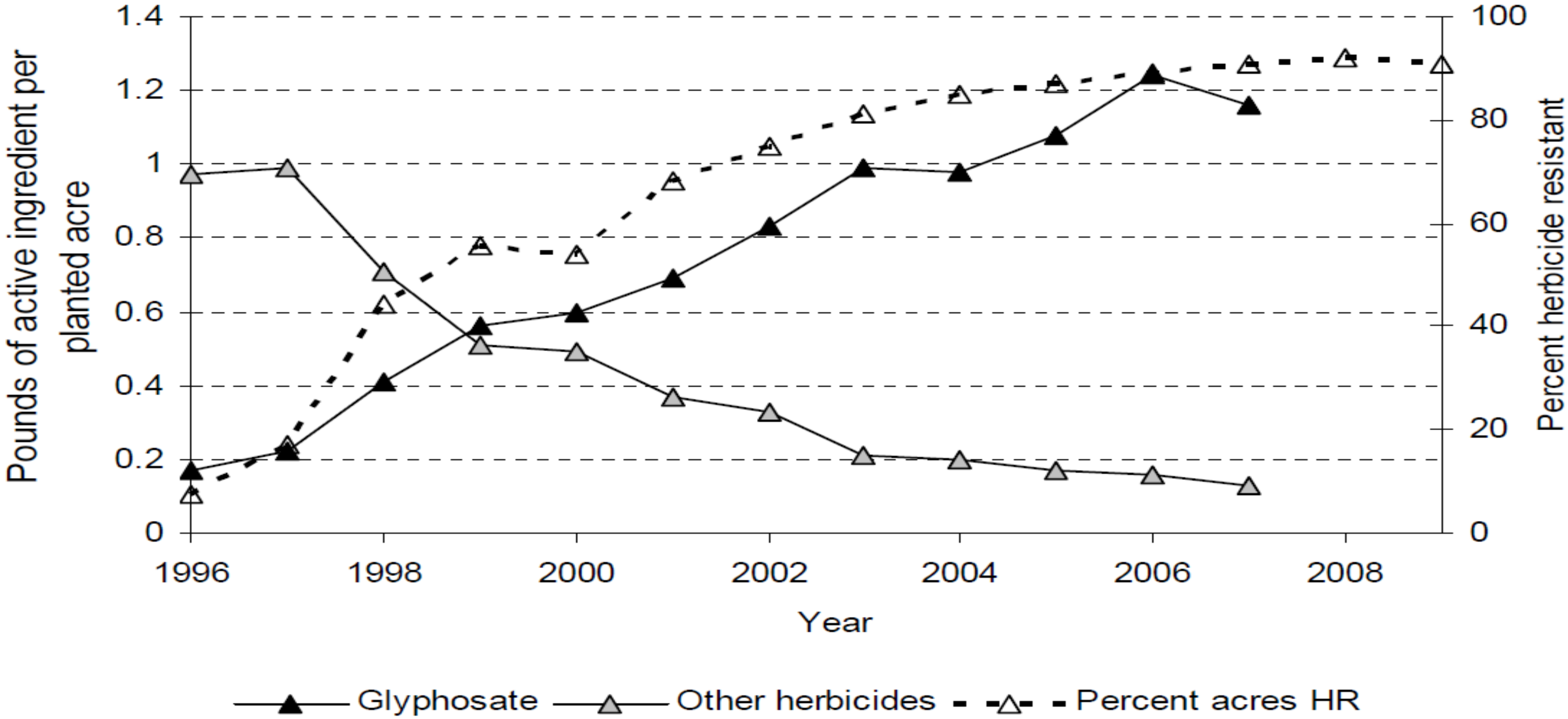
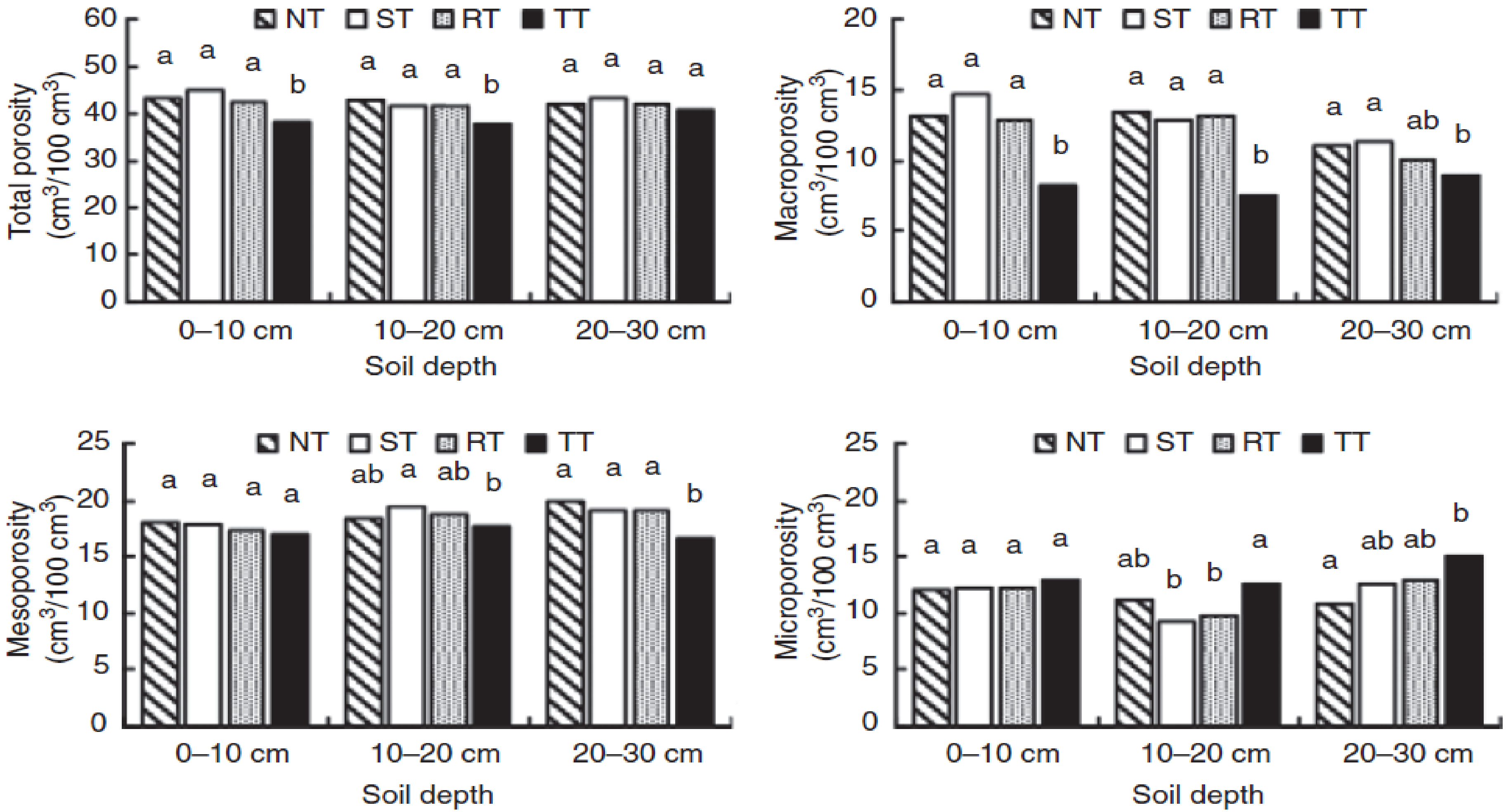


FIGURE S-1 Application of herbicide to soybean and percentage of acres of HR soybean.
NOTE: The strong correlation between the rising percentage of herbicide-resistant (HR) soybean acres planted over time, the increased applications of glyphosate, and the decreased use of other herbicides suggests but does not confirm causation between these variables.
SOURCES: USDA-NASS, 2001; 2003, 2005, 2007, 2009a, b; Fernandez-Cornejo et al., 2009.

National Research Council (2010)
Impact of Genetically Engineered Crops on Farm Sustainability in the United States, IS: ISBN: 0-309-14709-3,, pp 240
http://www.botanischergarten.ch/Benefits/NAS-Report-Benefits-full-2010.pdf AND http://www.botanischergarten.ch/Benefits/NAS-Report-Benefits-Summary-2010.pdf AND comments http://www.botanischergarten.ch/Benefits/Ronald-GM-Distortions-NY-Times-201005.PDF

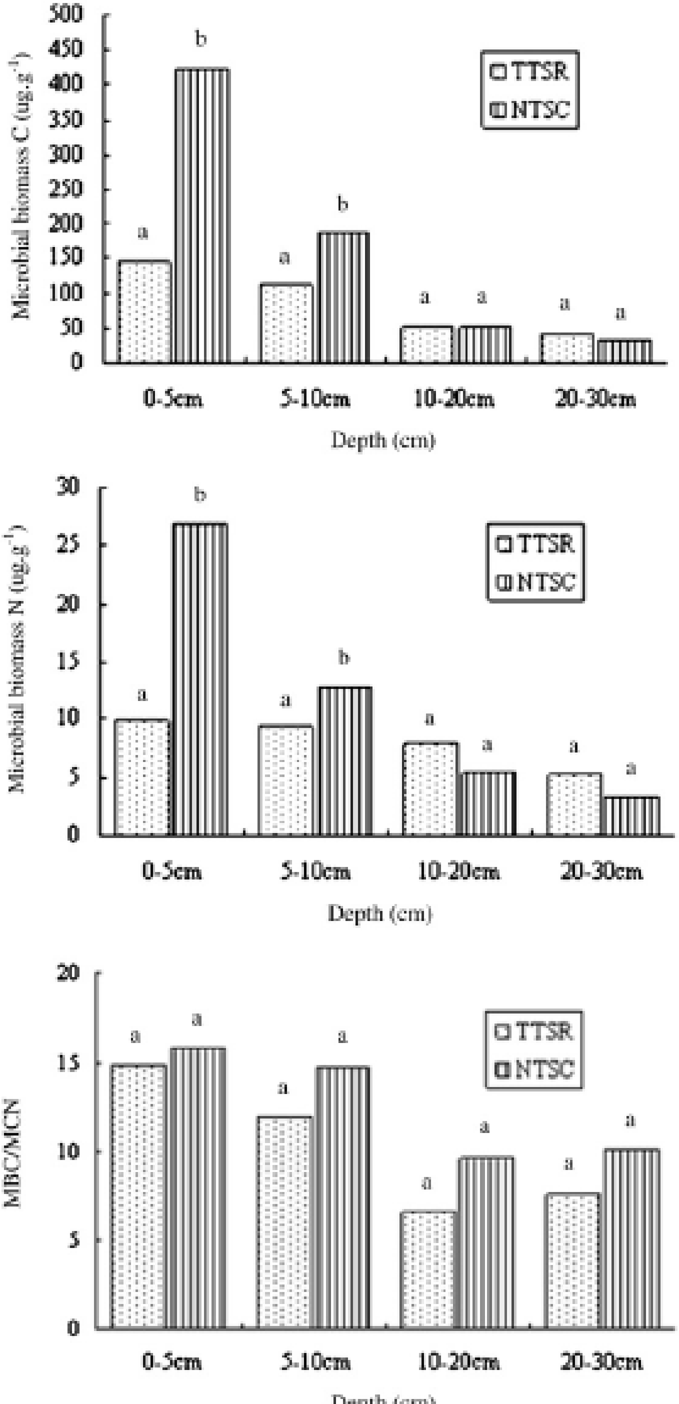
Benefits of Conservation Tillage for Soil Porosity



Mean soil porosity in the 0–30 cm soil layer. Means in the same soil profile followed by same letters are not significant ($P < 0.05$). NT, no-tillage with straw cover; ST, subsoiling with straw cover; RT, rototilling with straw cover; TT, traditional ploughing.

He, J., Kuhn, N.J., Zhang, X.M., Zhang, X.R., & Li, H.W. (2009)
Effects of 10 years of conservation tillage on soil properties and productivity in the farming-pastoral ecotone of Inner Mongolia, China. Soil Use and Management, 25, 2, pp 201-209
http://www.botanischergarten.ch/Tillage/He-Effects-10-years-NT-2009.pdf

Benefits of Conservation Tillage for Microbial Biomass in Soil



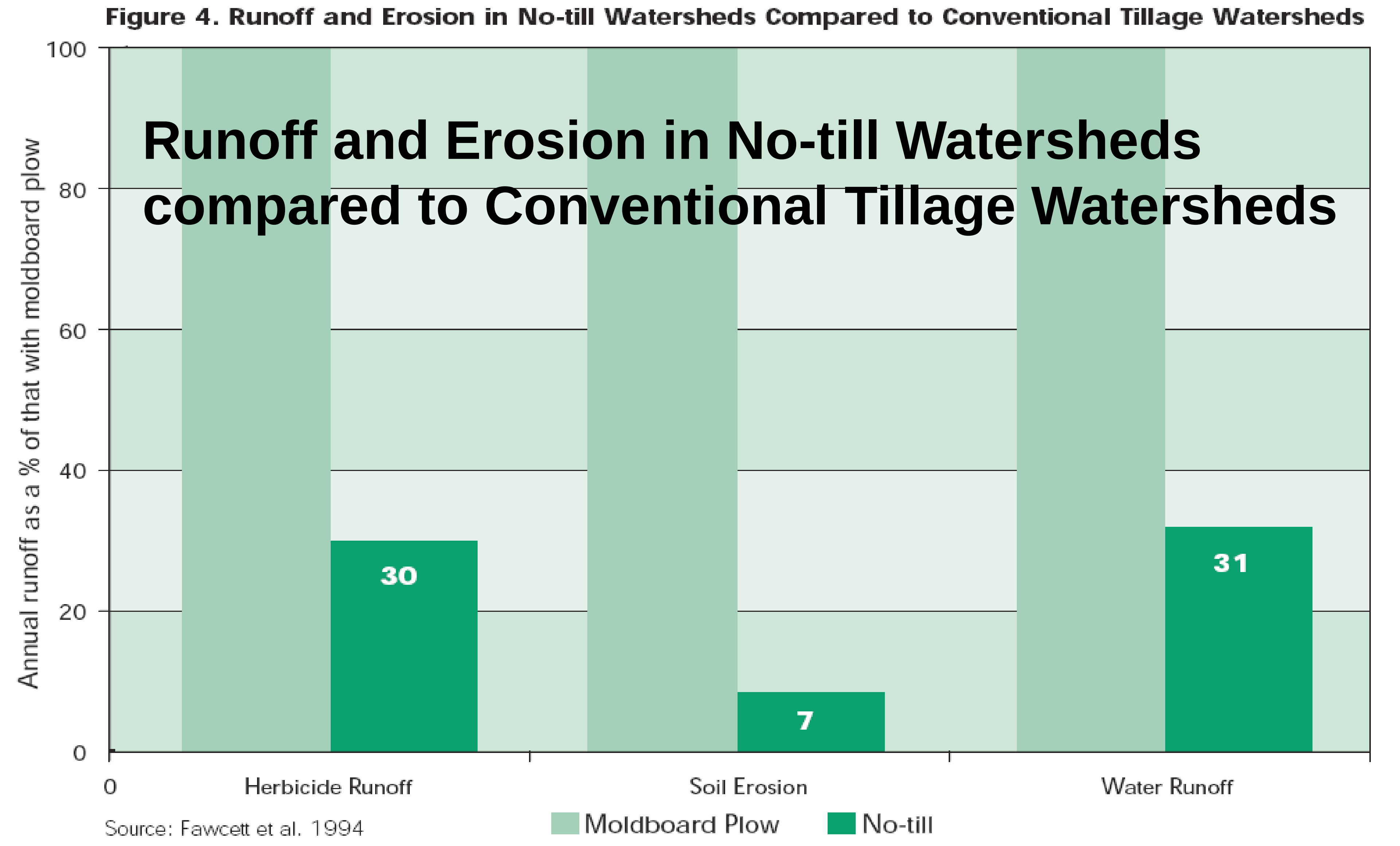
Mean bulk density for 2 treatments at 0–5, 5–10, 10–20 and 20–30 cm depths.

Samples were taken before harvesting in May, 2007.

Means within each depth followed by the same letter were not significantly different (Pb0.05).

Wang, Q.L., Bai, Y.H., Gao, H.W., He, J., Chen, H., Chesney, R.C., Kuhn, N.J., & Li, H.W. (2008)
Soil chemical properties and microbial biomass after 16 years of no-tillage fanning on the Loess Plateau, China. Geoderma, 144, 3-4, pp 502-508
http://www.botanischergarten.ch/Tillage/Wang-No-tillage-China-2008.pdf

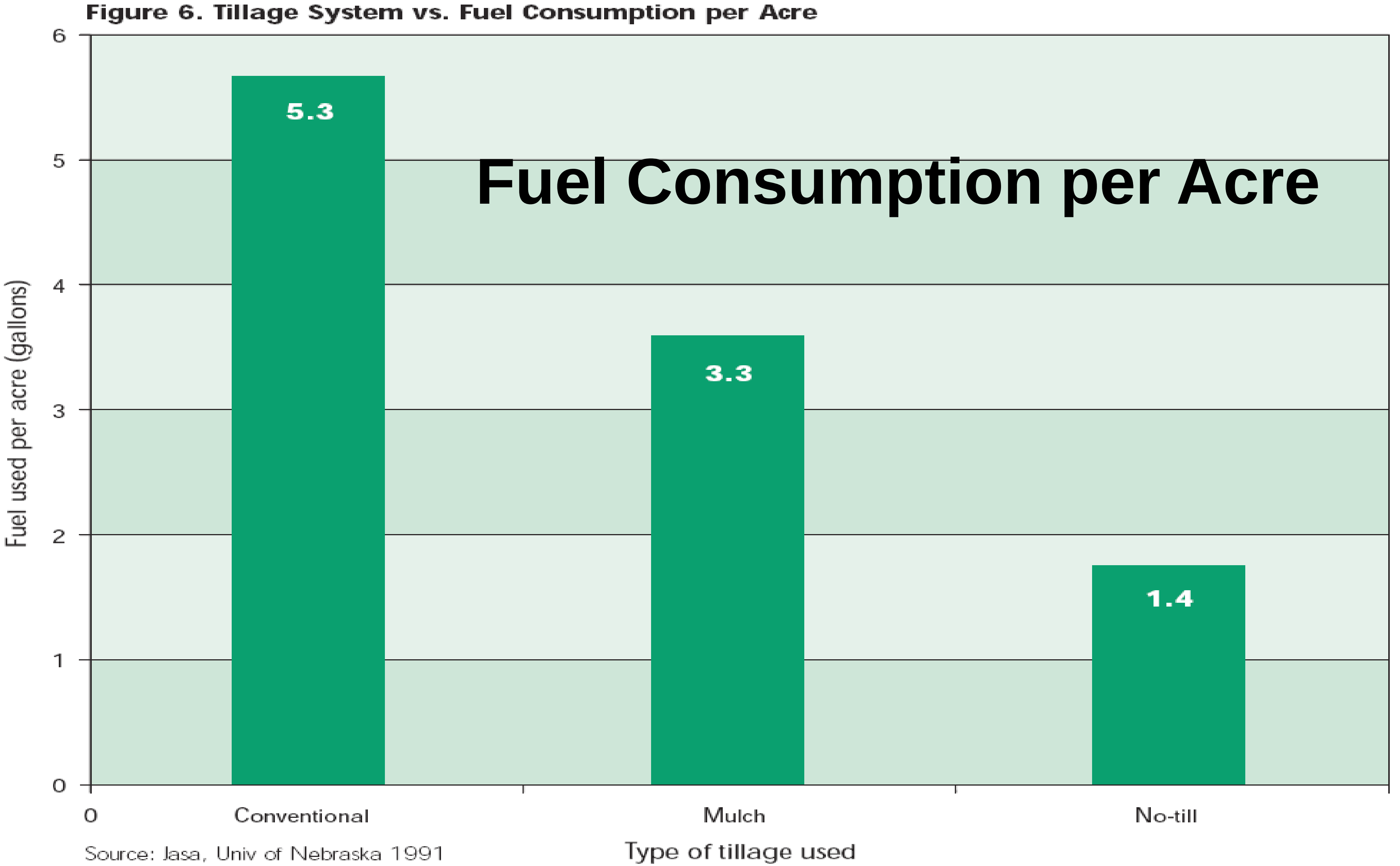
Runoff and Erosion in No-till Watersheds compared to Conventional Tillage Watersheds



Fawcett, R. & Towery, D. (2002)

Electronic Source: Conservation Tillage and Plant Biotechnology: How New Technologies Can Improve the Environment by Reducing the Need to Plow., published by: Purdue University,

www.ctic.purdue.edu/CTIC/CTIC.html or http://www.botanischergarten.ch/HerbizideTol/Fawcett-BiotechPaper.pdf

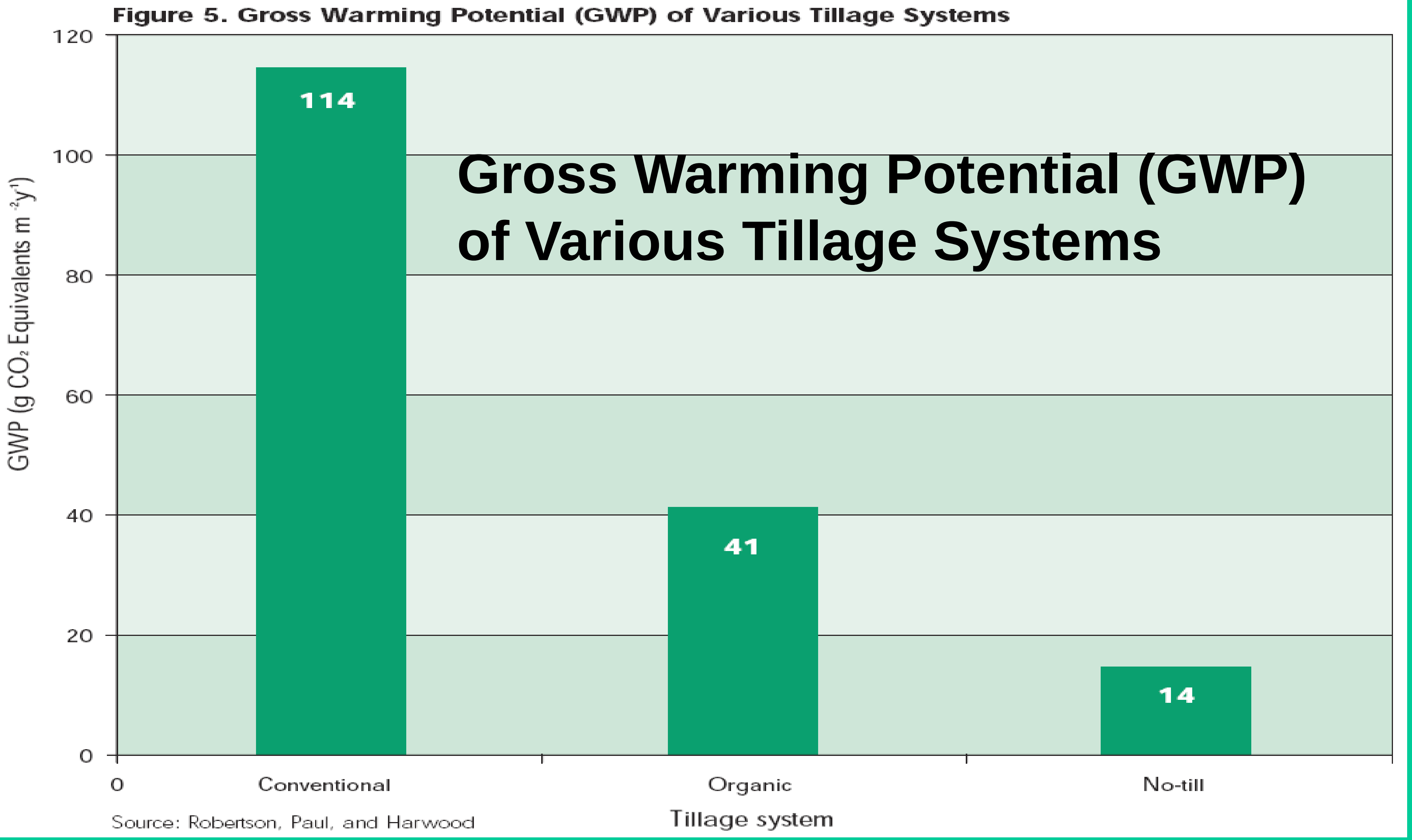


Fawcett, R. & Towery, D. (2002)

Electronic Source: Conservation Tillage and Plant Biotechnology: How New Technologies Can Improve the Environment by Reducing the Need to Plow., published by: Purdue University,

www.ctic.purdue.edu/CTIC/CTIC.html or http://www.botanischergarten.ch/HerbizideTol/Fawcett-BiotechPaper.pdf

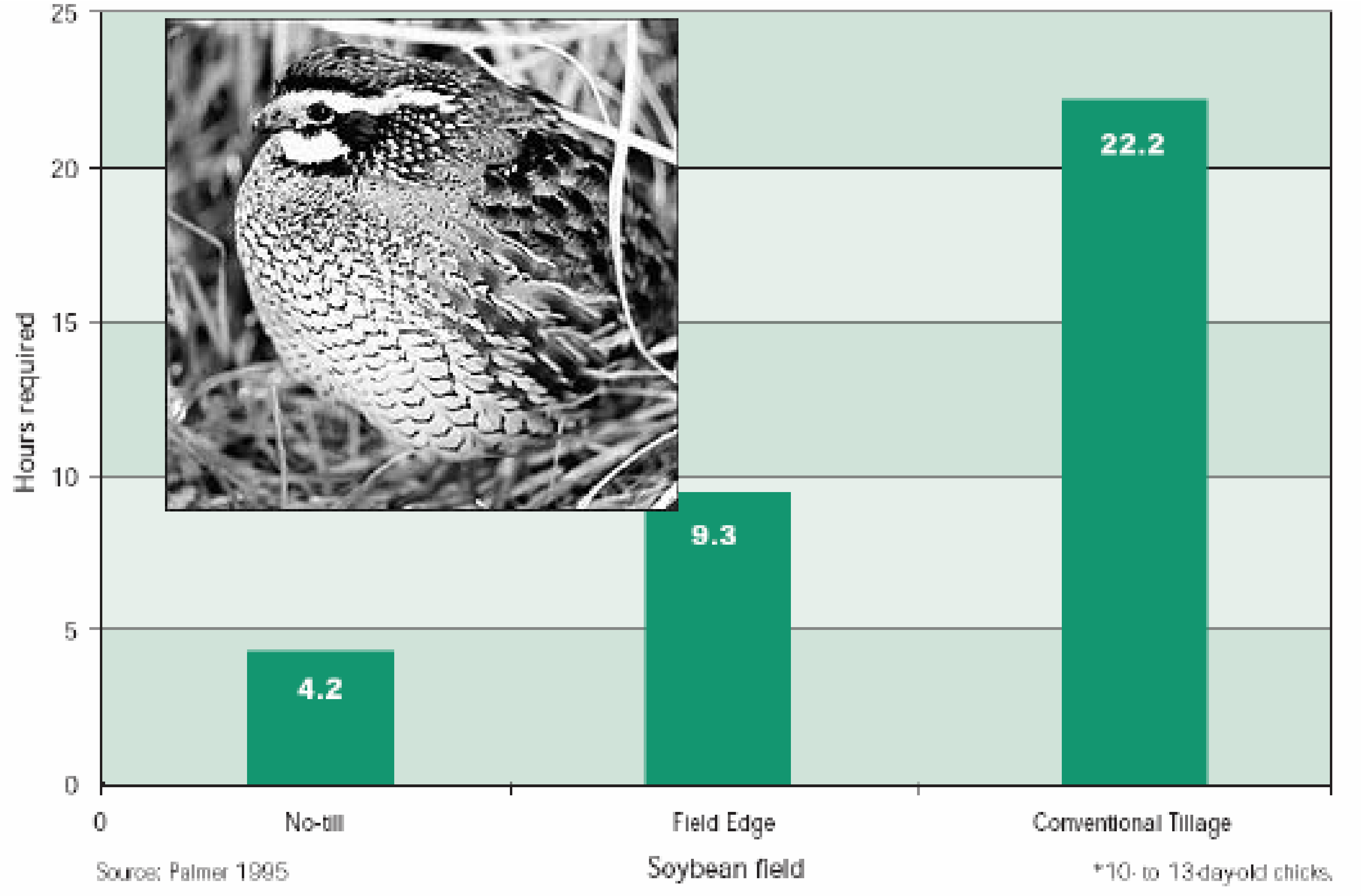
Gross Warming Potential (GWP) of Various Tillage Systems



Fawcett, R. & Towery, D. (2002)

Electronic Source: Conservation Tillage and Plant Biotechnology: How New Technologies Can Improve the Environment by Reducing the Need to Plow., published by: Purdue University,

www.ctic.purdue.edu/CTIC/CTIC.html or http://www.botanischergarten.ch/HerbizideTol/Fawcett-BiotechPaper.pdf



more seeds on the field for rare birds

Figure 12: Time needed for Bobwhite Quail Chicks to Satisfy Daily Inect Requirements

Fawcett, R. & Towery, D. (2002), Electronic Source: Conservation tillage and plant biotechnology: How new technologies can improve the environment by reducing the need to plow., published by: Purdue University, accessed: 2003 www.ctic.purdue.edu/CTIC/CTIC.html or http://www.botanischergarten.ch/HerbizideTol/Fawcett-BiotechPaper.pdf

Time neede for Bobwhite Quali Chicks to satisfy daily insect requirements: Clear ecological benefit of no tillag

anti-GM headlines

The Prime Monster.

The Daily Mirror (16.02.99)

The mad forces of genetic darkness.

Sunday Times (21.02.99)

Can "Frankenstein" foods harm your unborn baby?

The Daily Mail (30.01.99)

M&S sells genetically modified Frankenpants

The Independent on Sunday (18.07.99)

Daily Mail

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SCIENTISTS WARN OF GM CROPS LINK TO MENINGITIS

By EMILY WILSON

THE nightmare possibility of GM food experiments producing untreatable killer diseases has been underscored by senior Government scientists.

Kosovo girl's smile of hope

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THE EXPRESS

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TOKEN COLLECT • SEE PAGE 59

Protests at move to 'cannibalism'

HUMAN GENES IN GM FOOD

SCIENTISTS are trying to produce the ultimate in Frankenstein foods

KATE LEADS THE WAY AS THE LADIES IN RED HIT TOWN

FULL STORY • PAGE 3

WEATHER 2 • OPINION 10 • LETTERS 32 • DIARY 33 • LIFE 37-41 • TV 42-45 • CROSSWORD 47 • CITY 50

Monarch Butterflies not harmed by transgenic maize

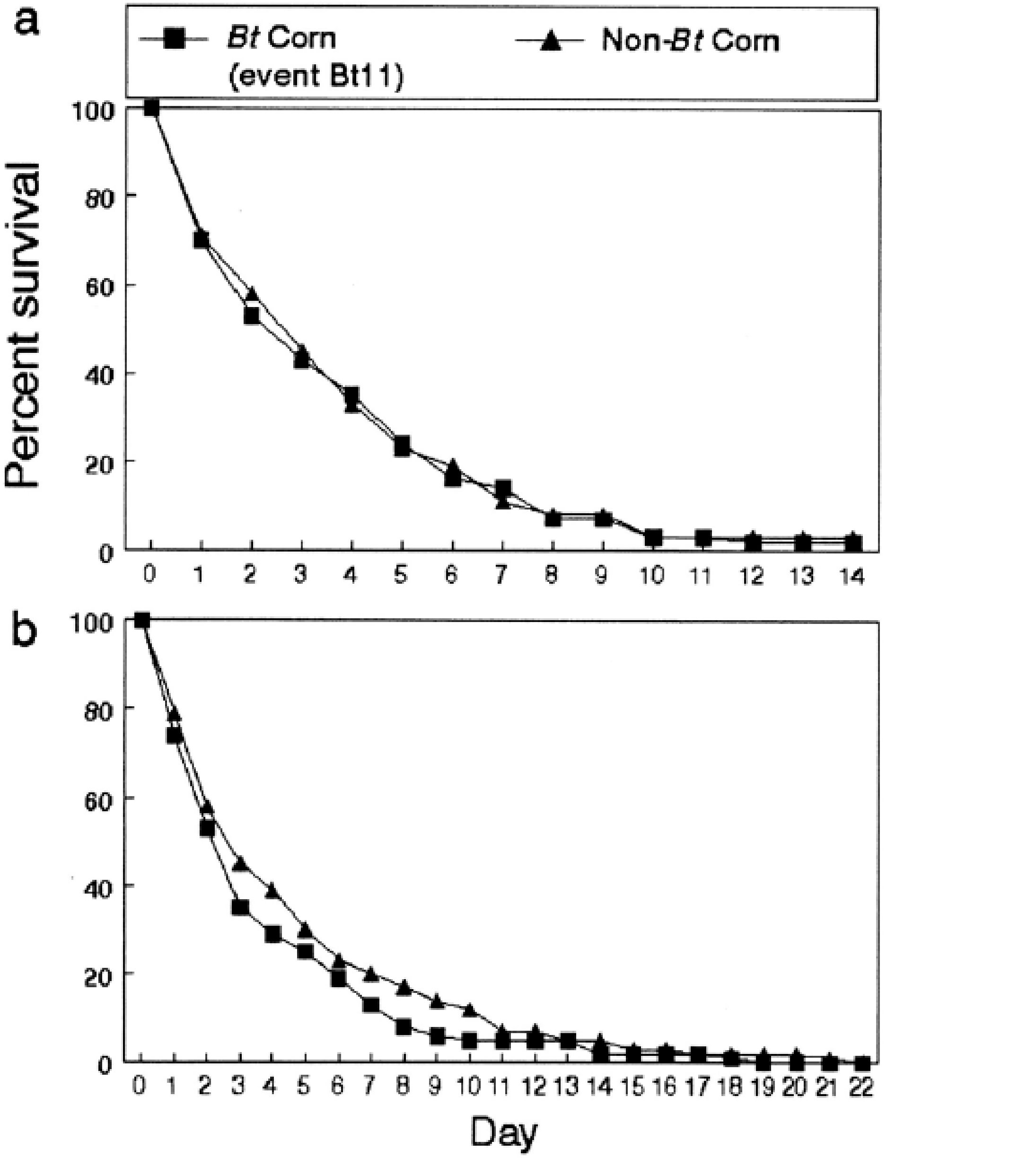


Figure 26: Survival curves for monarch larvae placed in and near *Bt* and non-*Bt* corn fields. (*a*) Iowa. (*b*) New York. The survival curves of larvae pooled over the three Bt corn sites were not significantly different from those in non-Bt (Fig. 13a). In New York, trends in survivorship were also statistically the same for cohorts of larvae feeding for 22 days on milkweeds in Bt and non-Bt fields (Fig. 13b). (Stanley-Horn et al., 2001)

Sears, M.K., Hellmich, R.L., Stanley-Horn, D.E., Oberhauser, K.S., Pleasants, J.M., Mattila, H.R., Siegfried, B.D., & Dively, G.P. (2001)
Impact of Bt corn pollen on monarch butterfly populations: A risk assessment. Proceedings of the National Academy of Sciences of the United States of America, 98, 21, pp 11937-11942
http://www.botanischergarten.ch/Bt/Searsreport-prelim-2000.pdf

Stanley-Horn, D.E., Dively, G.P., Hellmich, R.L., Mattila, H.R., Sears, M.K., Rose, R., Jesse, L.C.H., Losey, J.E., Obrycki, J.J., & Lewis, L. (2001)
Assessing the impact of Cry1Ab-expressing corn pollen on monarch butterfly larvae in field studies. Proceedings of the National Academy of Sciences of the United States of America, 98, 21, pp 11931-11936
http://www.pnas.org/cgi/content/full/98/21/11931

Survival rates: no difference between Bt and non-Bt maize, results of extensive field research by science consorti

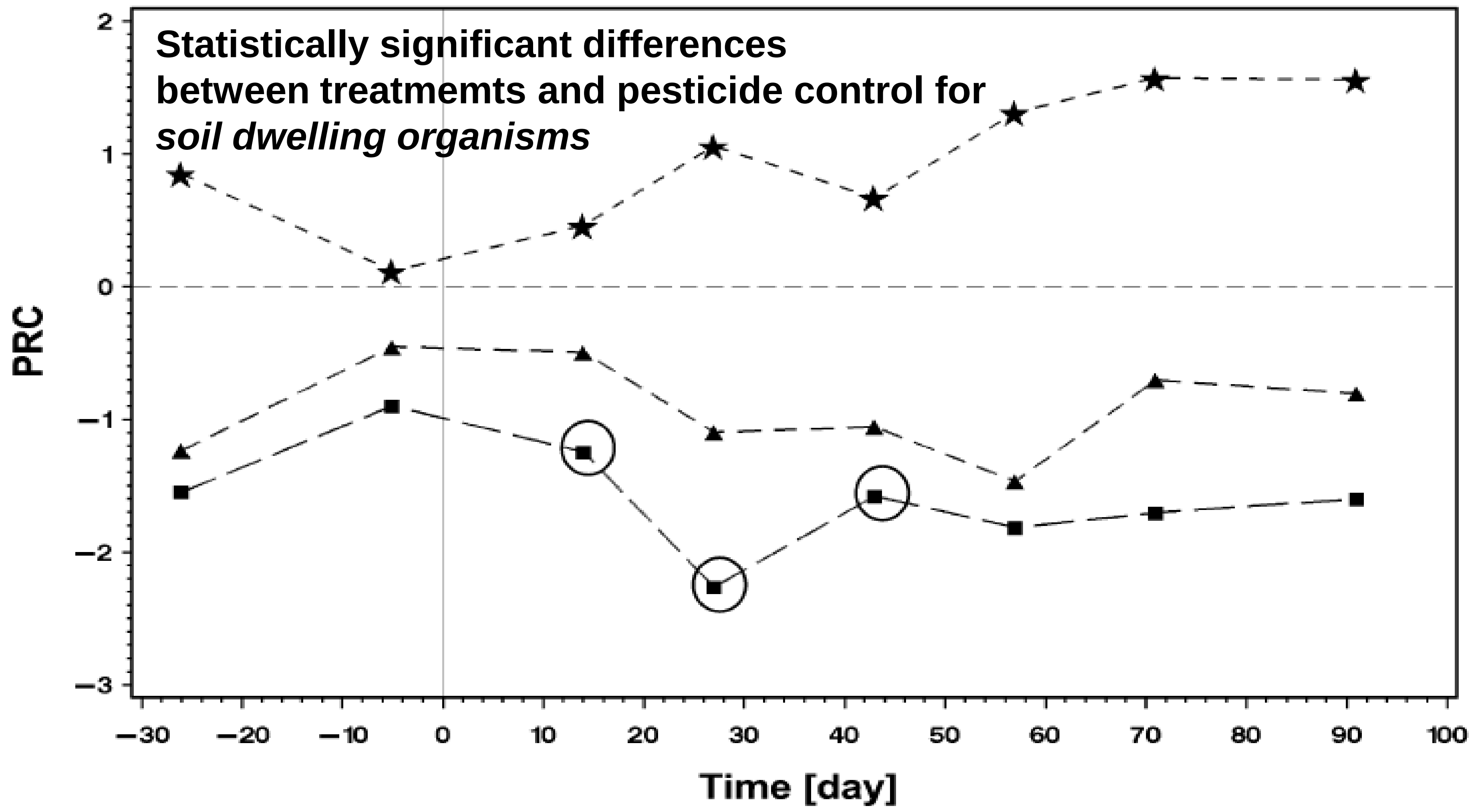


FIGURE 4. Principal response curve analysis for soil dwelling organinsms: zero line of the y-axis = untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. Statistically significant treatment effects when compared to control are circled (goodness of fit $R^2 = 0.74$, goodness of prediction Crossvalidation/Jacknife $R^2 = 0.62$).

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)
A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170
http://www.botanischergarten.ch/Bt/Candolfi-Biocontrol-2004.pdf

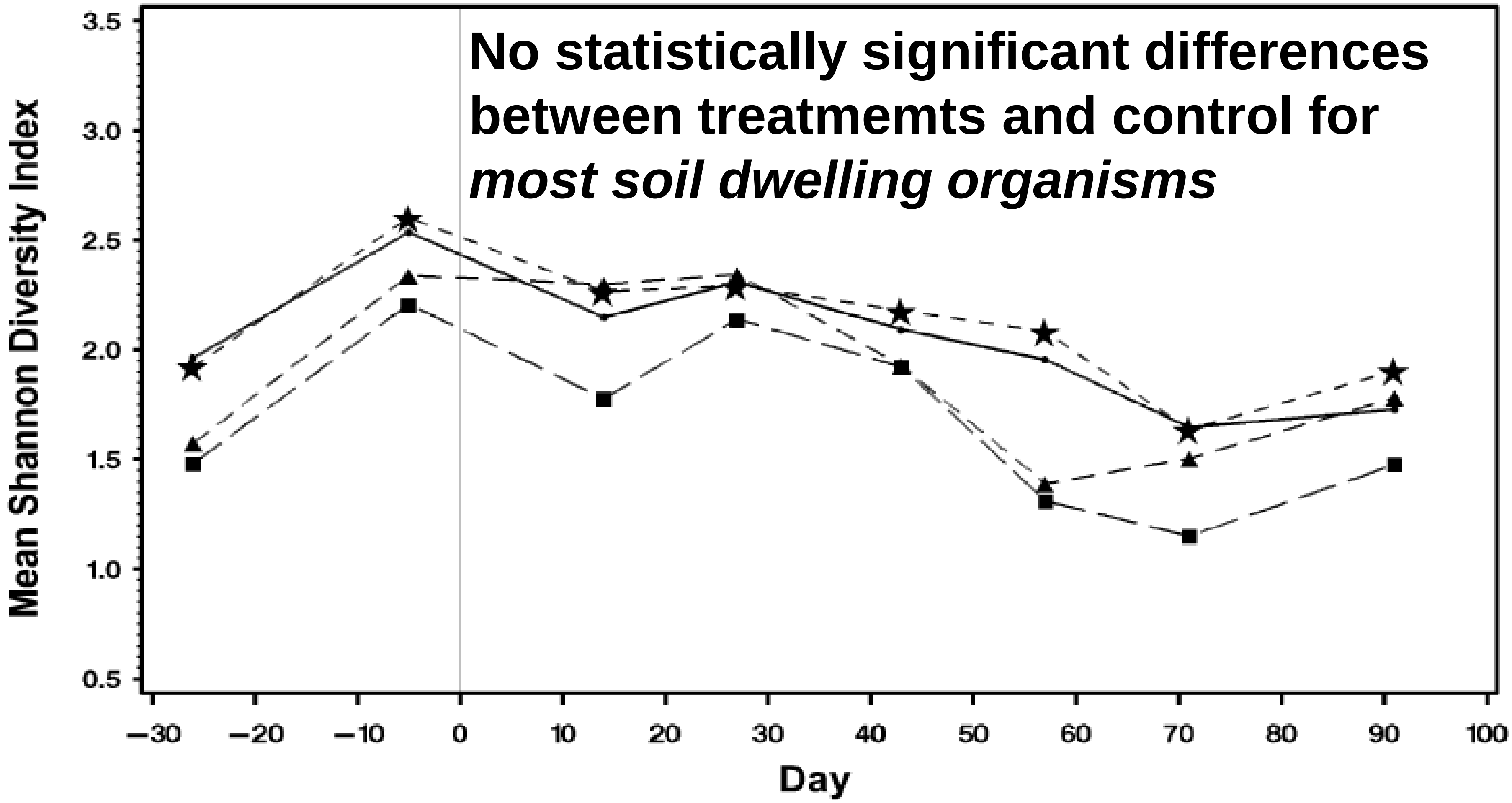


FIGURE 3. Shannon diversity indices of soil dwelling taxa per trap collected with the pitfall traps throughout the sampling season: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant differences between treatments were observed (Tukey test, $P = 0.05$).

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)
A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170
http://www.botanischergarten.ch/Bt/Candolfi-Biocontrol-2004.pdf

No statistically significant differences between treatmemts and control for *Spiders*

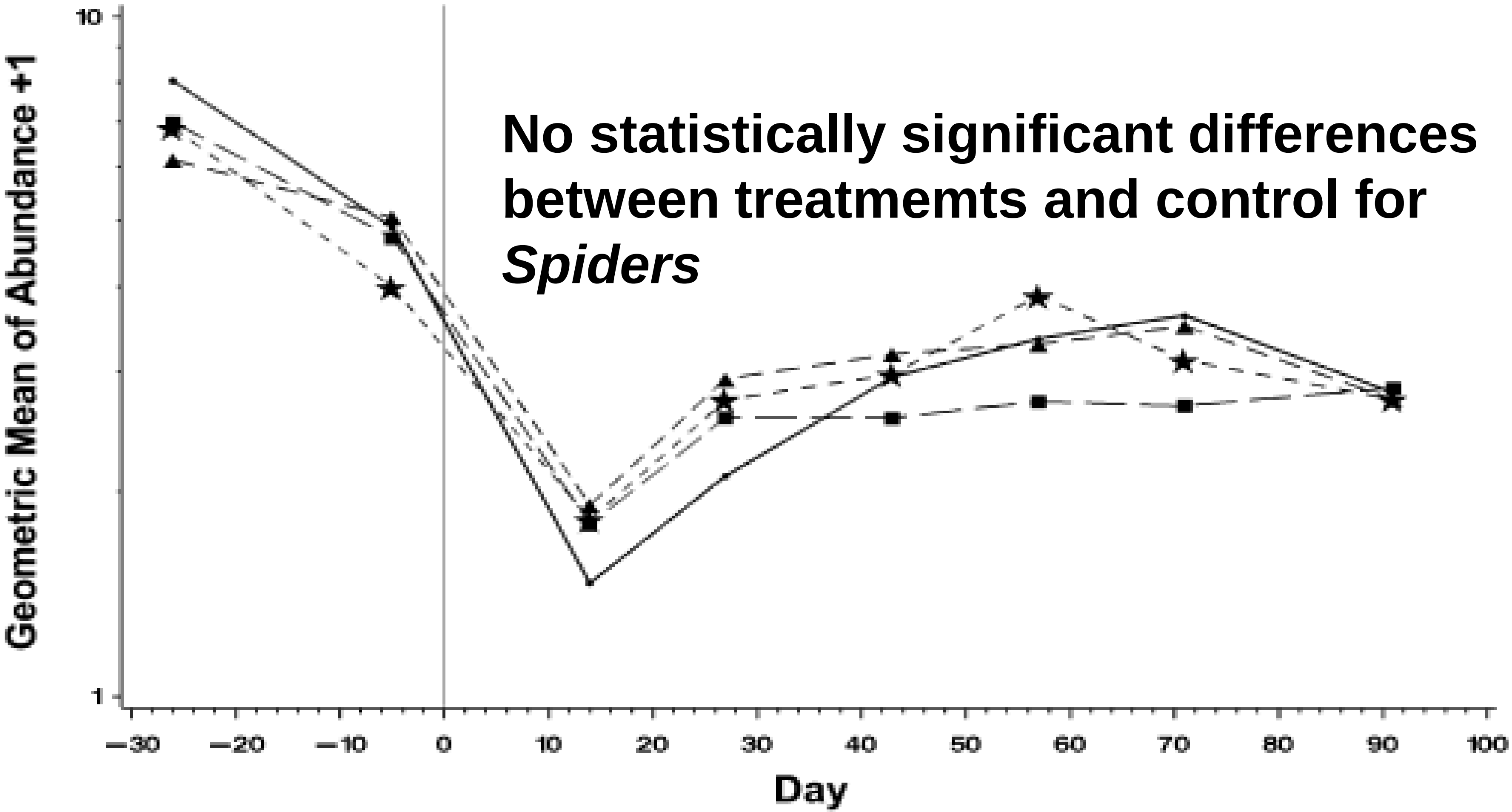
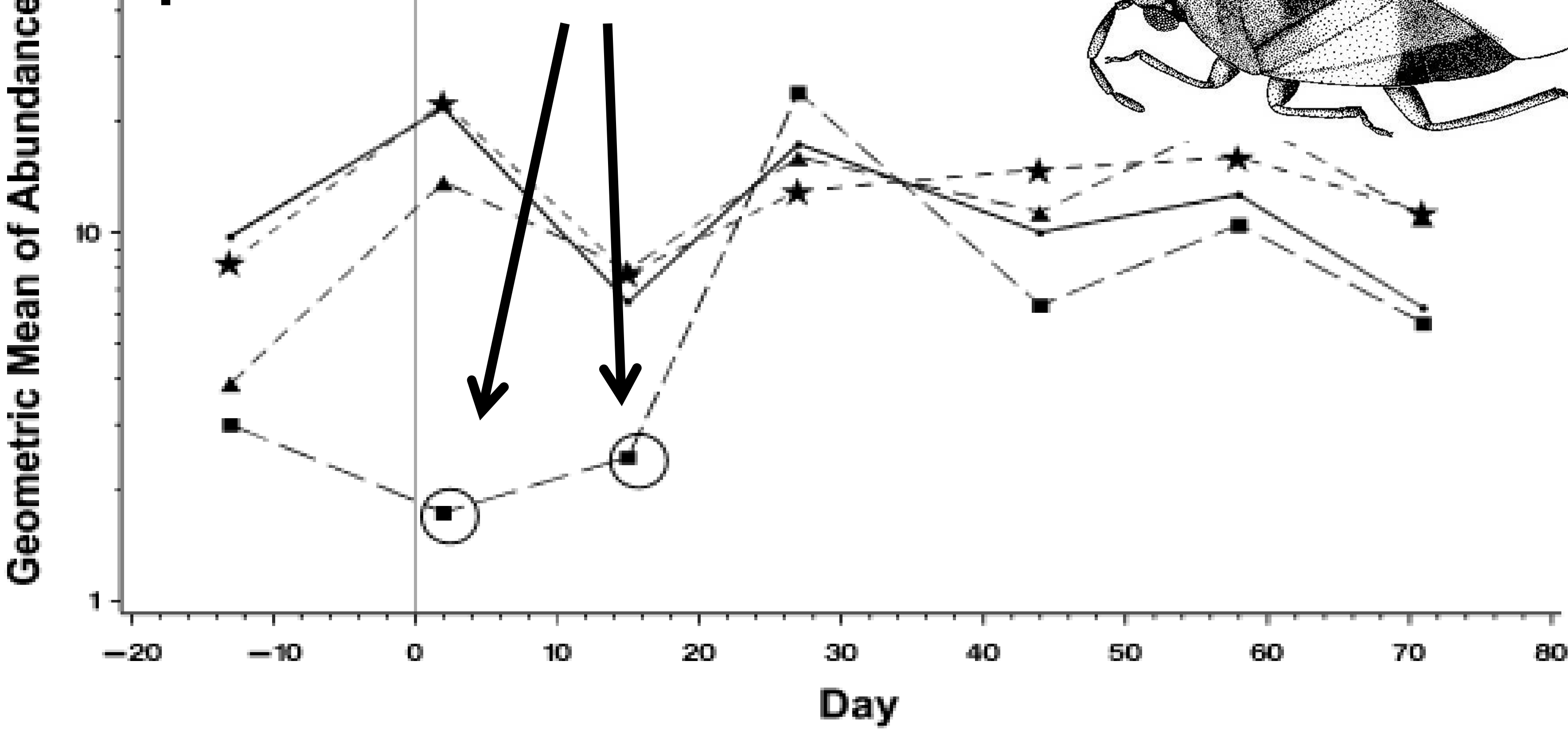


FIGURE 6. Population density of *Alopecosa* sp. (Araneae: Lycosidae). Plotted are the geometric means of abundance +1 per trap against time: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant differences between treatments and the control were observed (Tukey test, $P = 0.05$).

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)
A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170
http://www.botanischergarten.ch/Bt/Candolfi-Biocontrol-2004.pdf

Temporary impact of pesticide Karate



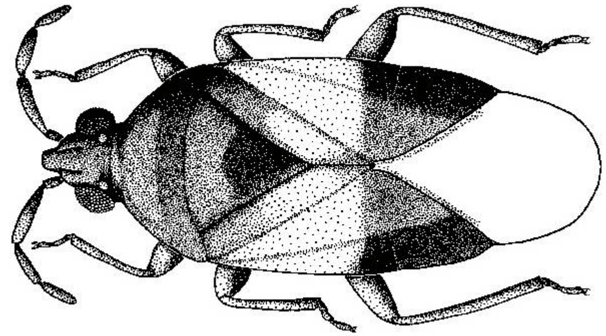


FIGURE 9. Population density of *Orius* sp. (Heteroptera: Anthocoridae). Plotted are the geometric means of abundance +1 per trap against time: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. Statistically significant treatment effects when compared to control are circled (Tukey test, $P \leq 0.05$).

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)
A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170
http://www.botanischergarten.ch/Bt/Candolfi-Biocontrol-2004.pdf

Flying target and non-target organisms

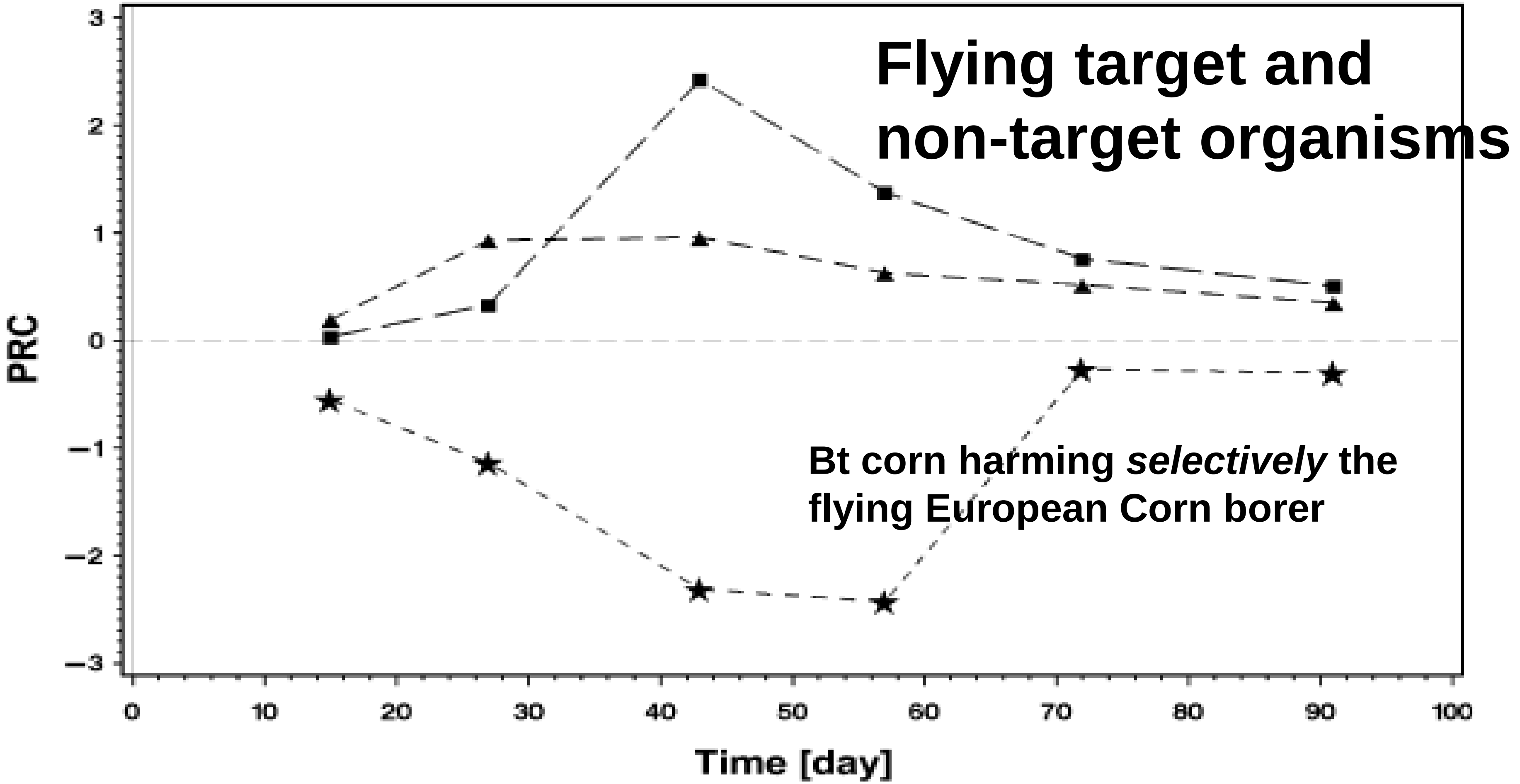
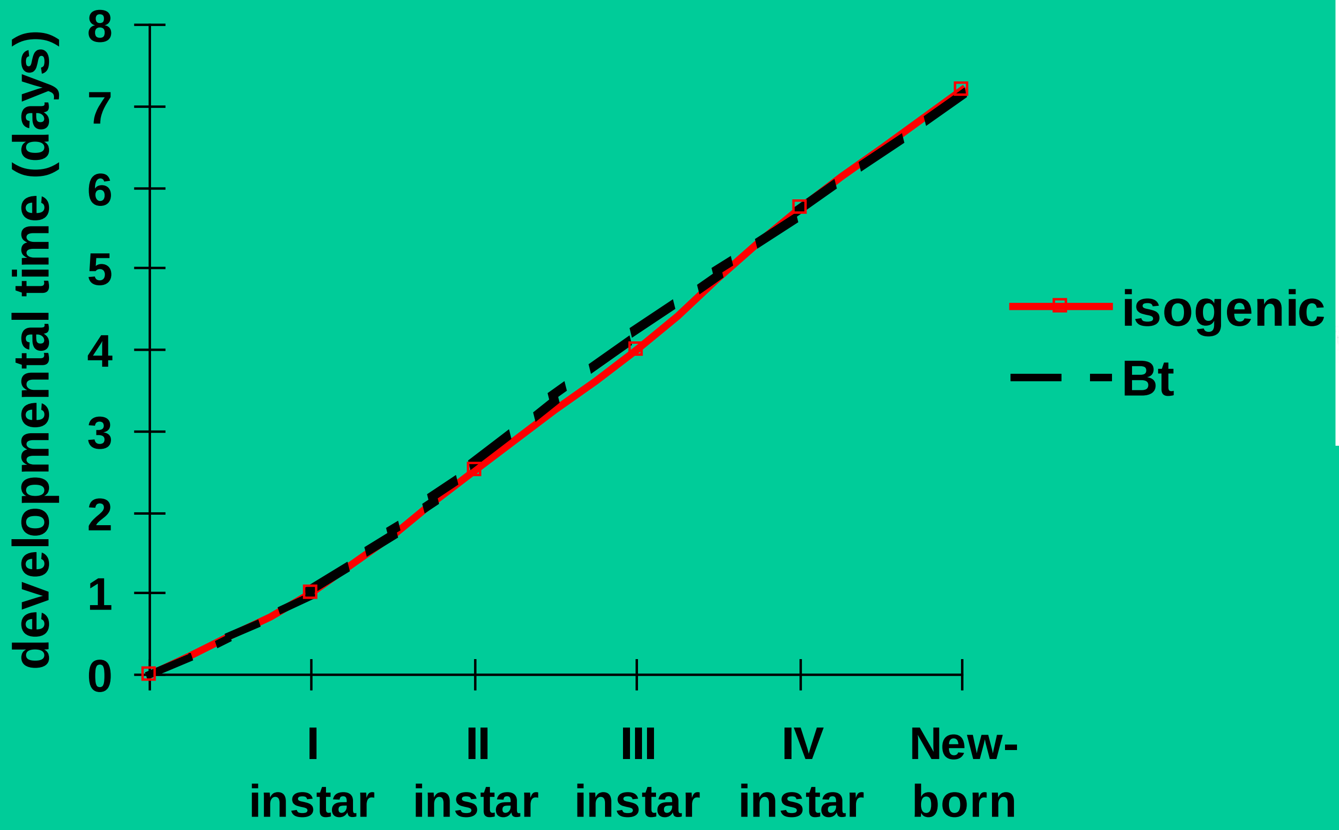
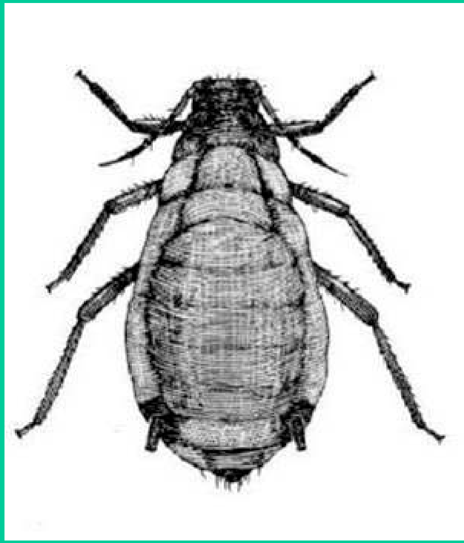


FIGURE 13. Principal response curve analysis for flying organisms: zero line of the *y*-axis, untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant (Crossvalidation/Jacknife) treatment effects were observed.

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)
A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170
http://www.botanischergarten.ch/Bt/Candolfi-Biocontrol-2004.pdf

Averages of two years (1997-1998) of development times (days) of a specific stage for *Rhopalosiphum padi* feeding on transgenic and isogenic corn leaves





Rhopalosiphum padi

Lozzia, G., Furlanis, C., Manachini, B., & Rigamonti, I. (1999)
Effects of Bt Corn on Rhodopalosiphum Padi (Rhynchota Aphidiae) and on Its Predator Chrysoperla Carnea Stephen (Neuroptera Chrysopidae). Boll. Zool. Agr. Bachic. Ser. II, 30, 2, pp 153-164
http://www.botanischergarten.ch/Bt/Lozzia-Effects-Bt-1998.pdf

Lozzia, G.C. (1999)
Biodiversity and Structure of Ground Beetle Assemblages (Coleopterae, Carabidae) in Bt Corn and Its Effects on Non Target Insects. Boll. Zool. Agr. Bachic. Ser. II, 31, pp 37-58
http://www.botanischergarten.ch/Bt/Lozzia-Biodiversity-1999.pdf

Early, but largely ignored research: Averages of two years (1997-1998) of development times (days) of a specific stage for *Rhopalosiphum padi* feeding on transgenic and isogenic corn leav

OPEN ACCESS Freely available online

PLoS one

Bt Crop Effects on Functional Guilds of Non-Target Arthropods: A Meta-Analysis

L. LaReesa Wolfenbarger[1], Steven E. Naranjo[2]*, Jonathan G. Lundgren[3], Royce J. Bitzer[4], Lidia S. Watrud[5]

1 Department of Biology, University of Nebraska at Omaha, Omaha, Nebraska, United States of America, 2 USDA-ARS Arid Land Agricultural Research Center, Maricopa, Arizona, United States of America, 3 USDA-ARS North Central Agricultural Research Laboratory, Brookings, South Dakota, United States of America, 4 Department of Entomology, Iowa State University, Iowa, United States of America, 5 U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis, Oregon, United States of America

Predator-nontarget herbivore relationships. We examined community level responses using predator/prey ratios to provide an alternate measure of impact on pest management services. To estimate predator to prey ratios, we identified studies in our database in which both predator and herbivore functional groups were measured. We then summed the mean abundance of predators ($Mean_{Predator}$) and herbivores ($Mean_{Herbivore}$) for each relevant study and used these measures to estimate the quotient of predators over herbivores (prey). The variance of this quotient is given as

$$\frac{Mean_{Predator}}{Mean_{Herbivore}} * \sqrt[2]{\frac{Var_{Herbivores}}{Mean^2_{Herbivores}} + \frac{Var_{Predators}}{Mean^2_{Predators}}}$$

where $Var_{Herbivore}$ and $Var_{Predator}$ are the sum of variances of individual herbivores or predators in a given study. We assumed that the covariance between predators and herbivores was zero, and thus this variance estimate is conservative. Species of

Wolfenbarger, L.L., Naranjo, S.E., Lundgren, J.G., Bitzer, R.J., & Watrud, L.S. (2008)

Bt Crop Effects on Functional Guilds of Non-Target Arthropods: A Meta-Analysis. PLoS ONE, 3, 5, pp e2118

http://www.botanischergarten.ch/Bt/LaReesa-Bt-crop-Meta-Analysis-2008.pdf

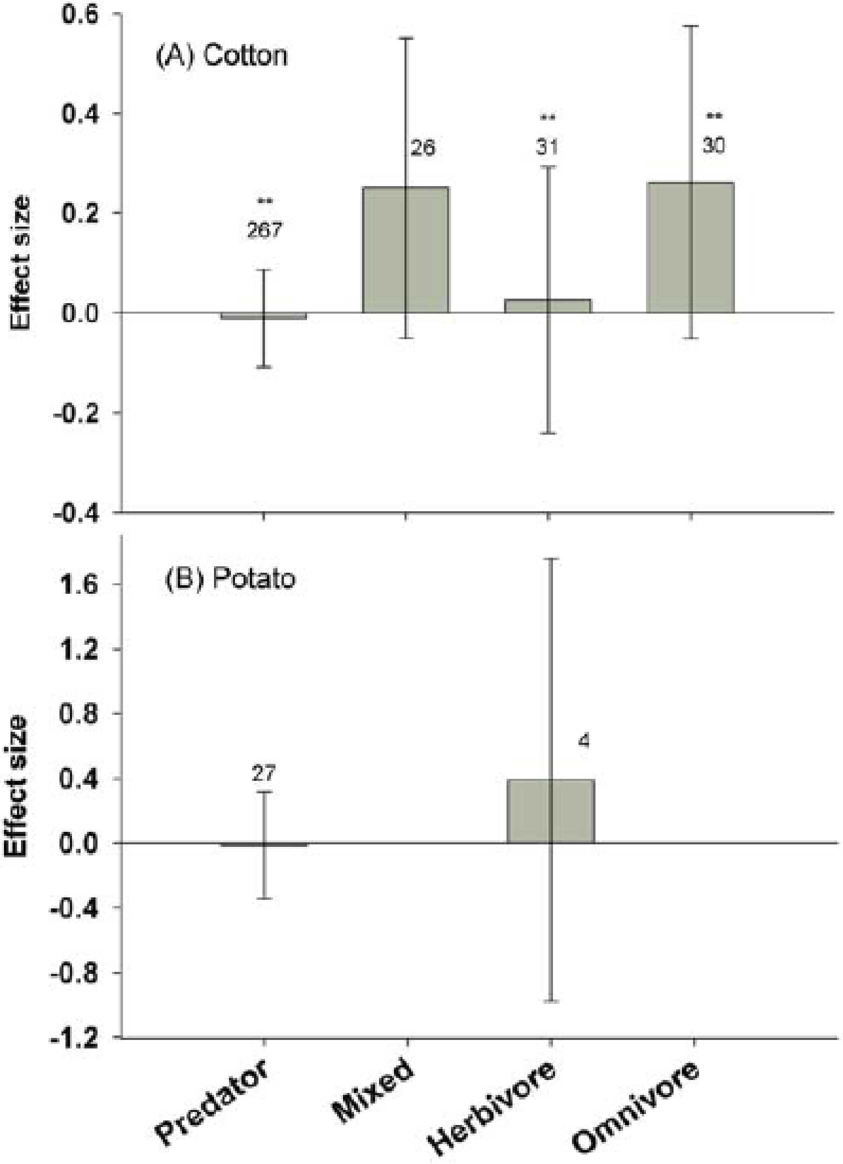


Figure 5. Effect of insecticide-treated Bt crops vs. insecticide-treated non-Bt control field on non-target functional guilds. Bars denote the 95% confidence intervals, asterisks denote significant heterogeneity in the observed effect sizes among the studies (* <0.05, ** <0.01, *** <0.001), and Arabic numbers indicate the number of observations included for each functional group.
doi:10.1371/journal.pone.0002118.g005

Conclusions/Significance: Overall, we find no uniform effects of Bt cotton, maize and potato on the functional guilds of non-target arthropods. Use of and type of insecticides influenced the magnitude and direction of effects; insecticde effects were much larger than those of Bt crops.

These meta-analyses underscore the importance of using controls not only to isolate the effects of a Bt crop per se but also to reflect the replacement of existing agricultural practices. Results will provide researchers with information to design more robust experiments and will inform the decisions of diverse stakeholders regarding the safety of transgenic insecticidal crops.

Wolfenbarger, L.L., Naranjo, S.E., Lundgren, J.G., Bitzer, R.J., & Watrud, L.S. (2008)
Bt Crop Effects on Functional Guilds of Non-Target Arthropods: A Meta-Analysis. PLoS ONE, 3, 5, pp e2118
http://dx.doi.org/10.1371%2Fjournal.pone.0002118 AND
http://www.botanischergarten.ch/Bt/LaReesa-Bt-crop-Meta-Analysis-2008.pdf

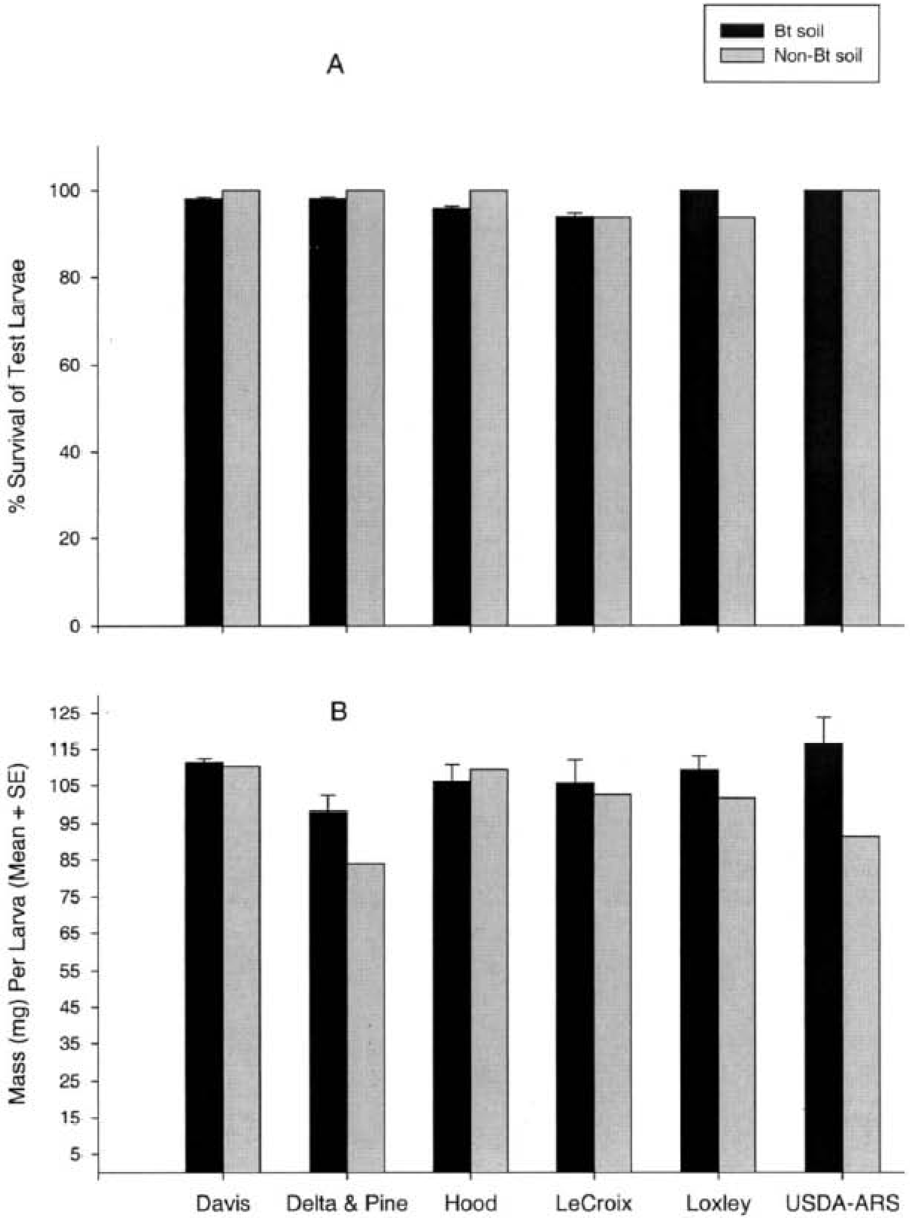


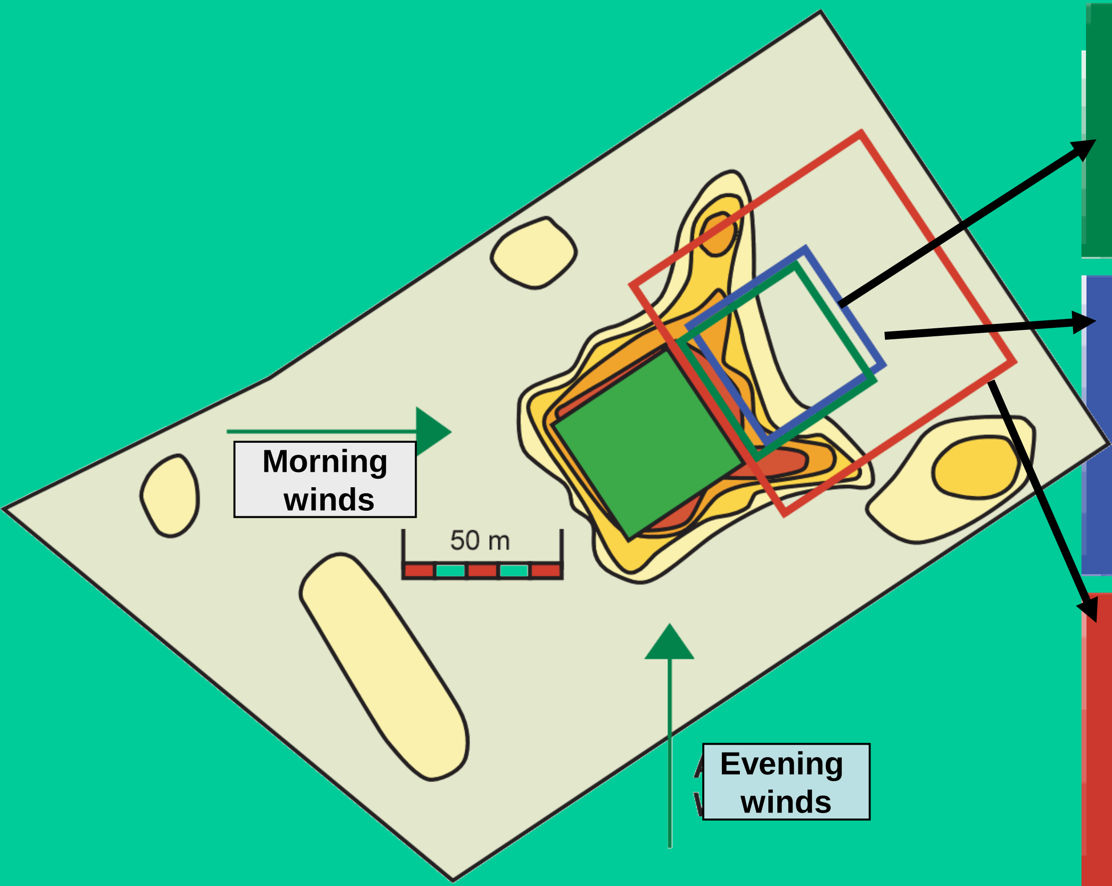
Fig. 2. Response of *H. virescens* larvae to diet mixed with soil samples collected from within and outside transgenic Bt cotton fields at six different sites. (A) Larval survival, and (B) average mass (mg) of surviving larvae.

No Detection of Cry1Ac Protein in Soil After Multiple Years of Transgenic Bt Cotton (Bollgard) Use

GRAHAM HEAD, JAMES B. SURBER, JON A. WATSON, JOHN W. MARTIN, AND JIAN J. DUAN

Monsanto Company, Ecological Technology Center, 800 North Lindbergh, St. Louis, MO 63141

Co-existence field experiments: Influence of field size in Spain 2003



0.25 ha: no safety distance
1, 77 % GM intermixed
Labeling required

0.25 ha: 6m safety distance
0.77 % GM intermixed
Labelling not required

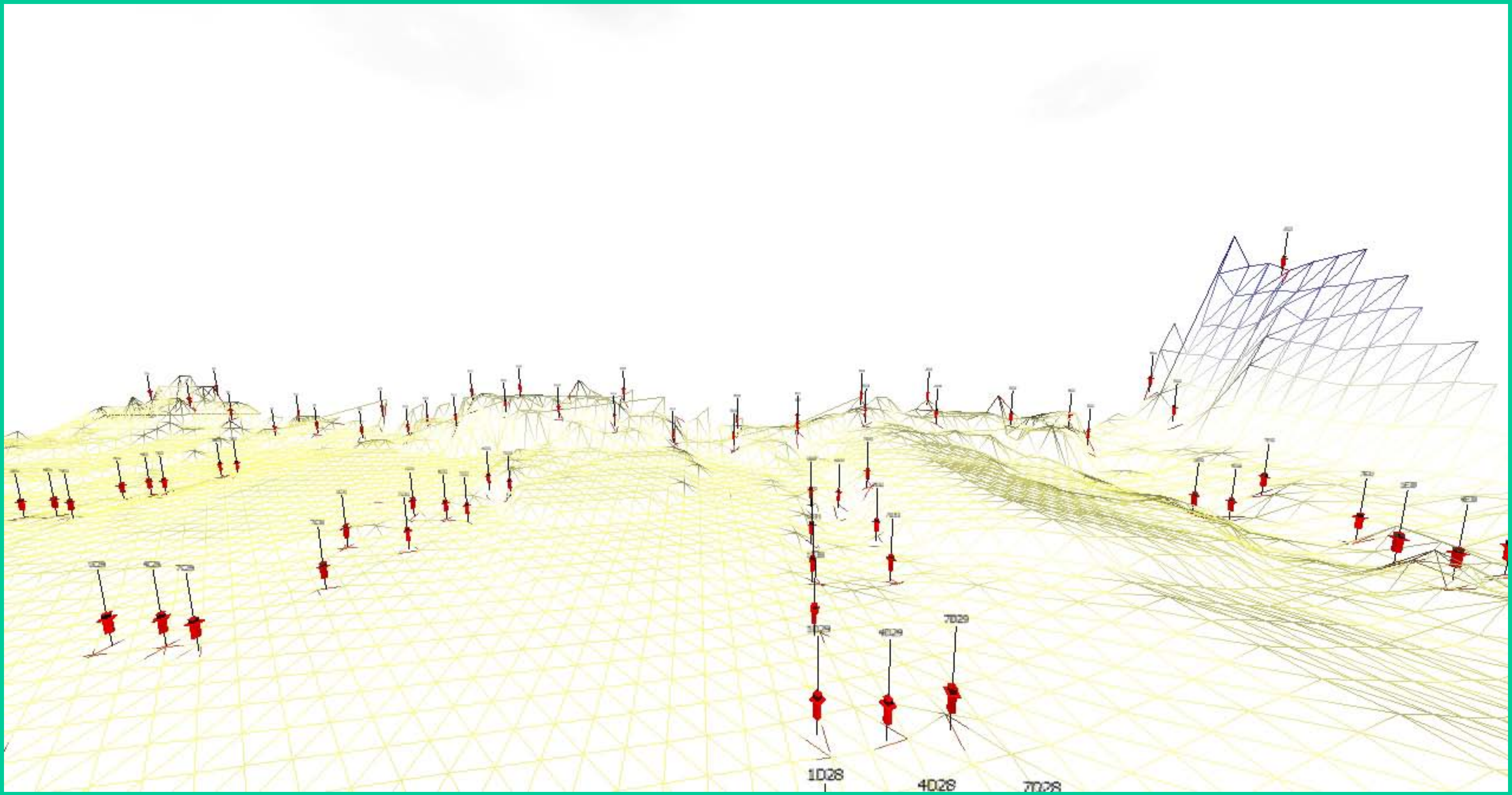
1 ha: no safety distance
0.83 % GM intermixed
Labelling not required

© ABIC2004 / Eric Mele, IRTA

Brookes, G. & Barfood, P. (2004).
Co-existence of GM and non GM crops: case study of maize grown in Spain, PG Economics Ltd, pp 13 Dorchester, UK1.
http://www.botanischergarten.ch/Coexistence/Brookes-Coexistence-Casestudy-Spain.01.pdf

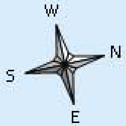
0.25 ha: no safety distance, 1.77% GM, labelling required
0.25 ha: safety distance 6m, 0,77% GM, labelling not required
1.0 ha: no safety distance, 0.83% GM, labelling not required

Field experiments in Switzerland, coexistence modeling based on single maize plants, GPS-mapping including several fields embedded in a hilly landscape EU-supported project: WIDER FIELDS, Klaus Ammann and Karol Kovacovsky

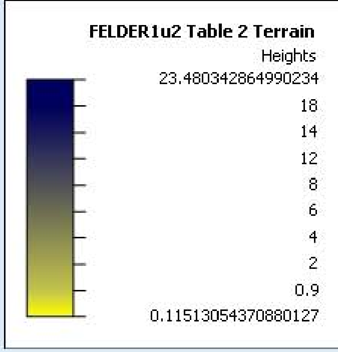


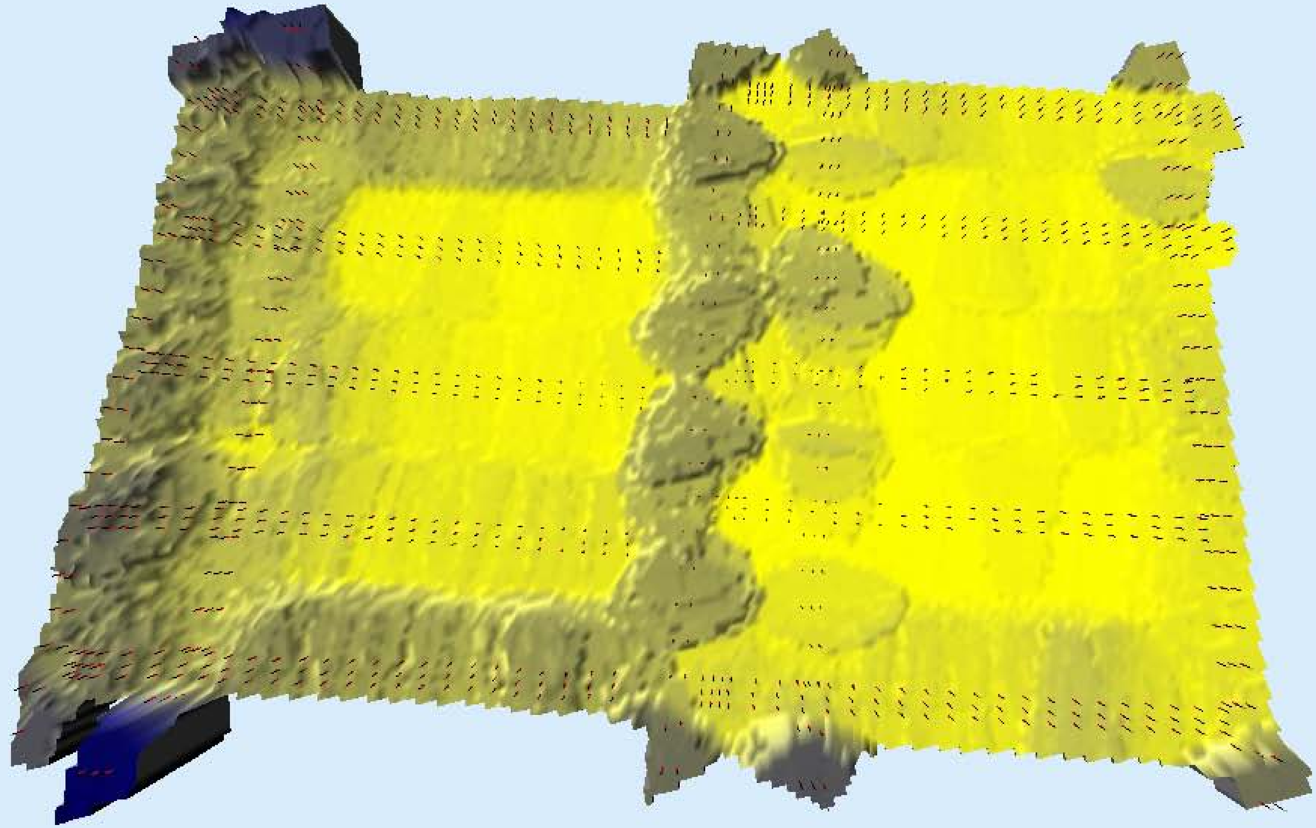
Maize field I, individual sampling plants

Ammann, K., Kovacovsky, K., & Bratschi, D. (2009)
Maize Geneflow - GPS-Mapping and 3-dimensional Landscape Modeling, final report WP2 SIGMEA project, Wider Fields University of Bern Participation pp 25 (Manuscript)
http://www.botanischergarten.ch/SIGMEA/SIGMEA-Bern-Final-Report-20090831.pdf



GPS-mapping of gene flow with maize: round spots: caused by the turning of the sowing machines





Outcrossing of blue kernel maize surrounding yellow kernel maize,
Slightly different growing conditions due to sowing machine turning Change in flowering synchronization: higher outcrossing, SIGMEA – results in field experiments from Switzerland,

Ammann, K., Kovacovsky, K., & Bratschi, D. (2009)
Maize Geneflow - GPS-Mapping and 3-dimensional Landscape Modeling, final report WP2 SIGMEA project, Wider Fields University of Bern Participation pp 25 (Manuscript)
http://www.botanischergarten.ch/SIGMEA/SIGMEA-Bern-Final-Report-20090831.pdf

Maize Field I and II from gene flow experiment in Switzerland: spots caused through sowing machine turned around, caused change in flowering synchroni-zation: higher outcrossing, but all results well within the legal threshold of the E

European Safety Attitude: let not the Europeans decide about Biosafety in Africa, **do your own safety assessment**

European safety attitude: a problem for many countries in the developing wo

PRRI: www.pubresreg.org see ASK-FORCE with blogs on biosafety
http://www.botanischergarten.ch/ASK-FORCE-Summary/ASK-FORCE-Summary.pdf

PRRI Public Research & Regulation Initiative

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Author | Topic: Are Bt toxins killing aquatic insects? (Read 580 times)

PRRI Secretariat
Guest

Are Bt toxins killing aquatic insects?
« **on:** October 26, 2007, 10:12:40 AM »

Quote

Topic:
In an article of PNAS (Proceedings of the National Academy of Sciences, USA) it is reported that aquatic organisms are potentially harmed by residues and toxins of Bt maize.

Source:
Toxins in Transgenic Crop Byproducts May Affect Headwater Stream Ecosystems. Proceedings of the National Academy of Sciences %R 10.1073/pnas.0707177104
By Rosi-Marshall, E.J., Tank, J.L., Royer, T.V., Whiles, M.R., Evans-White, M., Chambers, C., Griffiths, N.A., Pokelsek, J., & Stephen, M.L. (2007)
Online publication: http://www.pnas.org/cgi/reprint/0707177104v2

The abstract:

危机 = 危 + 机

Risk = Hazard / Opportuniy

Widespread definition, but onetrack-minded
Risk = Hazard x Likelyhood
Or worse: Risk = Social bla bla x media frenzy

Ammann, K. (2004)
The Role of Science in the Application of the Precautionary Approach,. *In Molecular Farming, Plant-made Pharmaceuticals and Technical Proteins* (eds R. Fischer & S. Schillberg), Vol. 1, pp. 291-302. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim,
http://www.botanischergarten.ch/Precautionary/Ammann-Precautionary-Approach1.pdf

4 Opportunities

4a A matter of common sense and public health:

replace conventional maize with its high content of cancer causing mycotoxins with genetically engineered Bt maize with much less mycotoxins

Transgenic maize healthier than conventional maize: more insect bites cause more mould infections causing much higher levels of cancerogenous mycotoxins

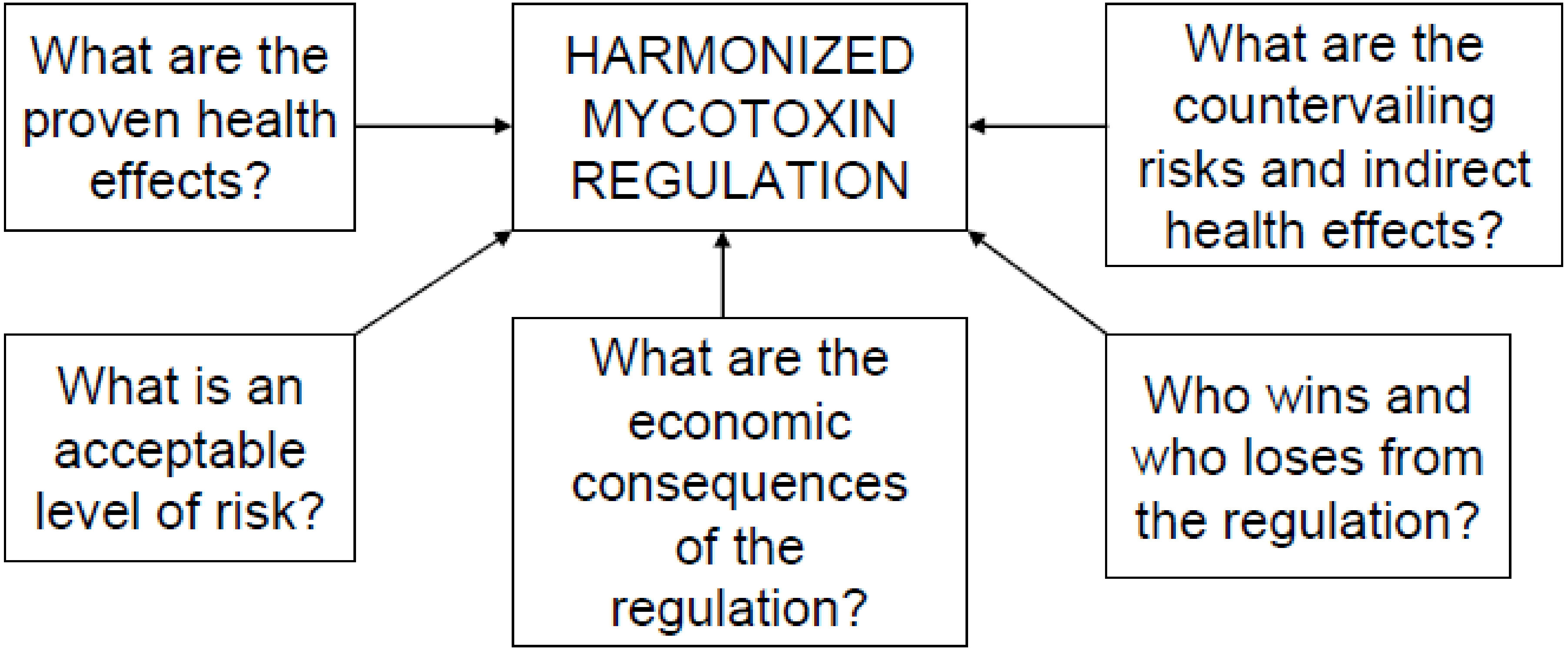


Figure 1. Integrated Assessment to Inform Development of Harmonized Mycotoxin Regulations

Wu, F., Miller, J.D., & Casman, E.A. (2004)
The economic impact of Bt corn resulting from mycotoxin reduction. Journal of Toxicology-Toxin Reviews, 23, 2-3, pp 397-424
http://www.botanischergarten.ch/Mycotoxins/Wu-Economic-Impact-2004.pdf

Results held back for political reasons since March 7, 2006
Data produced by the University of Milan

Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione

MINISTERO POLITICHE AGRICOLE E FORESTALI

Ricerche sugli OGM in Agricoltura

RISULTATI

Roma, 7 marzo 2006

Yield

Conventional varieties 11 and 11.1 tons per hectare

Engineered varieties 14.1 and 15.9 tons per hectare.

Increase: 28 to 43 percent.

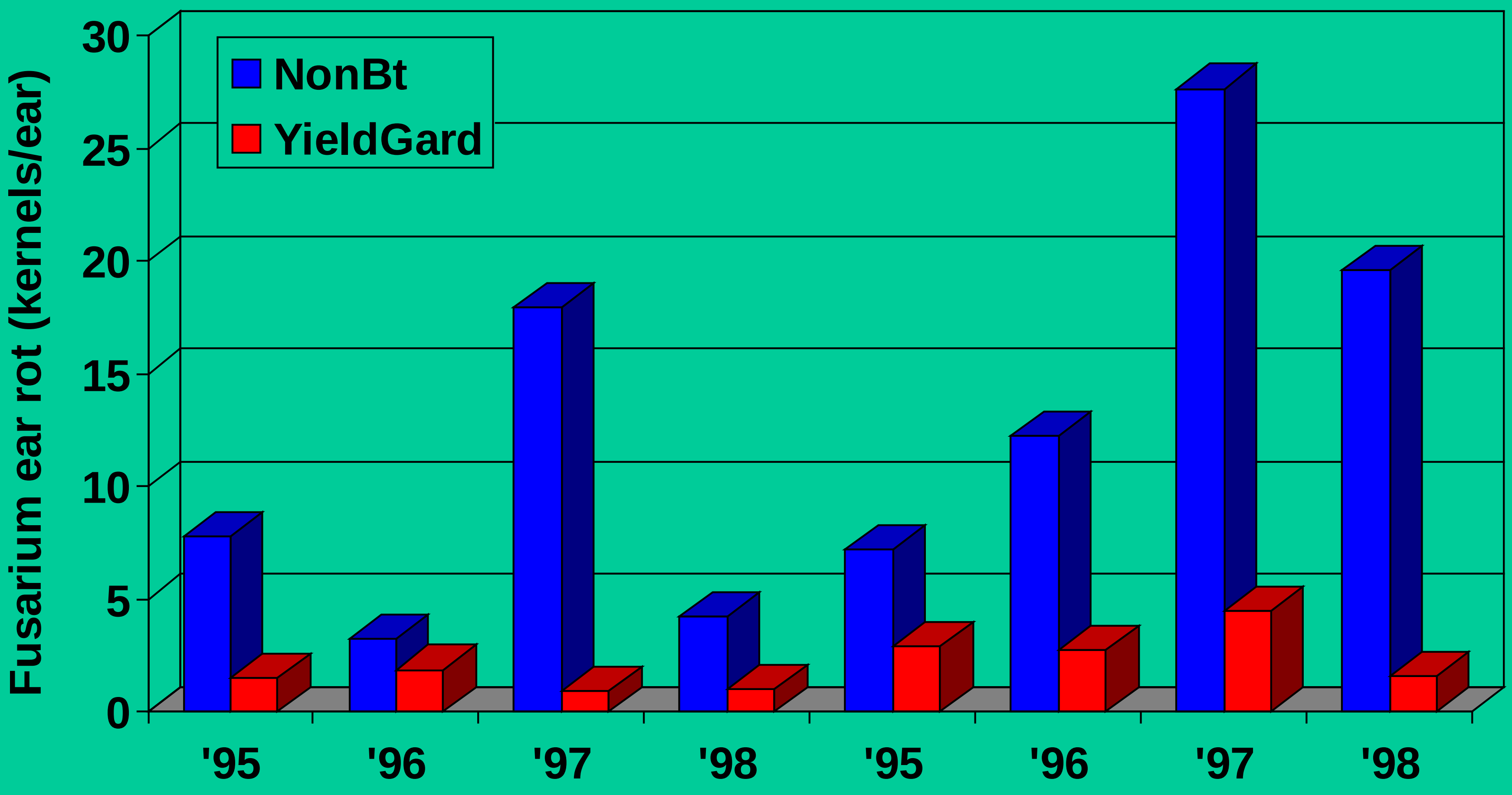
Economic losses 300 million to 1 billion Euro per year due to prohibition of Bt crops

Increase of health risks in conventional maize:

The extensive infection causes a dramatic increase in fumonisin levels, while the engineered varieties had between 100 and 130 times less of the toxins.

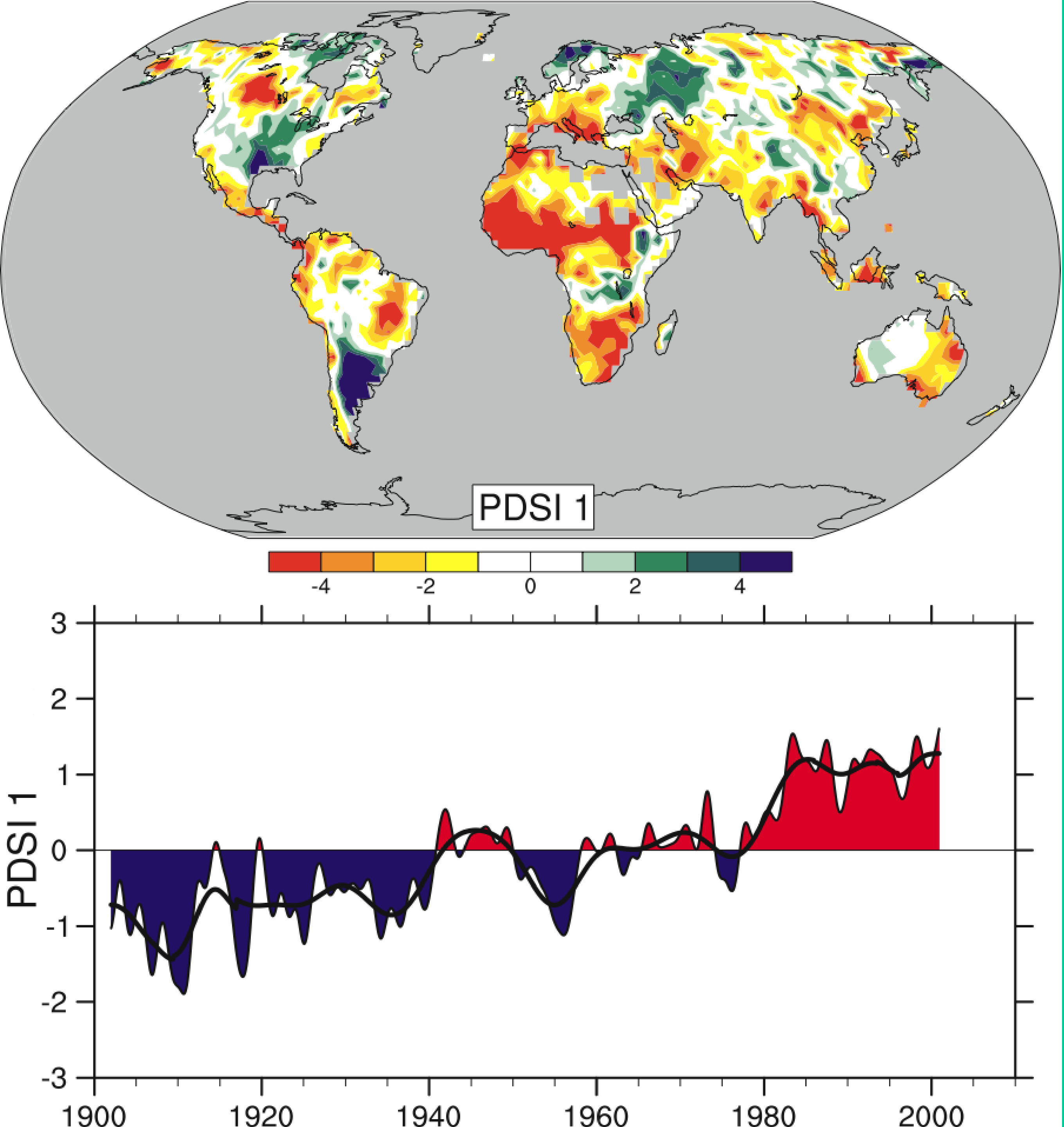
November 13, 2007 - Milan, Italy and Tuskegee, Alabama - via AgBioView, http://www.agbioworld.org , Piero Morandini, Milano, piero.morandini@unimi.it and Roberto Defez, Napoli, defez@igb.cnr.it

the first study on transgenic maize mycotoxins (red) being much lower than in conventional maize (blue)



Munkvold, G.P., Hellmich, R.L., & Showers, W.B. (1997)
Reduced Fusarium ear rot and symptomless infection in kernels of maize genetically engineered for European corn borer resistance. Phytopathology, 87, 10, pp 1071-1077
http://www.botanischergarten.ch/Bt/Munksvold-Reduced-Fusarium-1997.pdf

4b Opportunities for modern breeding for draught resistant and salt resistant crops



Palmer drought severity index

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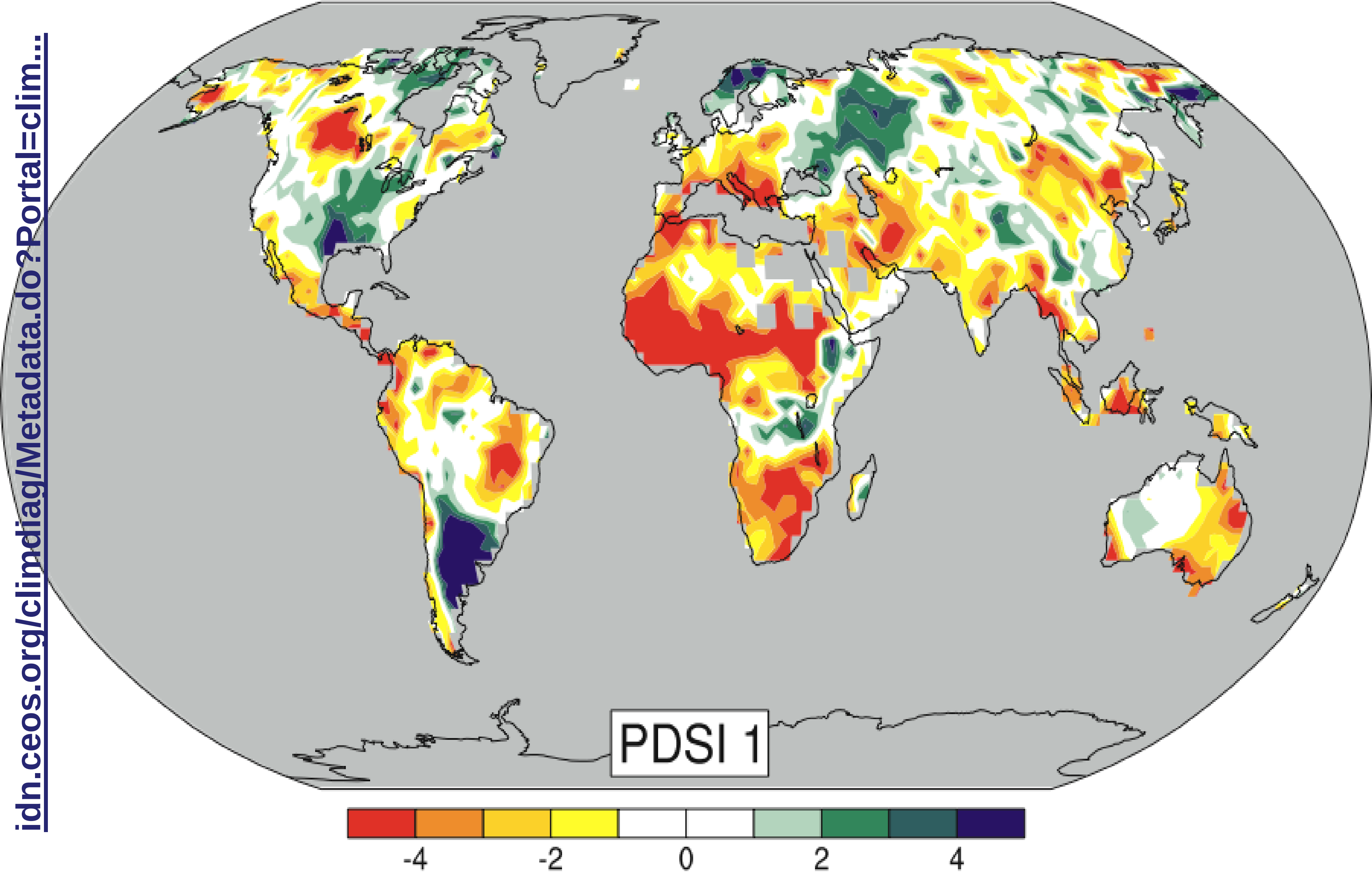
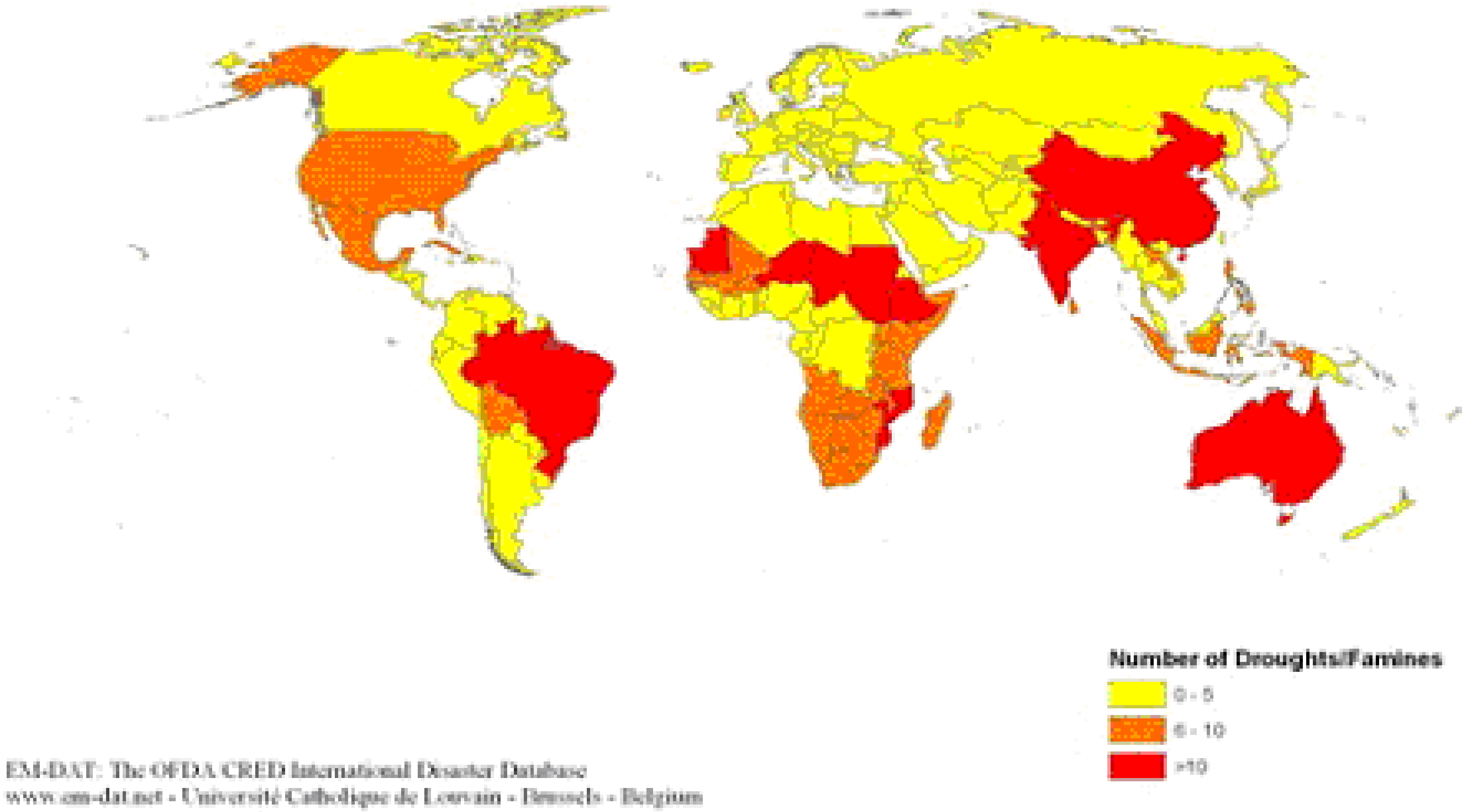


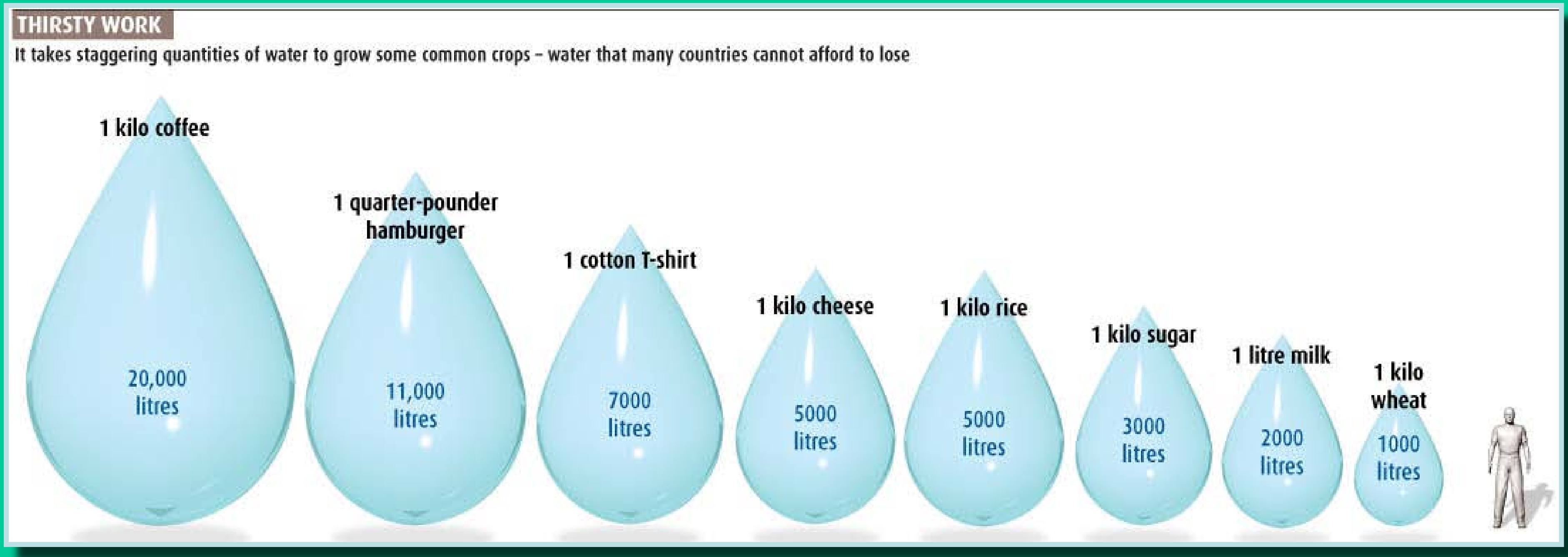
Palmer drought severity index

Nuber of Occurrences of Drought/Famine Disasters by Country: 1974-2003

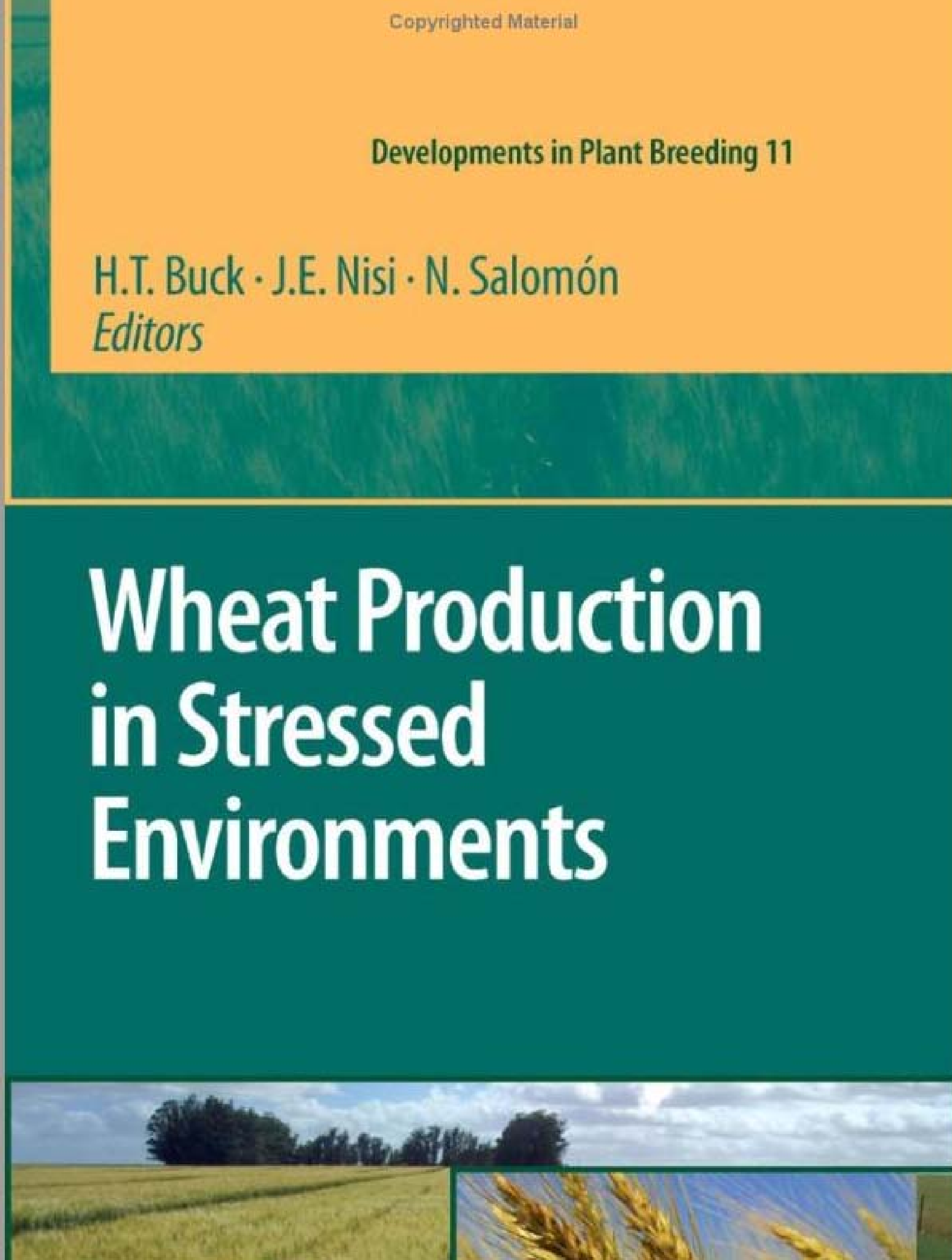


www.odec.ca/projects/2005/pete5o0/public_html/Pages/Background.html

- **Embedded water** or **hidden water**
- Water used in the production of a good or service In the context of trade



http://technology.newscientist.com/



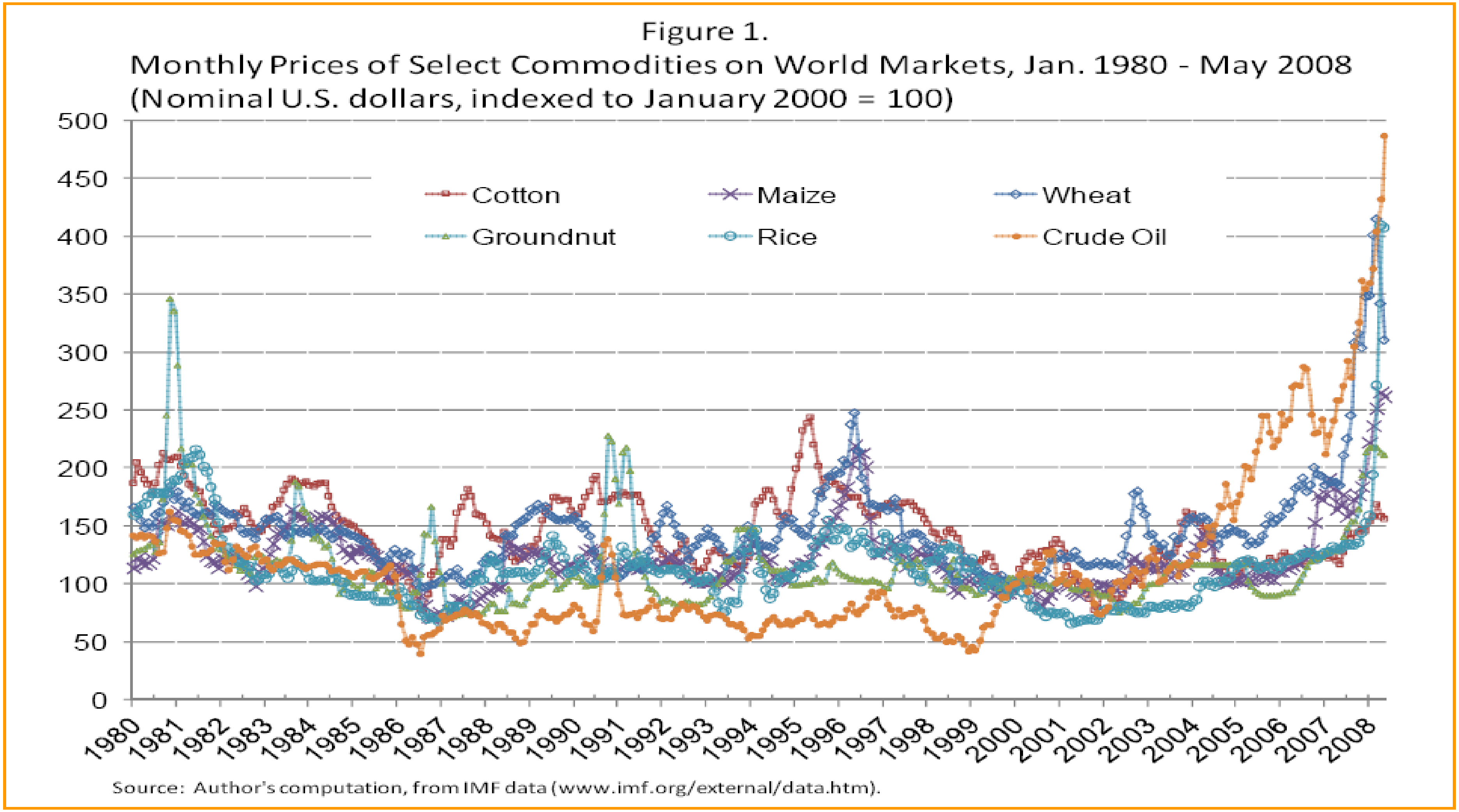
Buck, H.T., Nisi, J.E., & Solomon, N. (2007) Wheat Production in Stressed Environments:, Mar del Plata, Argentina Springer; 1 edition (July 11, 2007),   Proceedings of the 7th International Wheat Conference, Ed. pp 795

Table 2
Relevant examples of genes conferring drought tolerance

Genes	Function	Mechanism of action	References
DREBs/CBFs; *ABF3*	Stress induced transcription factors	Enhanced expression of downstream stress related genes confers drought/cold/salt tolerance. Constitutively overexpression can lead to stunting growth	Oh et al. (2005), Ito et al. (2006)
SNAC1	Stress induced transcription factor	*SNAC1* expression reduces water loss increasing stomatal sensitivity to ABA	Hu et al. (2006)
OsCDPK7	Stress induced Ca-dependent protein kinase	Enhanced expression of stress responsive genes	Saijo et al. (2000)
Farnesyl-transferase (*ERA1*)	Negative-regulator of ABA sensing	Down-regulation of farnesyltransferase enhances the plant's response to ABA and drought tolerance reducing stomatal conductance	Wang et al. (2005)
Mn-SOD	Mn-superoxide dismutase	Overexpression improves stress tolerance also in field conditions	McKersie et al. (1996)
AVP1	Vacuolar H^+-pyrophosphatase	Overexpression facilitate auxin fluxes leading to increased root growth	Gaxiola et al. (2001), Park et al. (2005)
HVA1; *OsLEA3*	Stress induced LEA proteins	Over-accumulation of LEA increases drought tolerance also in field conditions	Bahieldin et al. (2005), Xiao et al. (2007)
ERECTA	A putative leucine-rich repeat receptor-like kinase is a major contributor to a locus for *Δ* on *Arabidopsis* chromosome 2	*ERECTA* acts as a regulator of transpiration efficiency with effects on stomatal density, epidermal cell expansion, mesophyll cell proliferation and cell–cell contact	Masle et al. (2005)
otsA and otsB	*Escherichia coli* trehalose biosynthetic genes	Increased trehalose accumulation correlates with higher soluble carbohydrate levels, elevated photosynthetic capacity and increased tolerance to photo-oxidative damage	Garg et al. (2002)
P5CS	δ-Pyrroline-5-carboxylate synthetase	Enhanced accumulation of proline leads to increased osmotolerance	Kavi Kishor et al. (1995), Zhu et al. (1998)
mtlD	Mannitol-1-phosphate dehydrogenase	Mannitol accumulation leads to increased osmotolerance	Abebe et al. (2003)
GF14λ	14-3-3 protein	Lines overexpressing *GF14λ* have a "stay green" phenotype, improved water stress tolerance and higher photosynthetic rates under water deficit conditions	Yan et al. (2004)
NADP-Me	NADP-malic enzyme	The overexpression decreased stomatal conductance and improves WUE	Laporte et al. (2002)

Cattivelli, L., Rizza, F., Badeck, F.W., Mazzucotelli, E., Mastrangelo, A.M., Francia, E., Mare, C., Tondelli, A., & Stanca, A.M. (2008)
Drought tolerance improvement in crop plants: An integrated view from breeding to genomics. Field Crops Research, 105, pp 1-14
http://www.botanischergarten.ch/DroughtResistance/Cattivelli-Drought-Tolerance-2008.pdf

short term character of crop supplies:
main cause of quick changes in crop price



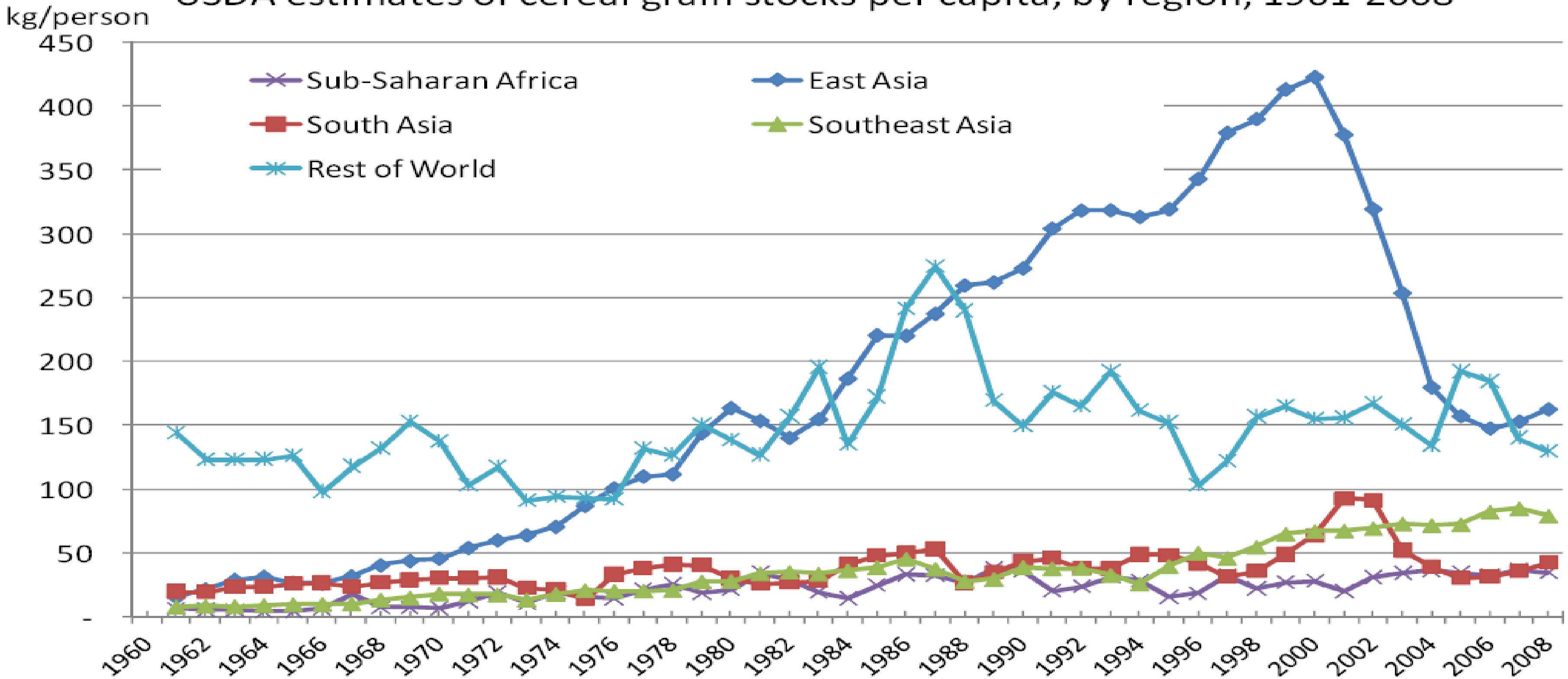
Masters, W.A. (2008)

Beyond the Food Crisis, Aid and Innovation in Africa. ATDF Journal, 5, 1/2, pp 3-15

http://www.botanischergarten.ch/Developing/ATDF-Journal-5-1-2-2008.pdf

short term character of crop supplies: main cause of quick changes in crop price

Figure 2.
USDA estimates of cereal grain stocks per capita, by region, 1961-2008

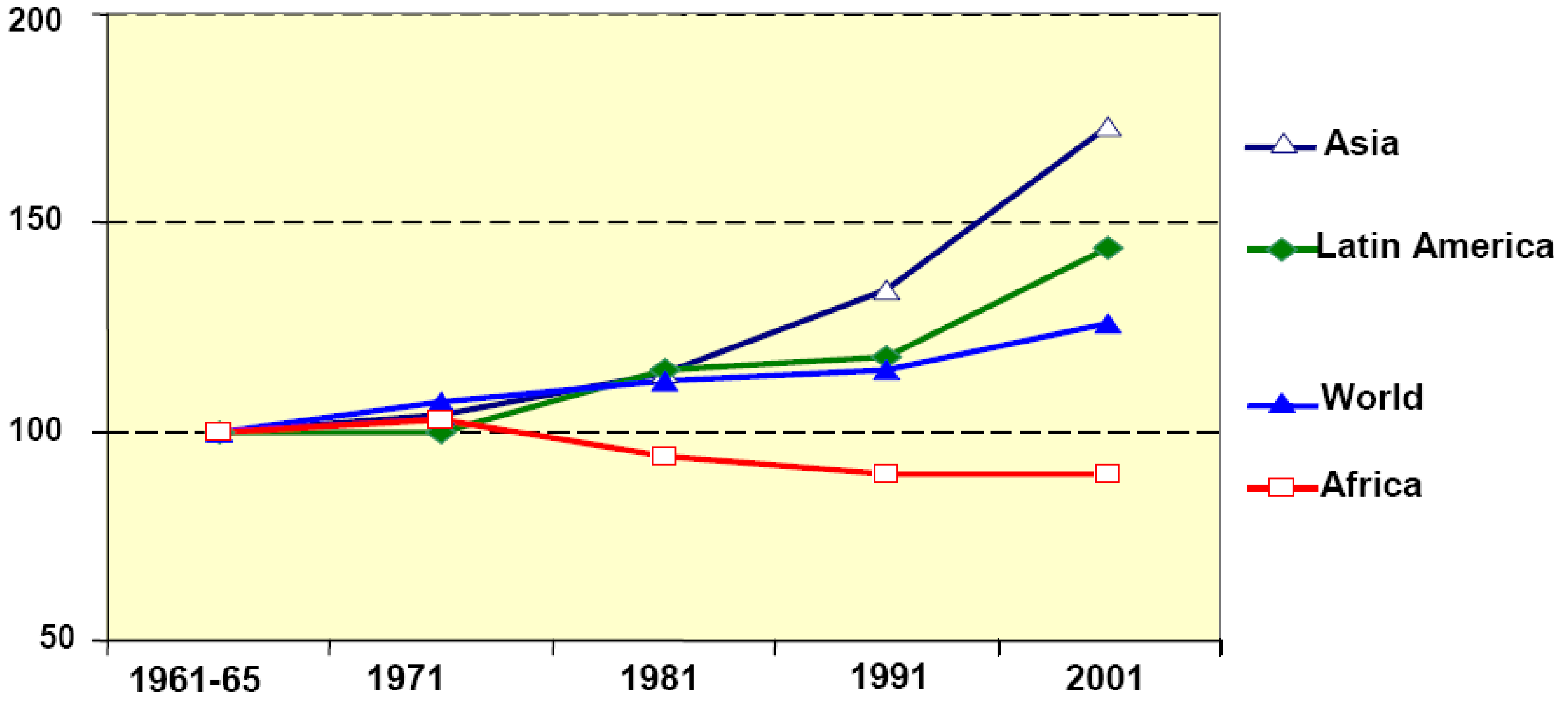


Source: Author's calculations. Grain stock estimates are for the end of the marketing season in the year shown, from USDA PS&D database (www.fas.usda.gov/psdonline), matched with mid-year population estimates from US Census Bureau, International Database (www.census.gov/ipc/www/idb).

Masters, W.A. (2008)
Beyond the Food Crisis, Aid and Innovation in Africa. ATDF Journal, 5, 1/2, pp 3-15
http://www.botanischergarten.ch/Developing/ATDF-Journal-5-1-2-2008.pdf

Dramatic differences in Agricultural Production/Capita: Low values in Africa due to lacking infrastructure

Figure 1: Regional Differences in the Development of Agricultural Production/Capita (Southgate et al. 2007: 67)



Masters, W.A (2008)
Beyond the Food Crisis, Aid and Innovation in Africa. ATDF Journal, 5, 1/2, pp 3-15
http://www.botanischergarten.ch/Developing/ATDF-Journal-5-1-2-2008.pdf

4c Opportunities for modern breeding draught tolerant and salt tolerant biofuel crops in dry regions

Excellent opportunity for biofuel production in dry regions

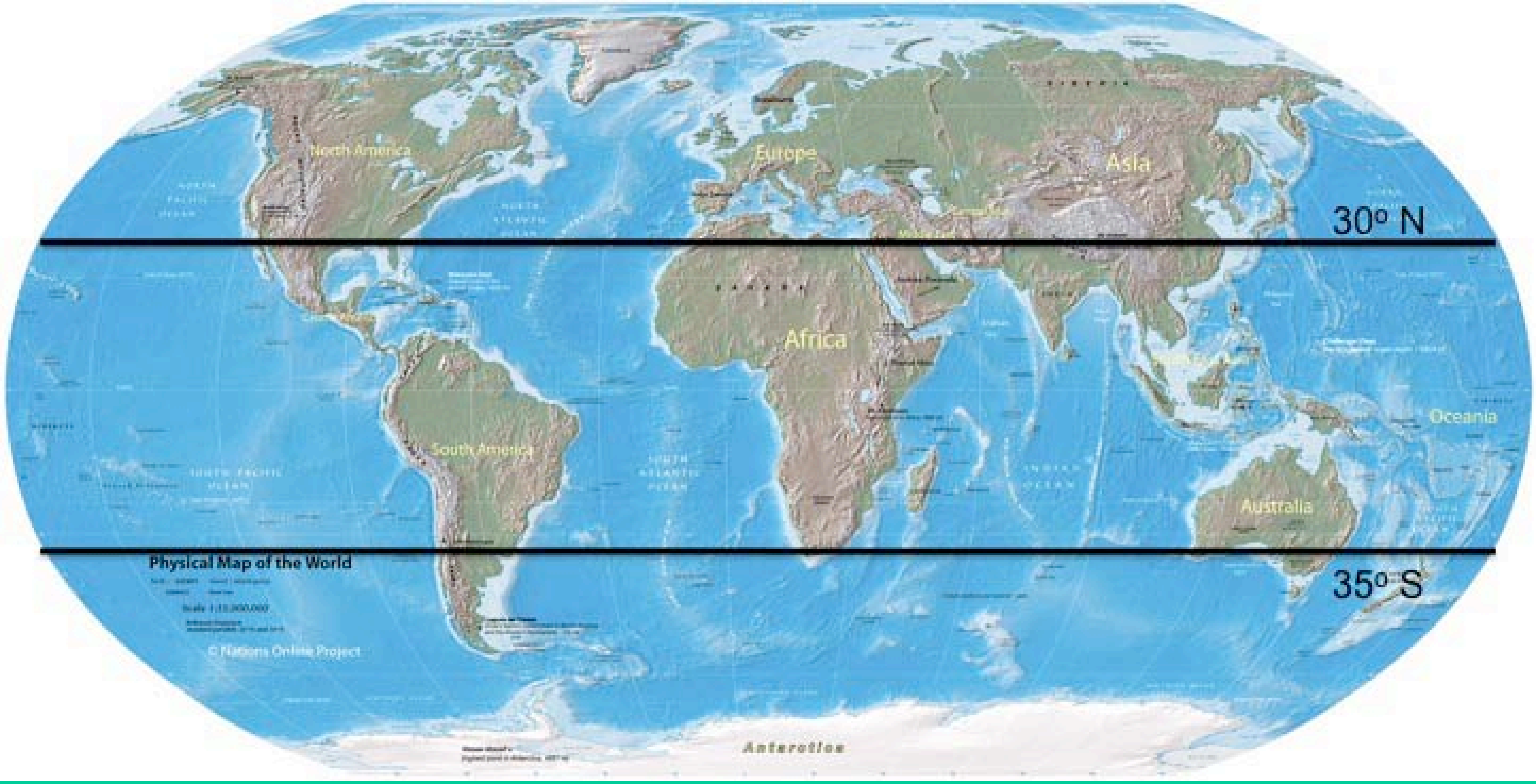
Jatropha curcas L.:

Center of origin, S. America, potentially Brazil

- Kingdom *Plantae*
- Family *Euphorbiaceae*
- Genus *Jatropha*
- Species *Jatropha curcas* L.

Jongschaap, R.E.E., Blesgraaf, R.A.R., Bogaard, T.A., van Loo, E.N., & Savenije, H.H.G. (2009)
The water footprint of bioenergy from Jatropha curcas L. Proceedings of the National Academy of Sciences of the United States of America, 106, 35, pp E92-E92
http://www.botanischergarten.ch/Biofuel/Jongschaap-Water-Footprint-Jatropha-2009.pdf AND
http://www.botanischergarten.ch/Biofuel/Jongschaap-Claims-Facts-Jatropha-2007.pdf

Growth range for Jatropha



Suitable growth 30º N - 35º S

Figure adapted from Jongschaap et al. (2007)

Jongschaap, R.E.E., Blesgraaf, R.A.R., Bogaard, T.A., van Loo, E.N., & Savenije, H.H.G. (2009)
The water footprint of bioenergy from Jatropha curcas L. Proceedings of the National Academy of Sciences of the United States of America, 106, 35, pp E92-E92
http://www.botanischergarten.ch/Biofuel/Jongschaap-Water-Footprint-Jatropha-2009.pdf AND
http://www.botanischergarten.ch/Biofuel/Jongschaap-Claims-Facts-Jatropha-2007.pdf

- India’s Planning Commission estimates 1,300 liters of oil per hectare from oilseeds
- Skeptical experts suggest half this value (Fairless, 2007)

Biodiesel crop species	Oil (L/ha)
Oil palm	**2,400**
Jatropha	***1,300***
Rapeseed (canola)	**1,100**
Sunflower	**690**
Soybean	**400**

Data: United Nations Development Program/World Bank

Fairless, D. (2007)
Biofuel: The little shrub that could - maybe. Nature, 449, 7163, pp 652-655
http://www.botanischergarten.ch/Biofuel/Fairless-Little-Shrub-2007.pdf

Yield potentials

Oasis in the desert: Jatropha cultivation can halt soil erosion, increase water storage in the soil and transform barren expanses into lush, productive land.
“I saw all this green in what is otherwise a complete desert.”
— Klaus Becker
Jatropha is already under cultivation in Tamil Nadu, India, where it can be grown with other crops such as sunflowers.

Fairless, D. (2007) Biofuel: The little shrub that could - maybe. Nature, 449, 7163, pp 652-655 http://www.botanischergarten.ch/Biofuel/Fairless-Little-Shrub-2007.pdf

- Hard soaps
- Candles
- Paints
- Lubricants
- Insecticide
- Fertilizer
- Medicine
- Living fence

- **Biodiesel fuel**

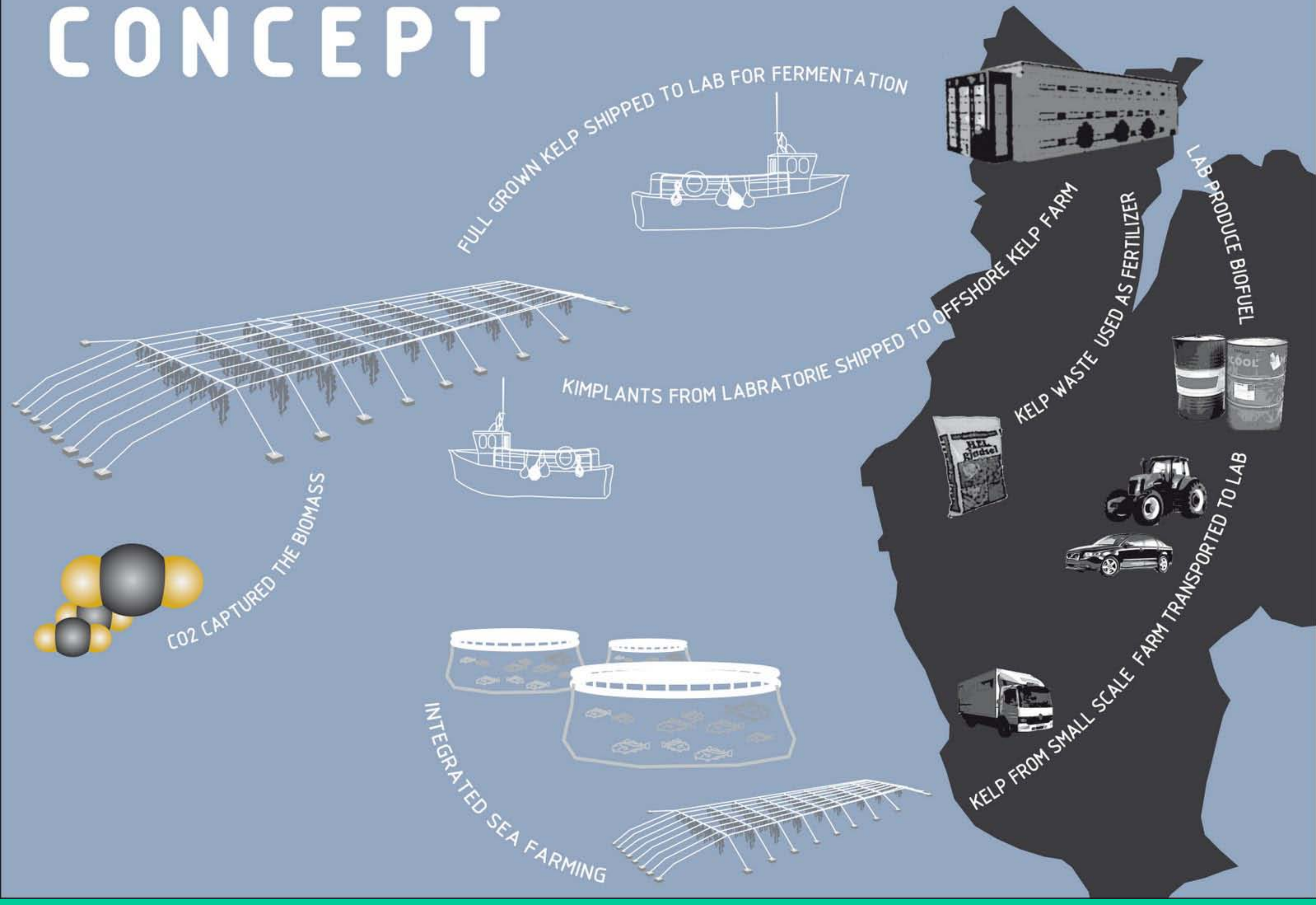
Uses for products

4d Opportunities for biofuel production with seaweeds and salt tolerant coast plants

Laminaria digitata

Oarweed, ***Laminaria digitata***, (also known as Common Kelp, Tangle and Kombu) is a brown alga (and a member of the Laminariaceae family [kelp]) that represents one of 15 species commonly referred to as 'kelp' but is by far the most common form in the North Atlantic. It grows grows profusely in the upper sublittoral zone in sheltered or moderately exposed sites and individuals exposed at low tide flop over on the substratum. It is very common in the lower intertidal and shallow subtidal growing on rock and often forms extensive meadows in low water. In terms of relatives, it is closely related to the five species (***Saccharina latissima***, ***Saccharina japonica***, ***Laminaria angustata***, ***Laminaria longissima*** and ***Laminaria ochotensis***) www.celtnet.org.uk/recipes/ancient/wild-food-...

CONCEPT



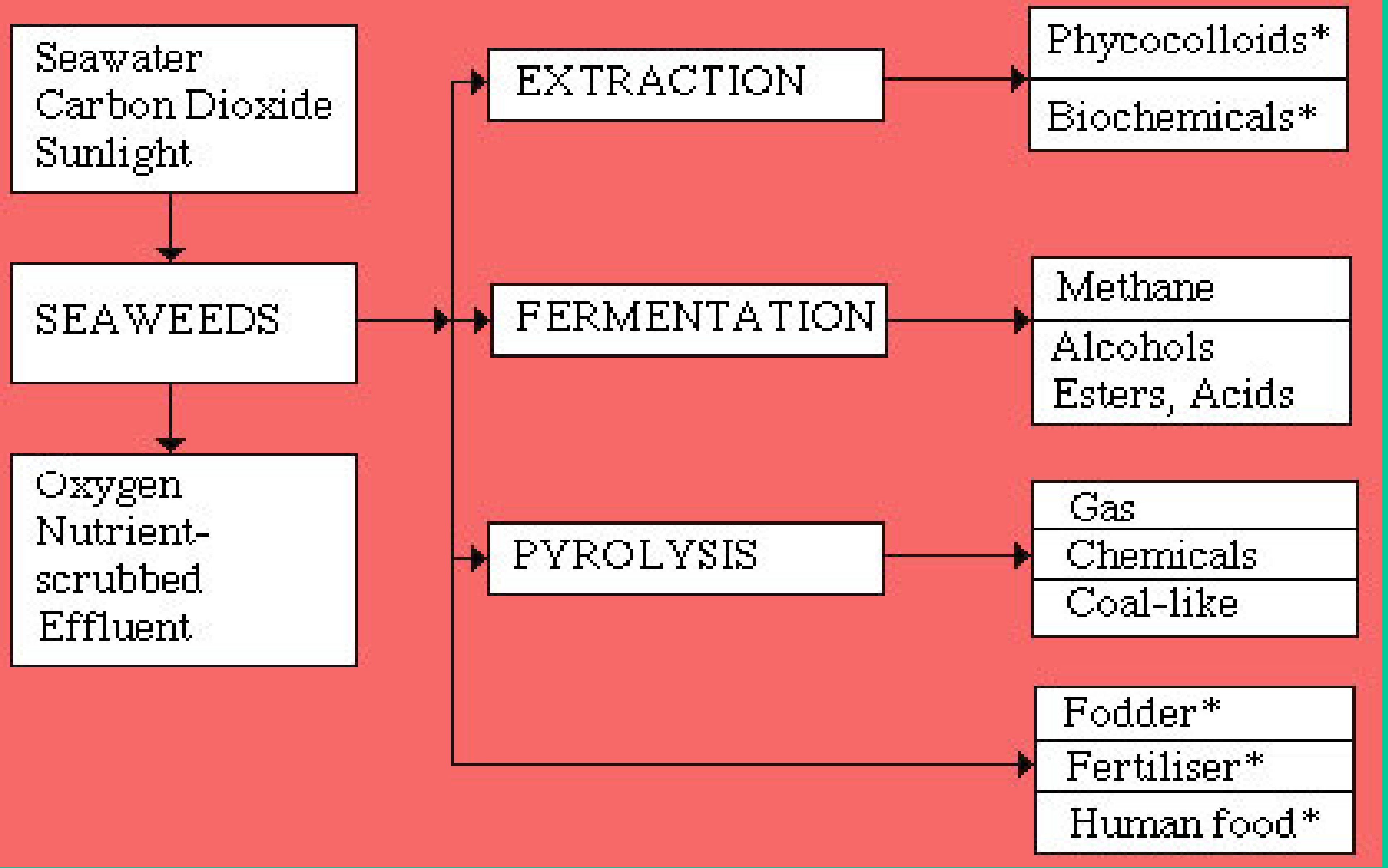
http://appearing-and-disappearing-landscapes.blogspot.com/2010/03/agriculture-over-board.html

Kelp harvester in California, which was used to harvest the kelp Macrocystis for alginate production (© Kelco, Ltd.). Such harvesters are now being used to collect kelp for abalone food.
http://www.seaweed.ie/uses_general/alginates.html

Saccharina japonica on ropes in north-west China (photograph © Dr D.L. Duan Delian; courtesy Zi-Min Hu)

Delesseria sanguinea

Description: Membranous, bright crimson fronds, with cartilaginous, cylindrical, branched stipe arising from a thickened discoid holdfast, to 300 mm long. Branches bearing spirally arranged, leaf-like, ovate-lanceolate blades, each with short stipe and pinnately branched midrib, membranous portion monostromatic, margin undulate (on mature blades), entire. Reproductive structures in small oval, stalked blades, borne on midribs in winter.
Habitat: On rocks, deep shady lower intertidal pools and subtidal, generally distributed, most common and perfectly beautiful in spring.
Similar species: *Phycodrys rubens* is superfically similar but has a duller brownish-red colour and its leaves have an oak-leaf outline.
Key characteristics: Leaf-like ovate-lanceolate blades.
Link: Algaebase



M. Indergaard (1983). The aquatic resource. I. The wild marine plants: a global bioresource. *In* Cote, W. A. *Biomass utilization*. Vol. Plenum Publishing Corporation, 137-168.

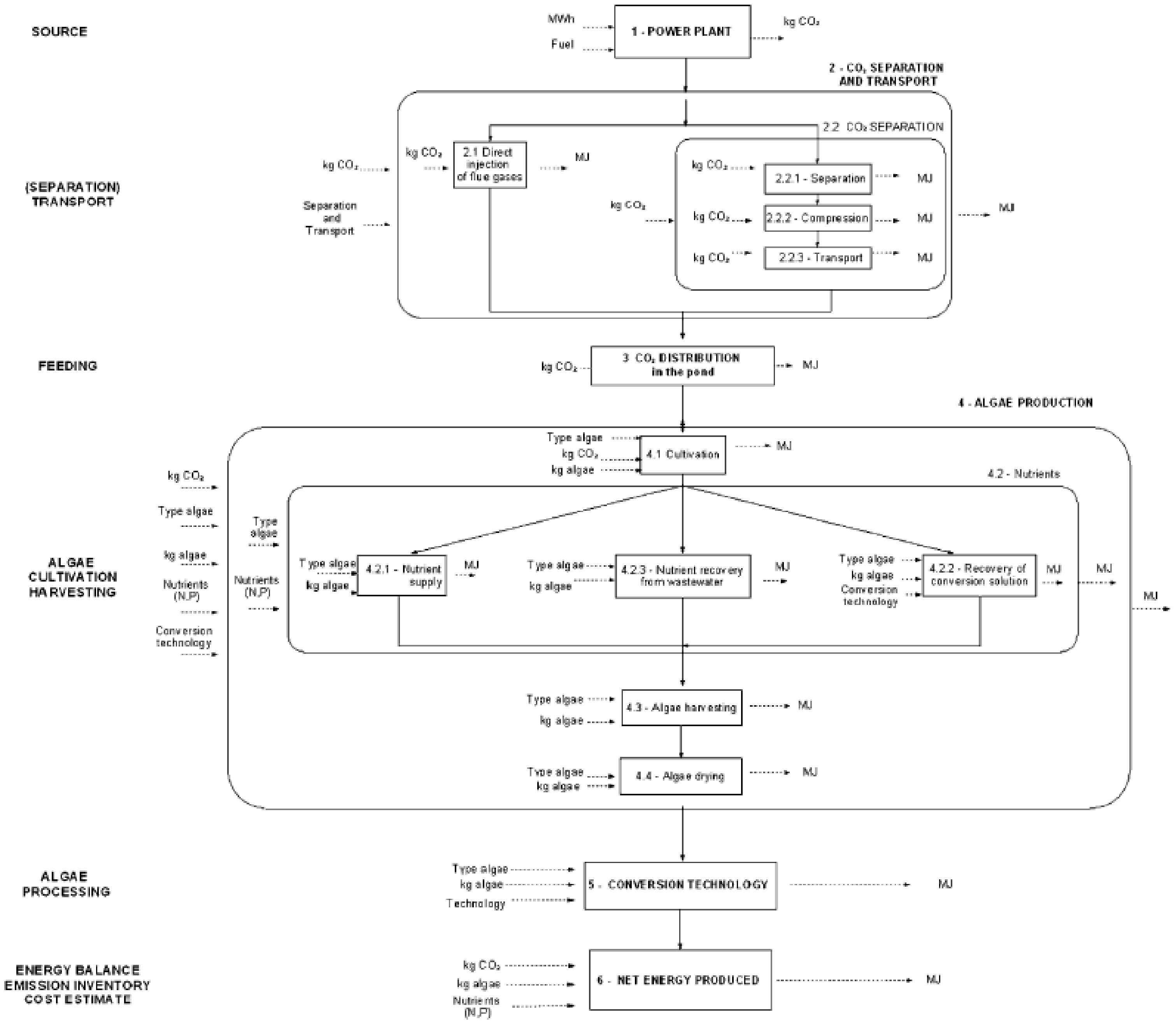
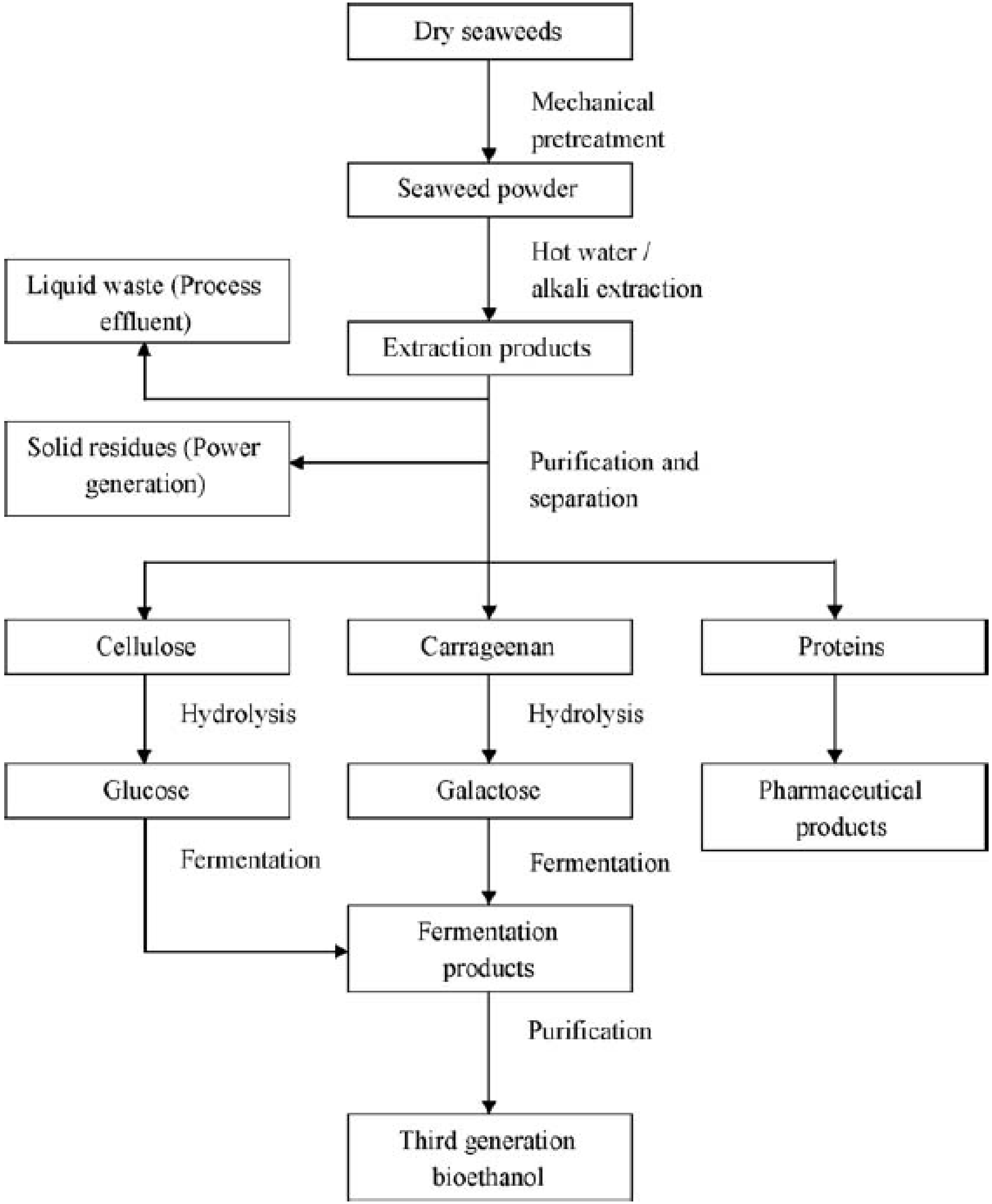


Fig. 1. Flowchart of the analyzed system.

Aresta, M., Dibenedetto, A., & Barberio, G. (2005) Utilization of macro-algae for enhanced CO2 fixation and biofuels production: Development of a computing software for an LCA study. Fuel Processing Technology, 86, 14-15, pp 1679-1693 http://www.botanischergarten.ch/Biofuel/Aresta-Utilization-Macroalgae-2005.pdf

The net energy gain depends on the conversion technology. In the best case considered so far, macro-algae can generate a net energy of the order of 11,000 MJ/tdryalgae compared to 9500 MJ/t relevant to micro-algae gasification.



Block flow diagram of conversion of seaweeds into TGB using algal biorefineries concept.

Conversion of seaweeds into TGB using algal biorefineries concept. Algal biorefineries concept is a green and zero pollution idea. Incorporating ecotourism with seaweed cultivation and refining would be a wise idea as it complies with the principle of sustainable development. It is also an alternate livelihood option for the coastal economy. Cameron Highland located at Peninsular Malaysia would be a good ecotourism example to follow.

Goh, C.S. & Lee, K.T. (2010)
A visionary and conceptual macroalgae-based third-generation bioethanol (TGB) biorefinery in Sabah, Malaysia as an underlay for renewable and sustainable development. Renewable & Sustainable Energy Reviews, 14, 2, pp 842-848
http://www.botanischergarten.ch/Biofuel/Goh-Visionary-Conceptual-Macroalgae-Bioethanol--2010.pdf

PERSPECTIVE

Radically Rethinking Agriculture for the 21st Century

N. V. Fedoroff,[1*] D. S. Battisti,[2] R. N. Beachy,[3] P. J. M. Cooper,[4] D. A. Fischhoff,[5] C. N. Hodges,[6] V. C. Knauf,[7] D. Lobell,[8] B. J. Mazur,[9] D. Molden,[10] M. P. Reynolds,[11] P. C. Ronald,[12] M. W. Rosegrant,[13] P. A. Sanchez,[14] A. Vonshak,[15] J.-K. Zhu[16]

Population growth, arable land and fresh water limits, and climate change have profound implications for the ability of agriculture to meet this century's demands for food, feed, fiber, and fuel while reducing the environmental impact of their production. Success depends on the acceptance and use of contemporary molecular techniques, as well as the increasing development of farming systems that use saline water and integrate nutrient flows.

Fedoroff, N.V., Battisti, D.S., Beachy, R.N., Cooper, P.J.M., Fischhoff, D.A., Hodges, C.N., Knauf, V.C., Lobell, D., Mazur, B.J., Molden, D., Reynolds, M.P., Ronald, P.C., Rosegrant, M.W., Sanchez, P.A., Vonshak, A., & Zhu, J.-K. Radically Rethinking Agriculture for the 21st Century. Science, 327, 5967, pp 833-834
http://www.sciencemag.org/cgi/content/abstract/327/5967/833 AND Podcast
http://www.sciencemag.org/cgi/content/full/sci;327/5967/833/DC1 AND
http://www.botanischergarten.ch/Regulation/Fedorof-Radically-Rethinking-2010.pdf

Fig. 1. Saline farming. Upper and lower right, brackish-water agriculture and tomato farming, Negev desert, Israel; center, saline farming of the halophyte salicornia, Eritrea.

Saline Farming

Fedoroff, N.V., Battisti, D.S., Beachy, R.N., Cooper, P.J.M., Fischhoff, D.A., Hodges, C.N., Knauf, V.C., Lobell, D., Mazur, B.J., Molden, D., Reynolds, M.P., Ronald, P.C., Rosegrant, M.W., Sanchez, P.A., Vonshak, A., & Zhu, J.-K. Radically Rethinking Agriculture for the 21st Century. Science, 327, 5967, pp 833-834

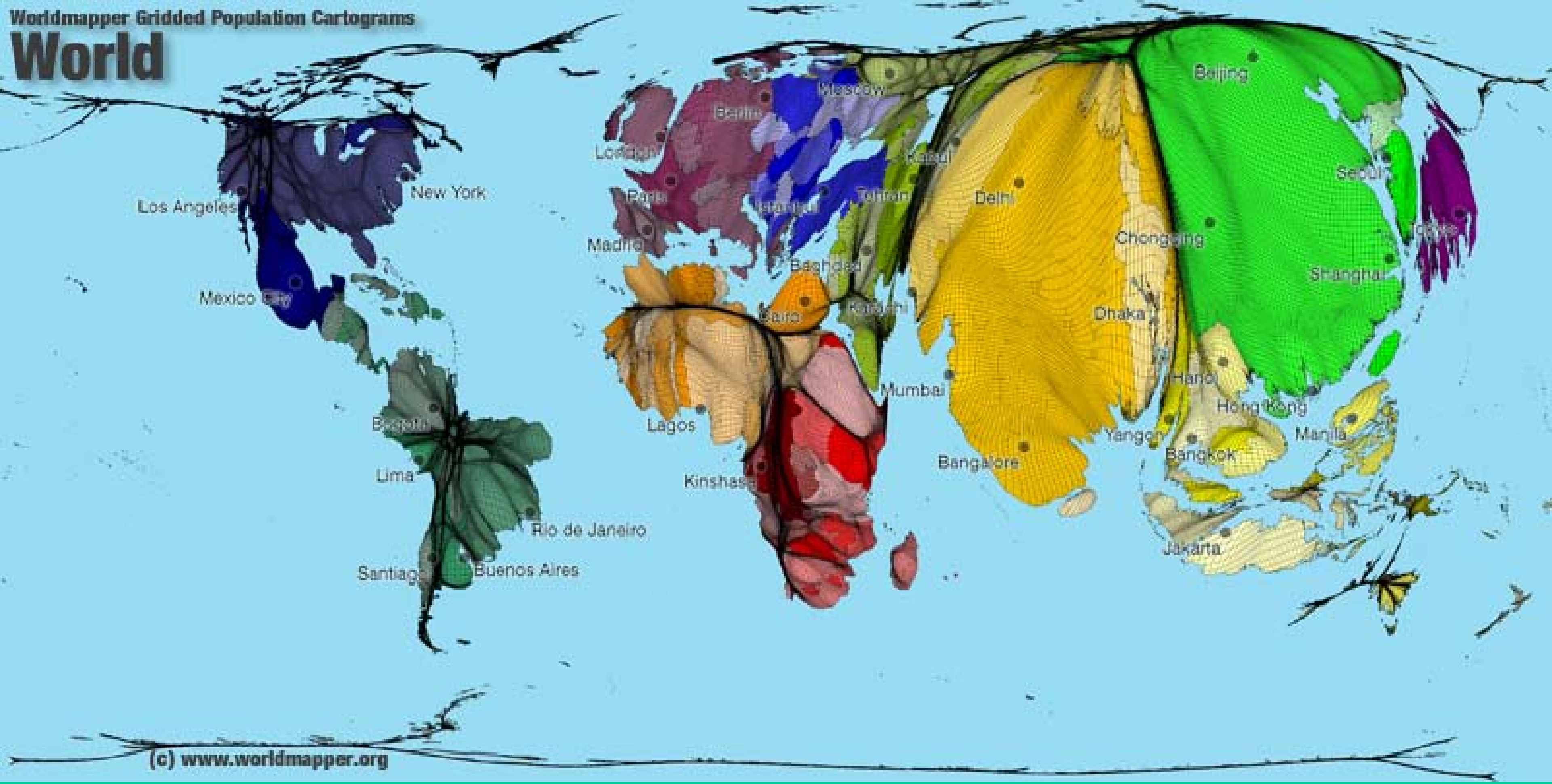
Podcast http://www.sciencemag.org/cgi/content/full/sci;327/5967/833/DC1 AND http://www.botanischergarten.ch/Regulation/Fedorof-Radically-Rethinking-2010.pdf

Salicornia

with great
potential
in coastal
situations
of desert
countries
like the
Gulf States
and Israel

several
annual
and
perennial
species
and other
gen**era**

4e Opportunities for modern breeding for biofortified crops in developing countries with nutritient deficiencies

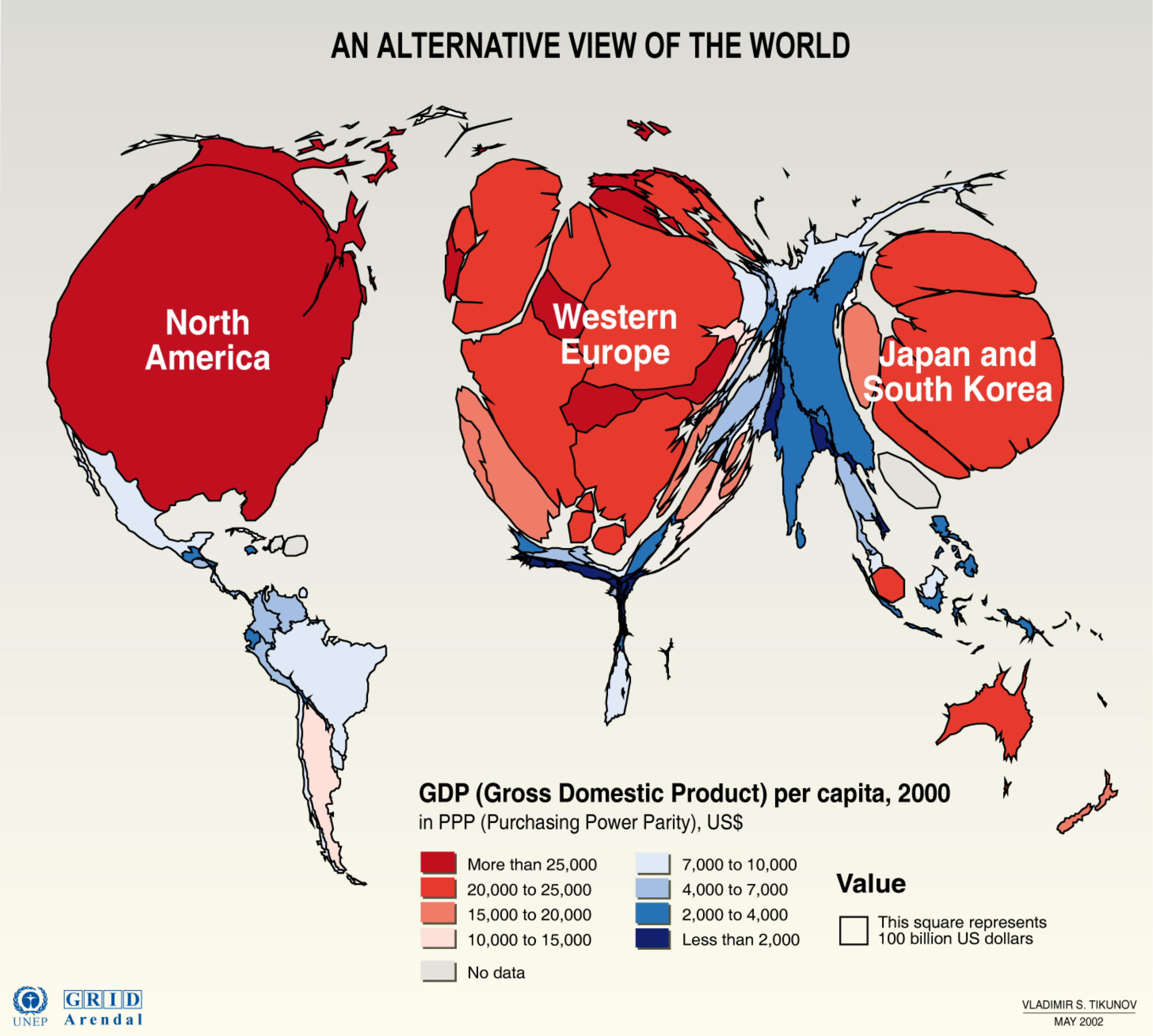


http://www.bondvigilantes.co.uk/blog/UserFiles/Image/world.jpg

Posted by Matthew Russell on 02 October 2009 14:27:00 BST

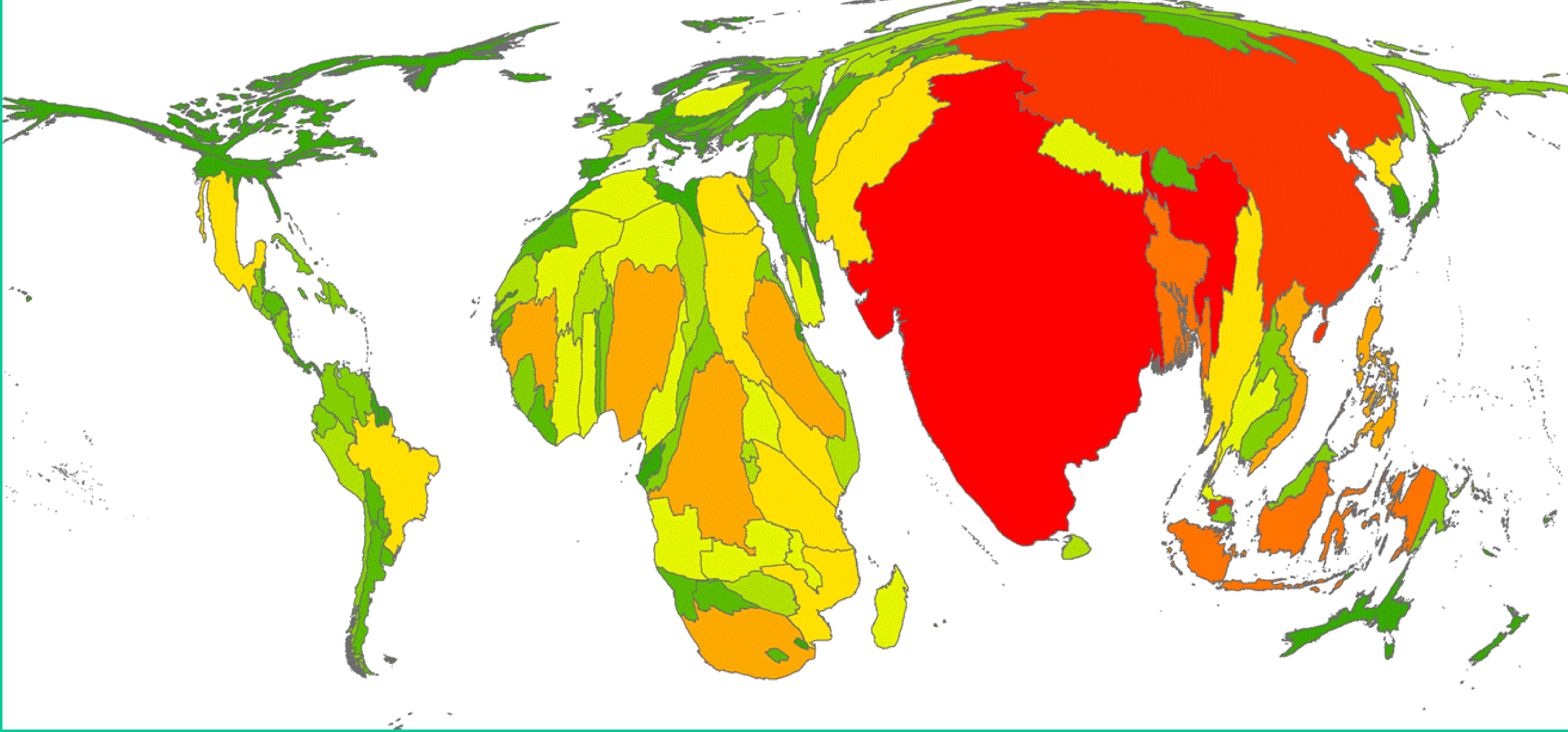
Practically every newspaper article or research note I have read on the global economy over the past couple of years hasn't failed to mention the huge pool of potential demand for goods and services that lies in the emerging middle classes of China and India. I think this map gives us some sense of perspective when reading the huge numbers the journalists and analysts have been talking about. The map re-sizes a country by population rather than by area. It also leaves me with a sense of how insignificant we in the West could become if these trends continue.

Sizing countries according to their per capita income, adjusted for purchasing power parity



Source : United Nations Environment Programme / GRID-Arendal
Cartographer/Designer: Philippe Rekacewicz, UNEP/GRID-Arendal, Vladimir S. Tikunov.

This cartogram illustrates an alternative world view by sizing countries according to their per capita income, adjusted for purchasing power parity.
Areas are color-coded according to their income category based on GDP (Gross Domestic Product) per capita in 2000, in US dollars adjusted for Purchasing Power Parity (PPP).

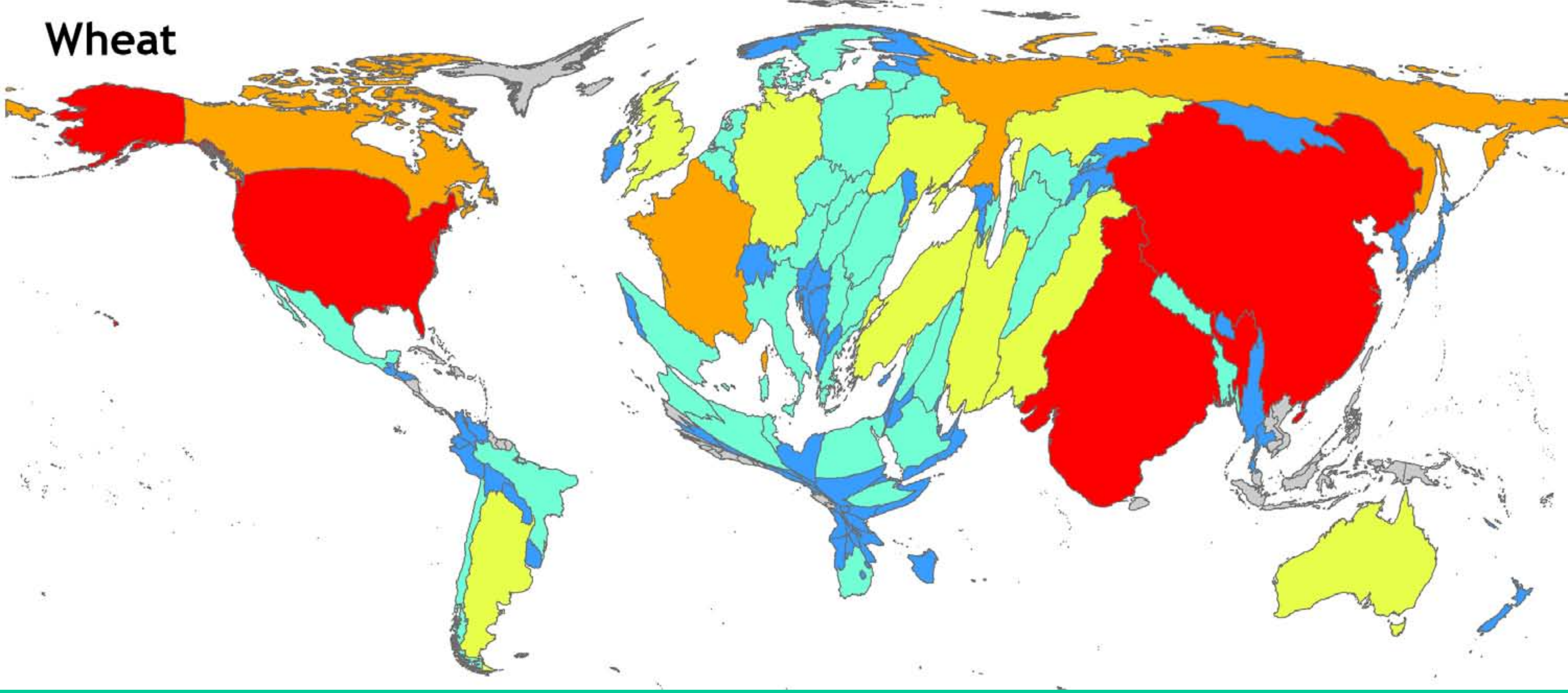


Poverty, number of people living on less than 1 US dollar (purchasing power adjusted) per day.

Cartograms

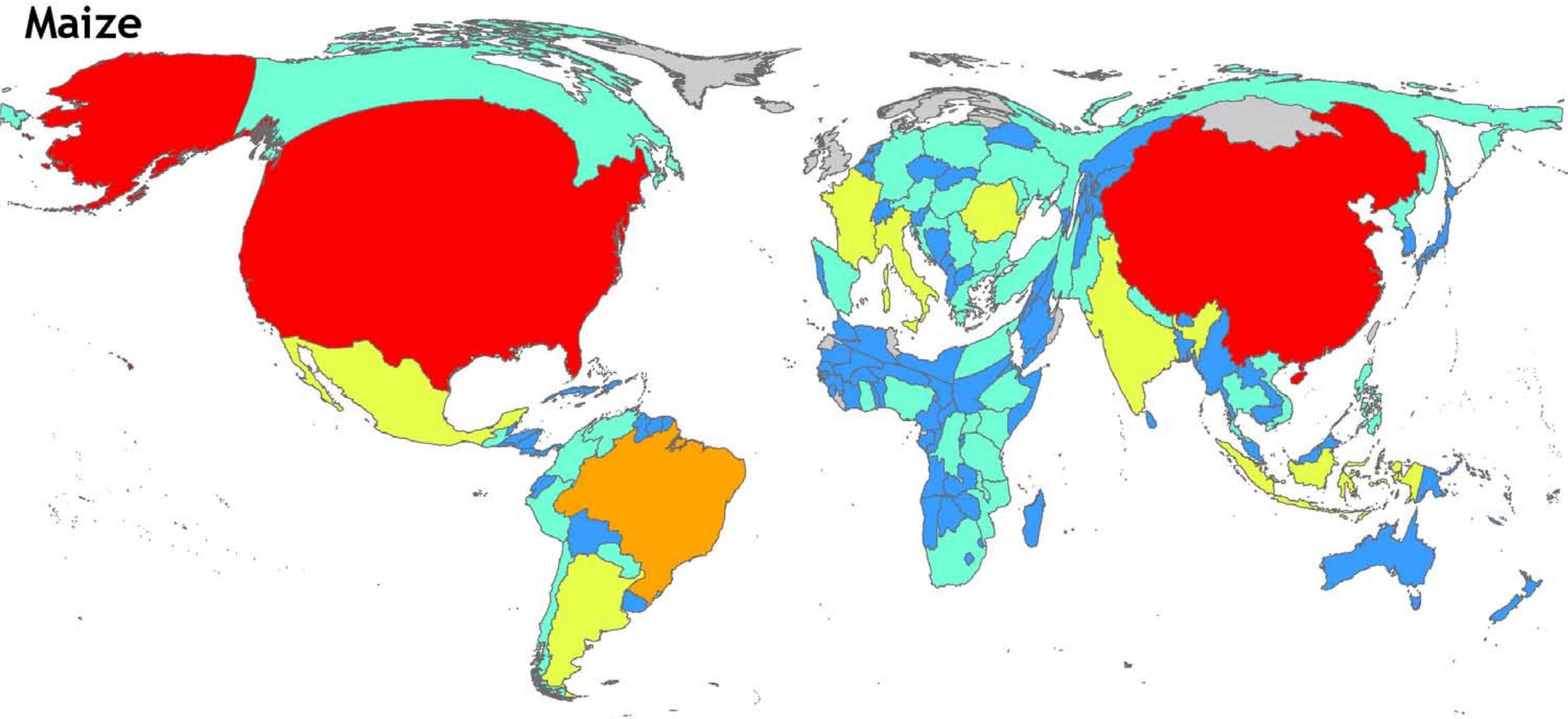
Cartograms are maps on which areas are altered to reflect the subject of interest. They accentuate patterns, making it easier to understand them.

http://www.irri.org/gis/cartograms/cartograms.htm



World Wheat Production in a Cartogram from IRRI

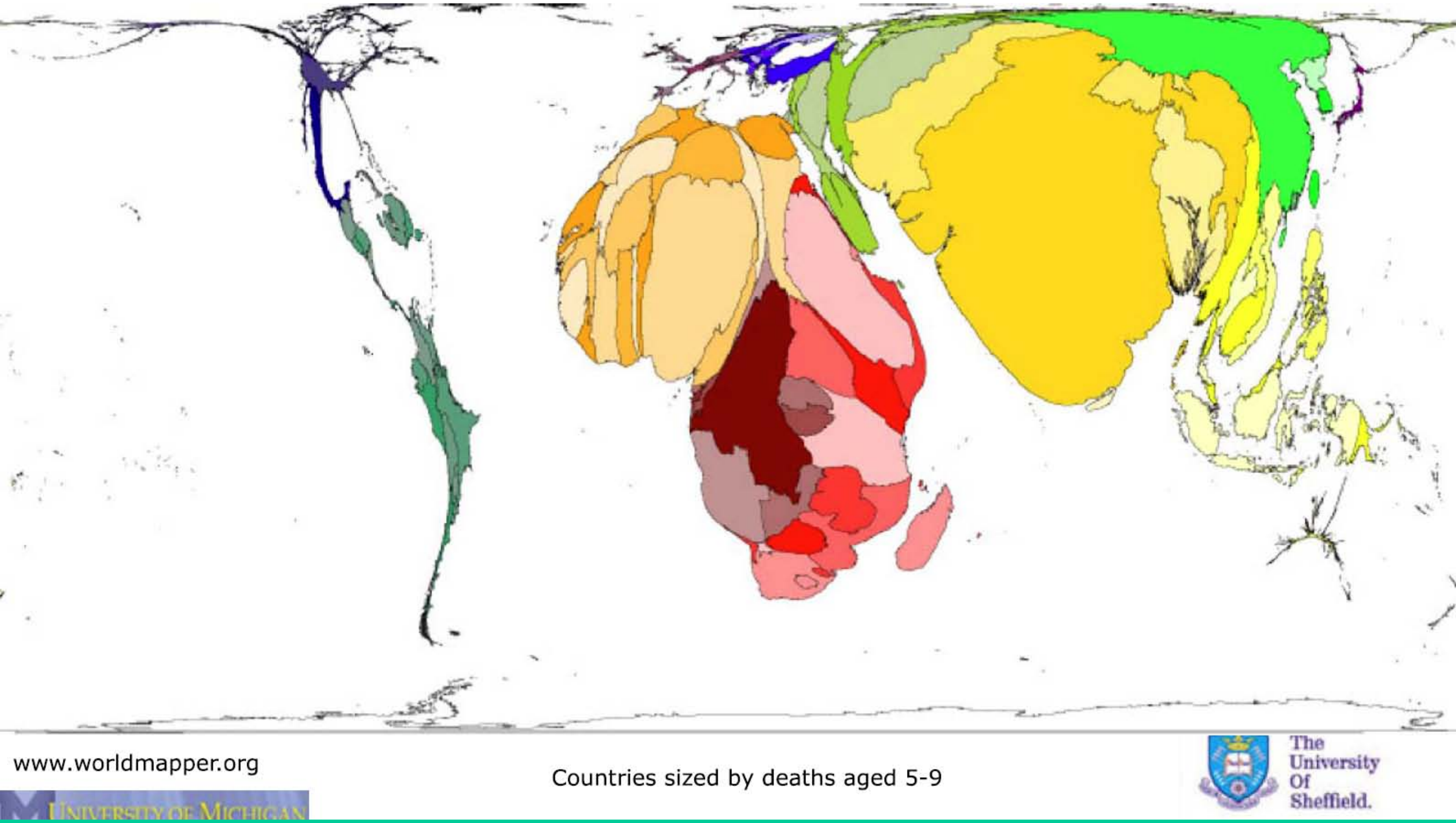
Cartograms
Cartograms are maps on which areas are altered to reflect the subject of interest. They accentuate patterns, making it easier to understand them.
http://www.irri.org/gis/cartograms/cartograms.htm



Cartogram World Maize Production

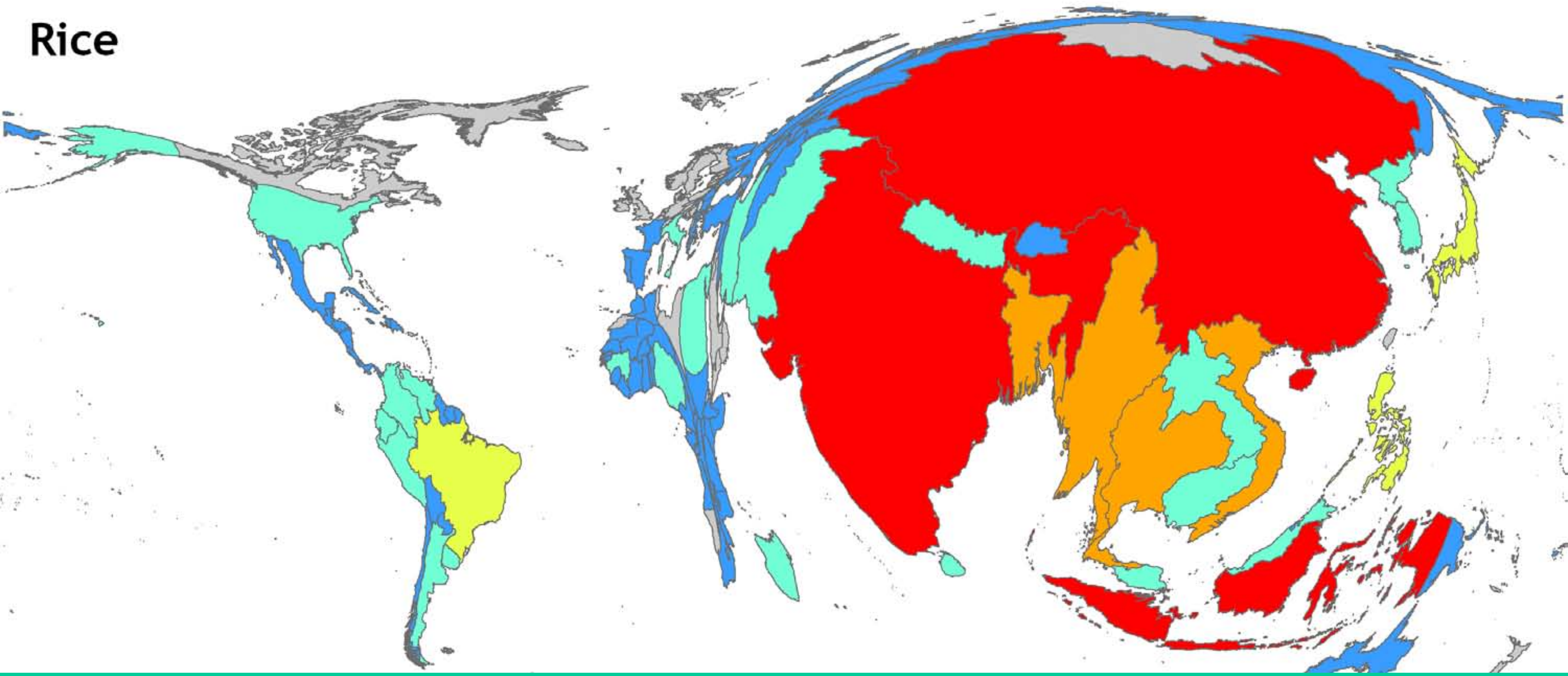
Cartograms
Cartograms are maps on which areas are altered to reflect the subject of interest. They accentuate patterns, making it easier to understand them.
http://www.irri.org/gis/cartograms/cartograms.htm

Contries sized by deaths aged 5-9



http://www.worldmapper.org/animations/age_of_death_animation.html

Priority countries for biofortified modern crops



Cartogram World Rice Production

Priority countries for biofortified modern rice: GOLDEN RICE

Cartograms

Cartograms are maps on which areas are altered to reflect the subject of interest. They accentuate patterns, making it easier to understand them.

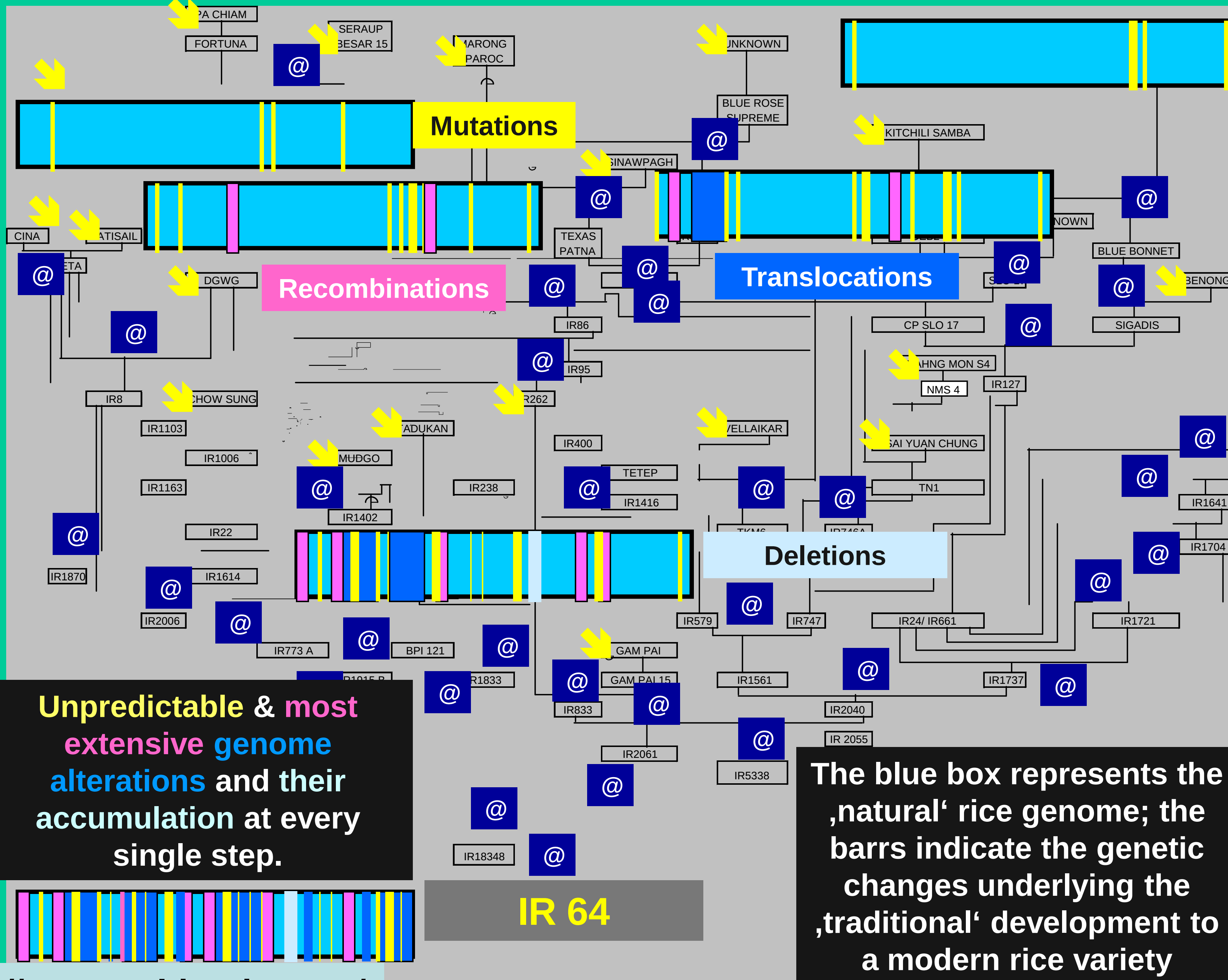
http://www.irri.org/gis/cartograms/cartograms.htm

Ingo Potrykus

***Golden Rice* is part of the solution**
Biofortified rice as a contribution to the alleviation of life-threatening micronutrient deficiencies in developing countries

Time Magazine July 31, 2000
US-Edition
http://www.goldenrice.org/image/who_ingo-TIME.jpg

Breeding tree for *Indica variety* IR64



Unpredictable & most extensive genome alterations and their accumulation at every single step.

The blue box represents the ‚natural' rice genome; the barrs indicate the genetic changes underlying the ‚traditional' development to a modern rice variety

http://www.goldenrice.org/

➘ If these GoldenRice seeds were derived from traditional technology, they could have been passed to breeders in 1999 and they would be in the hands of the farmers since early 2003 .

➘ As these seeds are, however, GMO's they have to pass numerous hurdles before they can be used by breeders, and many more before they can be passed on to the farmers –

if they reach them at all.

➘ To the European society this does not matter: the blind children do not live amongst us and „life of a butterfly in Europe is more important than life of a child" in Southeast Asia.

http://www.goldenrice.org/

- 500 000 children p.a. are becoming blind because of vitamin A deficiency – despite traditional interventions.
- „Golden Rice“ accumulating provitamin A to 1.6 µg/g endosperm may be sufficient to prevent vitamin A-deficiency on the basis of a daily diet of 200g of rice.
- The science is available since 1999.
- Popular Indica rice varieties are ready since early 2003.

They may not reach the farmer before 2012!

Why 13 years of unnecessary further blind children ?!

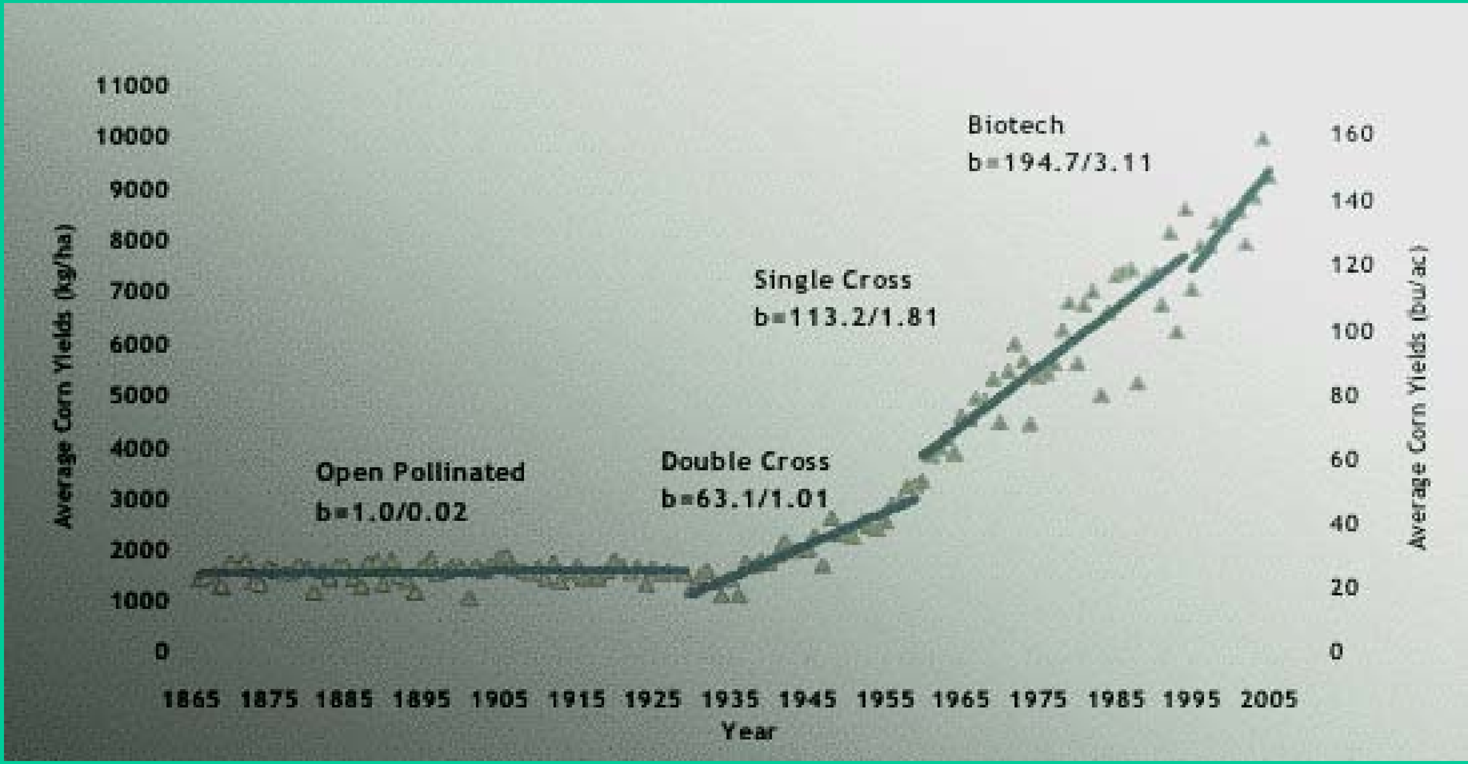
GMO-specific hurdles delay application of the technology - - and may even prevent that the benefit reaches the poor.

http://www.goldenrice.org/

4f Basics on progress in molecular breeding, opportunities and the follow-up of over-regulation in Europe

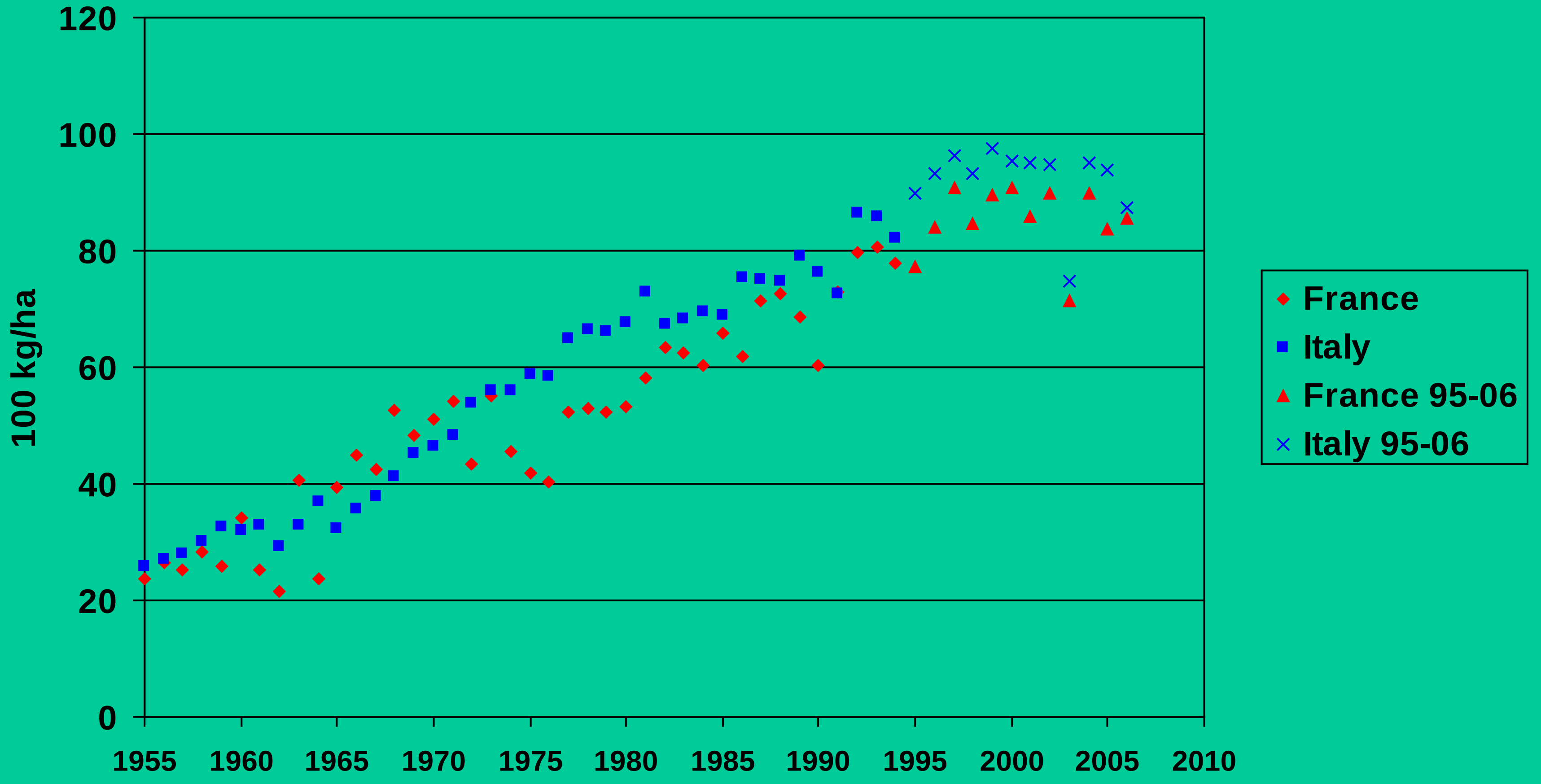
In the US maize yields have accelerated in the last ten years due to modern breeding

• actual breeding plus cultural practice gain



Source: March 2006. Crop Science. Ref# 46:528-543

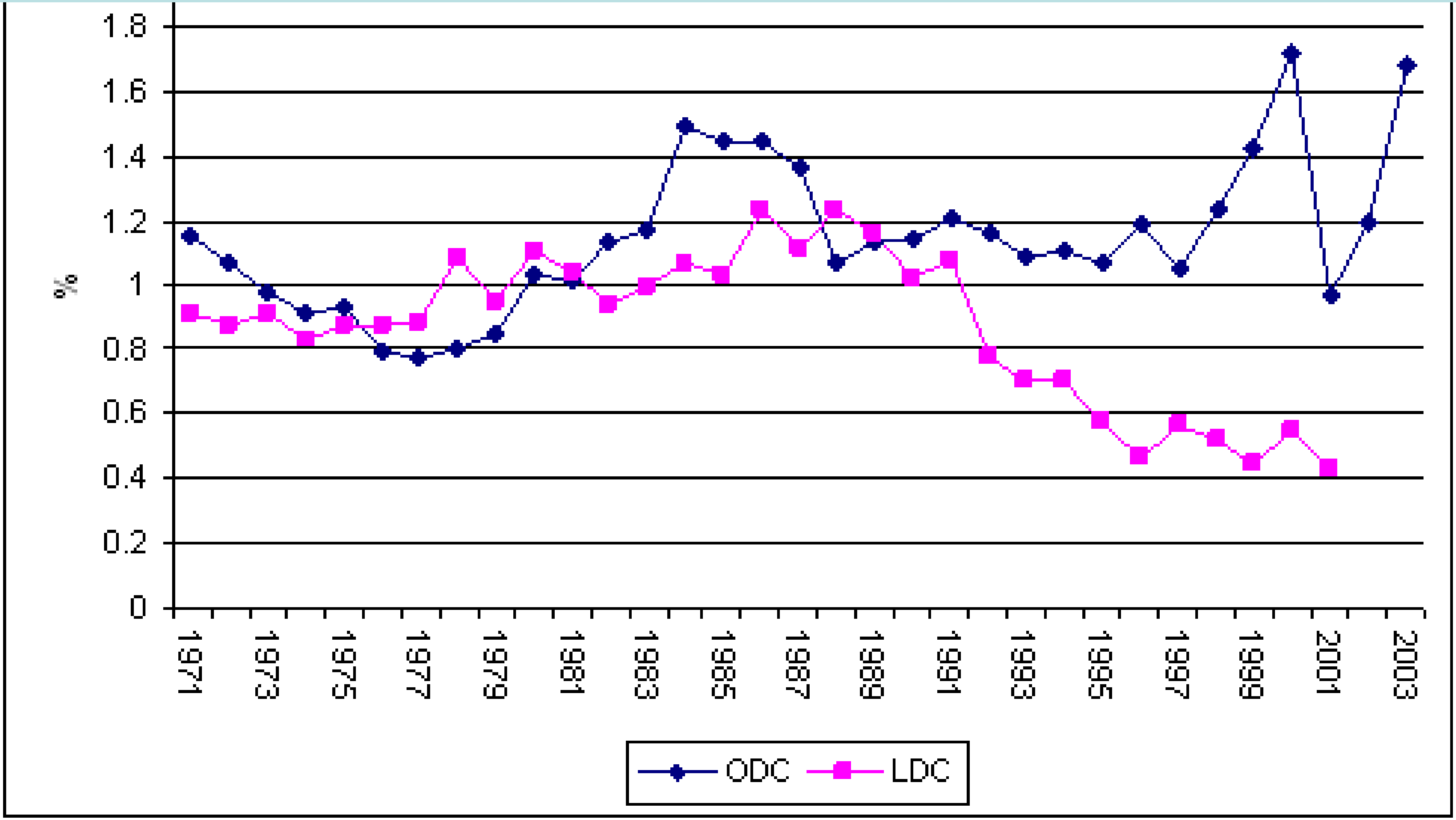
Corn yields in France and Italy in the last 10 years fail to show the same positive trends as in the USA due to GM crop restrictions



Source; Eurostat

Agricultural research intensity in the LDCs and other developing countries (ODC), 1971-2000

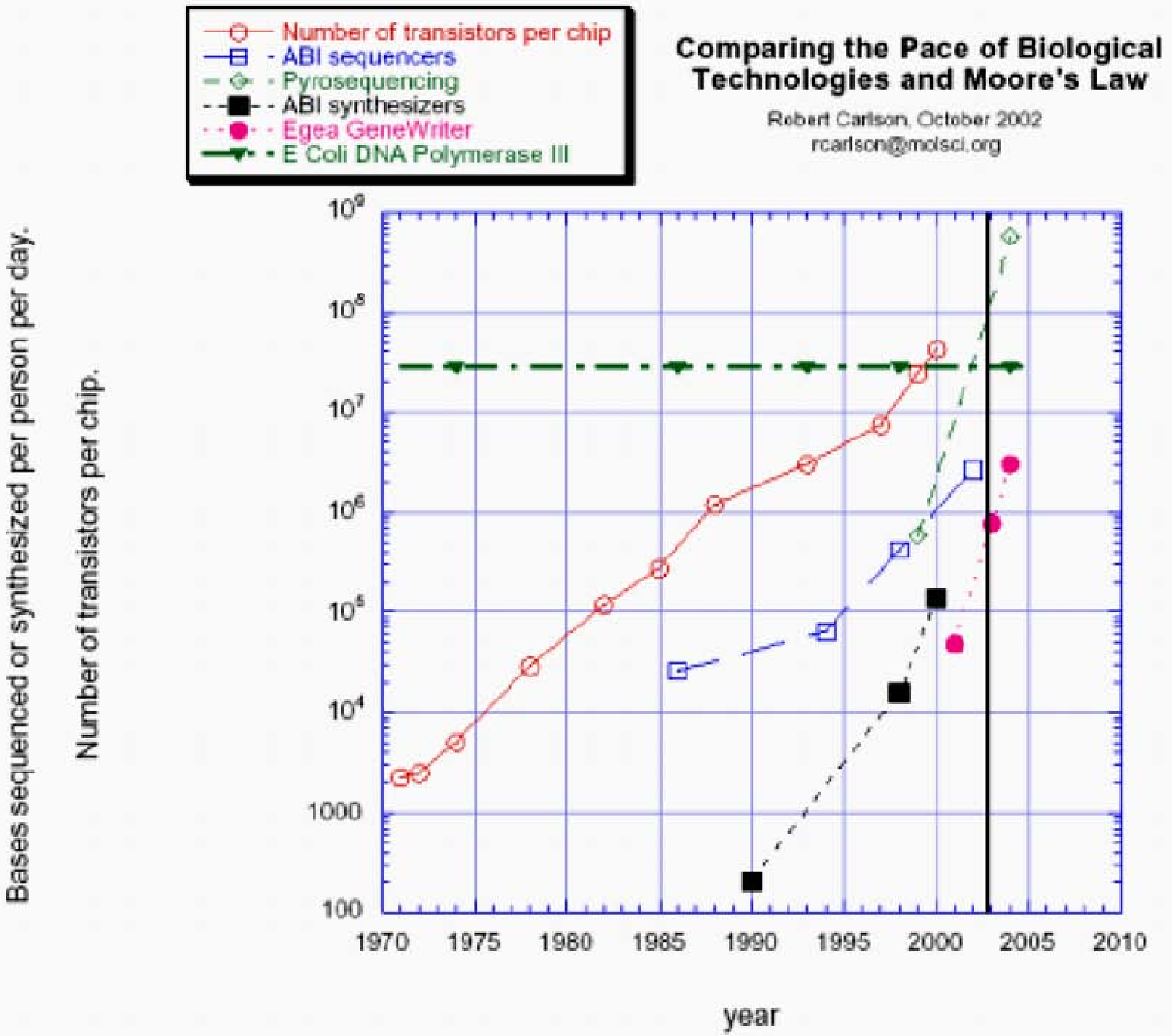
(Investment in agricultural research as % of agricultural output)



Source: UNCTAD, Least Developed Countries Report 2007

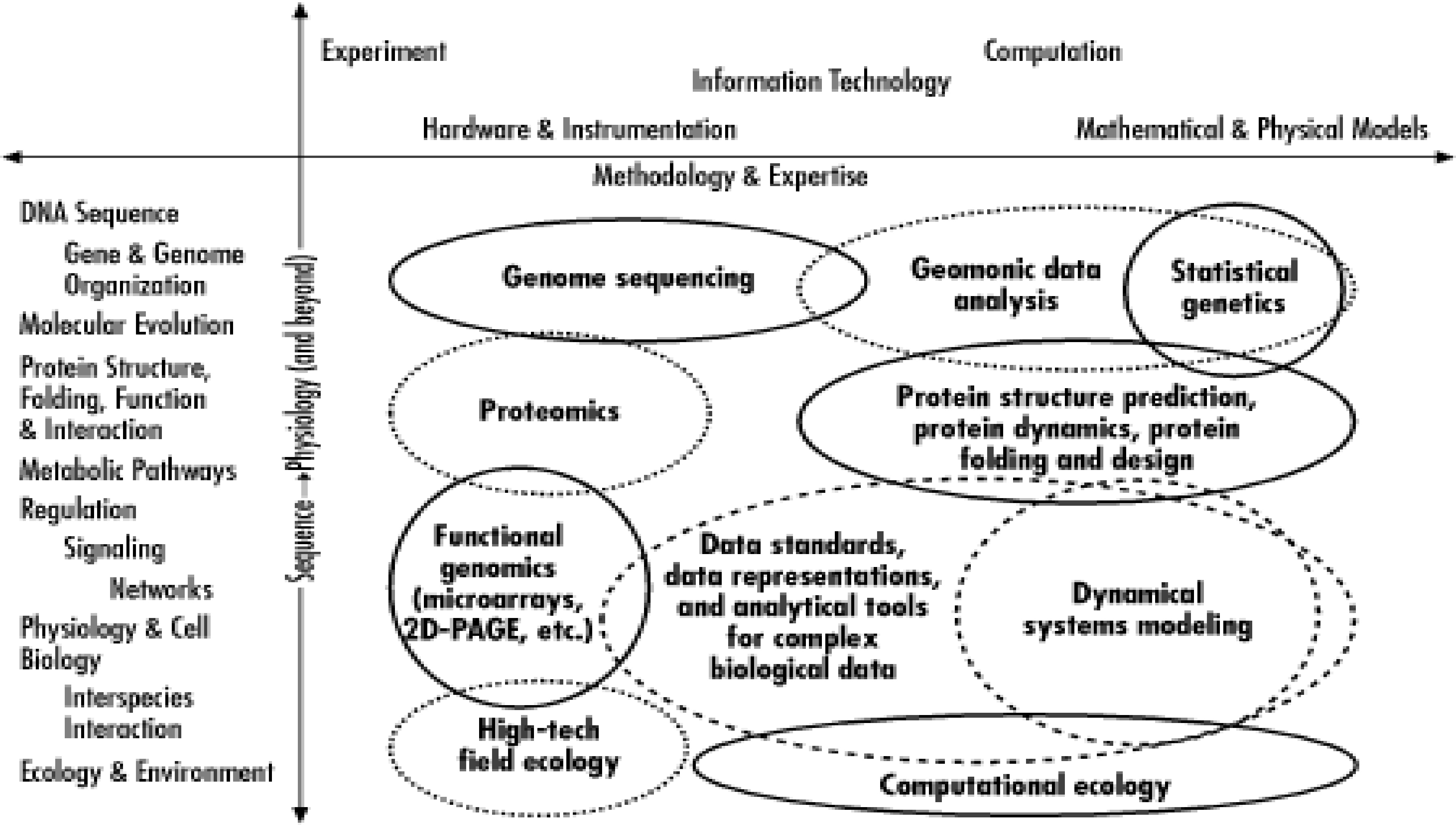
Prometheus Unbound: Revolutionary Advances in Biological Technologies

Dramatic Acceleration in Analysis



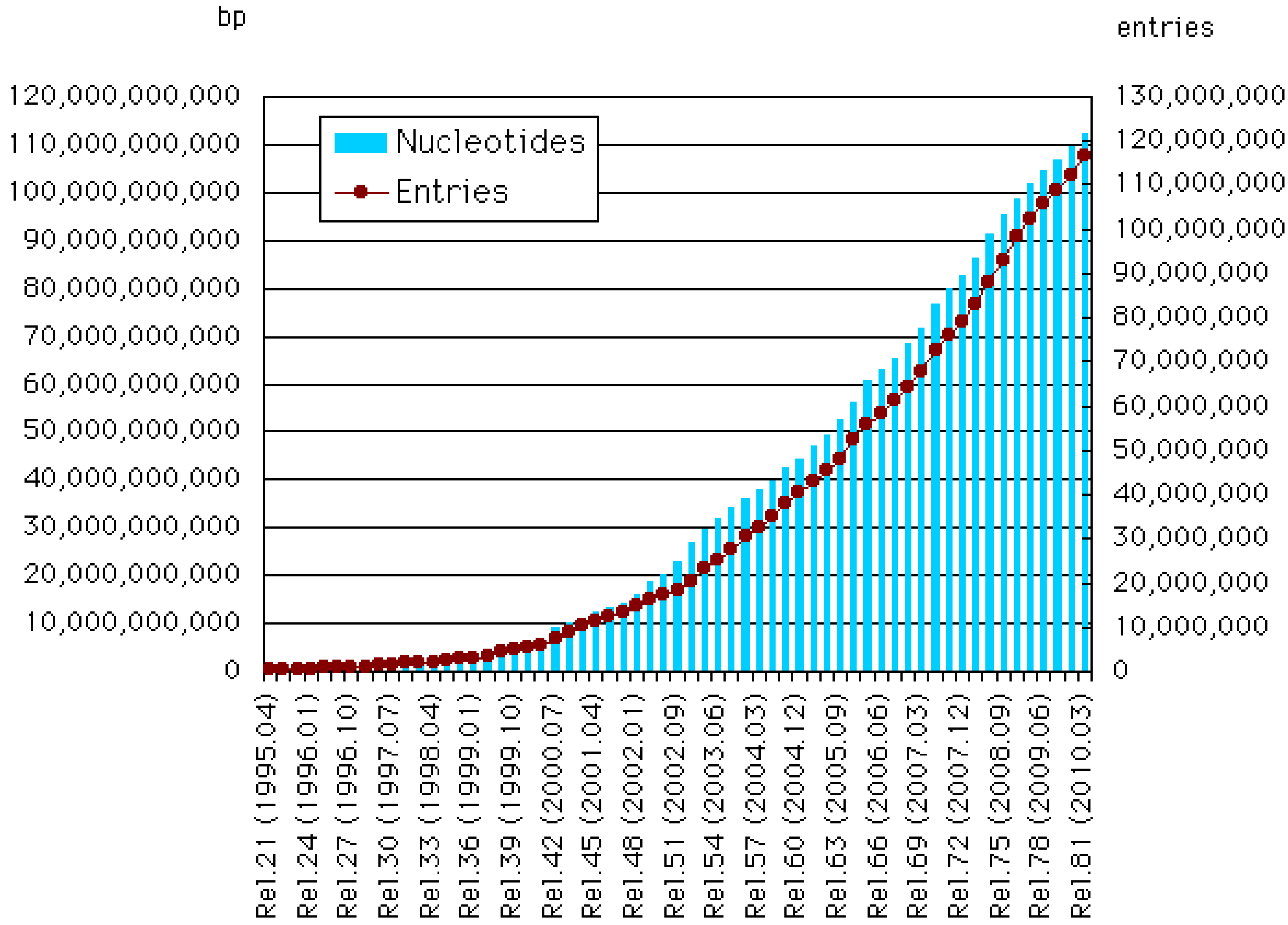
Carlson, R. (2003)
The Pace and Proliferation of Biological Technologies. Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science, 1, 3, pp 203-214
http://www.liebertonline.com/doi/abs/10.1089/153871303769201851 AND
http://www.botanischergarten.ch/Genomics/Carlson-Pace-Proliferation-2003.pdf

Evolution of Molecular Life Sciences



Gibas, C. & Jambeck, P. (2001)
Developing Bioinformatics Computer Skills *In Developing Bioinformatics Conputer Skills, an Introduction to Software Tools for Biological Applications*, pp. 446. O-Reilly http://oreilly.com/news/bioinformatics_0401.htm l AND http://oreilly.com/news/bioint_0501.html

DDBJ/EMBL GenBank database growth

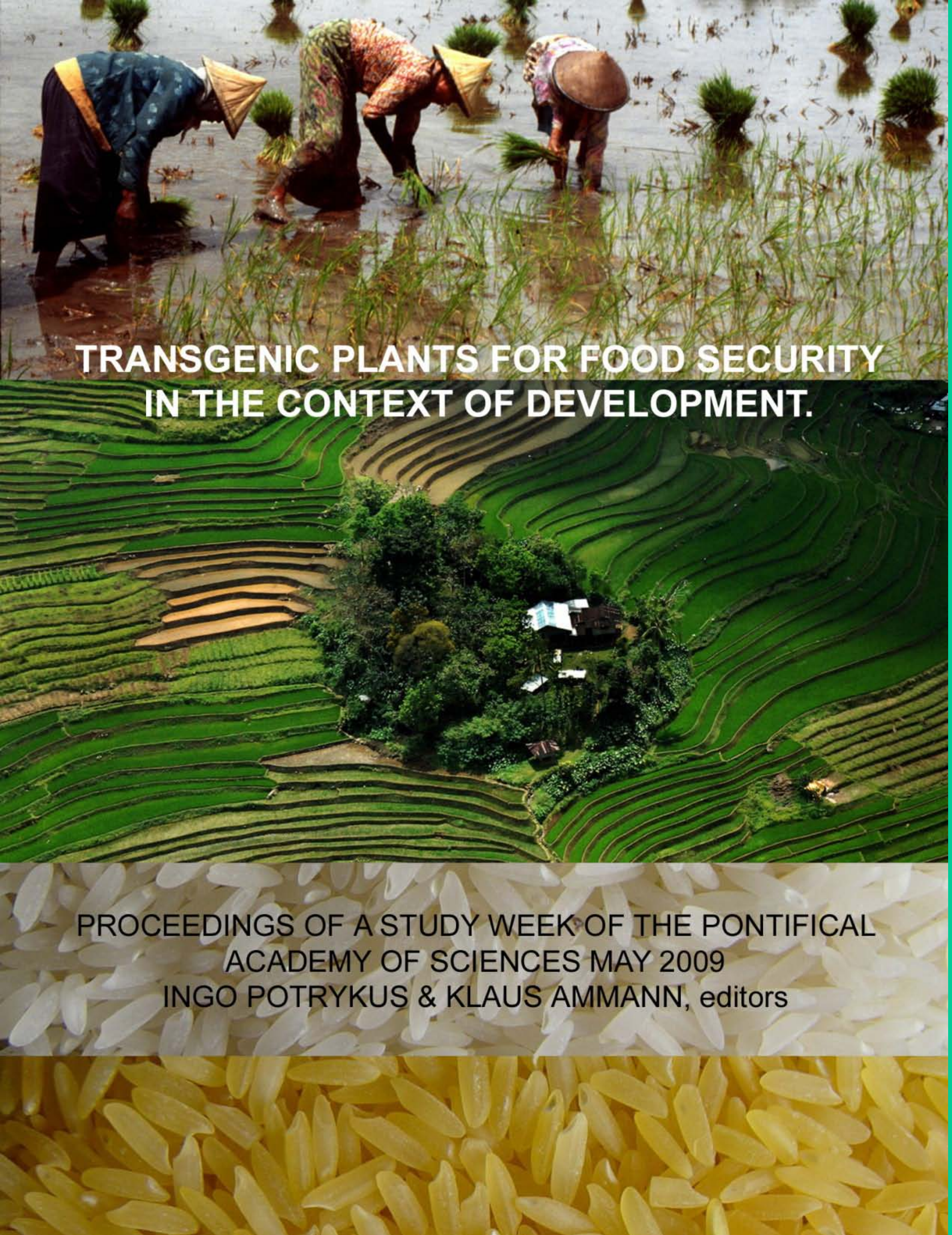


* Note : CON and TPA divisions are not counted in the Release statistic.

http://www.ddbj.nig.ac.jp/images/breakdown_stats/DBGrowth-e.gif

outside London airport mid August 2007: Their slogan: "We are armed ... only with peer reviewed science".
risingtide.org.uk/node/220

4g Positive statements on genetically engineered crops of a scientific Vatican conference invited by the Academia Pontificiae of the Holy See



The Vatican Conference May 2009 on Transgenic Plants for Food Security in the Context of Development makes an unanimously positive statement in favour of genetically engineered crops

Conference Summary:

http://www.botanischergarten.ch/Vatican/PAS-Study-Week-booklet_transgenic_34.pdf

Monsignore Marcelo + Sanchéz Sorondo, Secretary of the Academia Pontificiae of the Holy See

***Pax perpetuo aedificanda*:**

Peace has to be ceaselessly built up.
Peace is a continuous effort which is entrusted to research, to technological applications aimed at promoting justice,
through the authority of the sciences, with that freedom of thought and that will enable other choices to be made to contrast violence
and the exploitation of research and discoveries against justice and human rights.

Forgot what we are protesting for…

http://www.nearlygood.com/