Development of Regulations to reduce Phosphorus Losses from Agriculture in the U.S. and Europe

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Presentation Format

- Focus on implementation actions in two regions:
  - Chesapeake Bay / Virginia, US (Rory)
  - Denmark (Gitte)
  - Northern Ireland (Bob)
  - Arkansas (Brian)

- Lessons

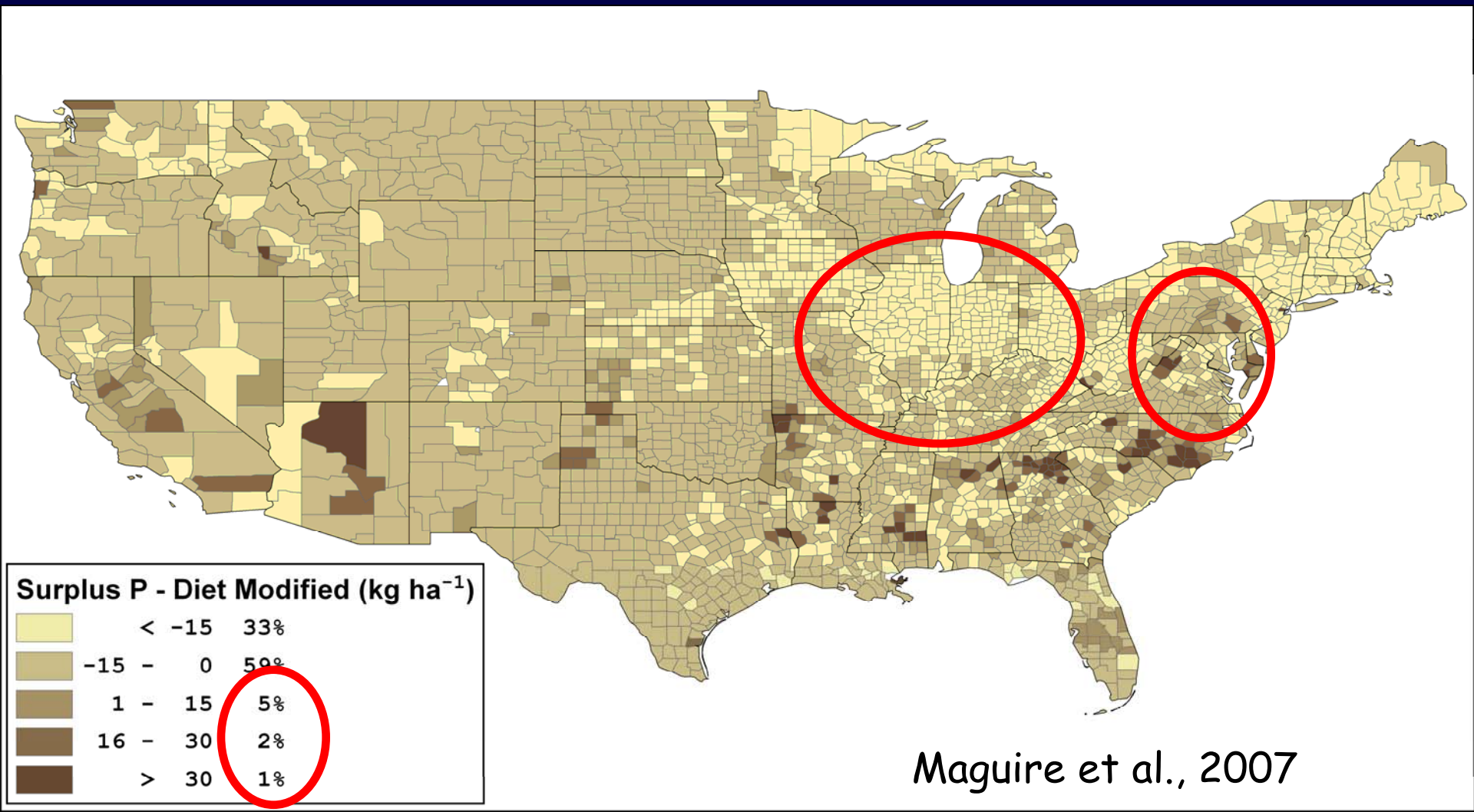
The Chesapeake Bay / Virginia Experience

How did it all start?

- Clean Water Act passed in the US in the 1970's and the USEPA designated the Bay as being impaired soon after
- Chesapeake Bay agreement signed by the USEPA and local states in 1983
- Collaborative effort to improve water quality with commitments to reduce nutrient pollution – many voices heard in regulation development

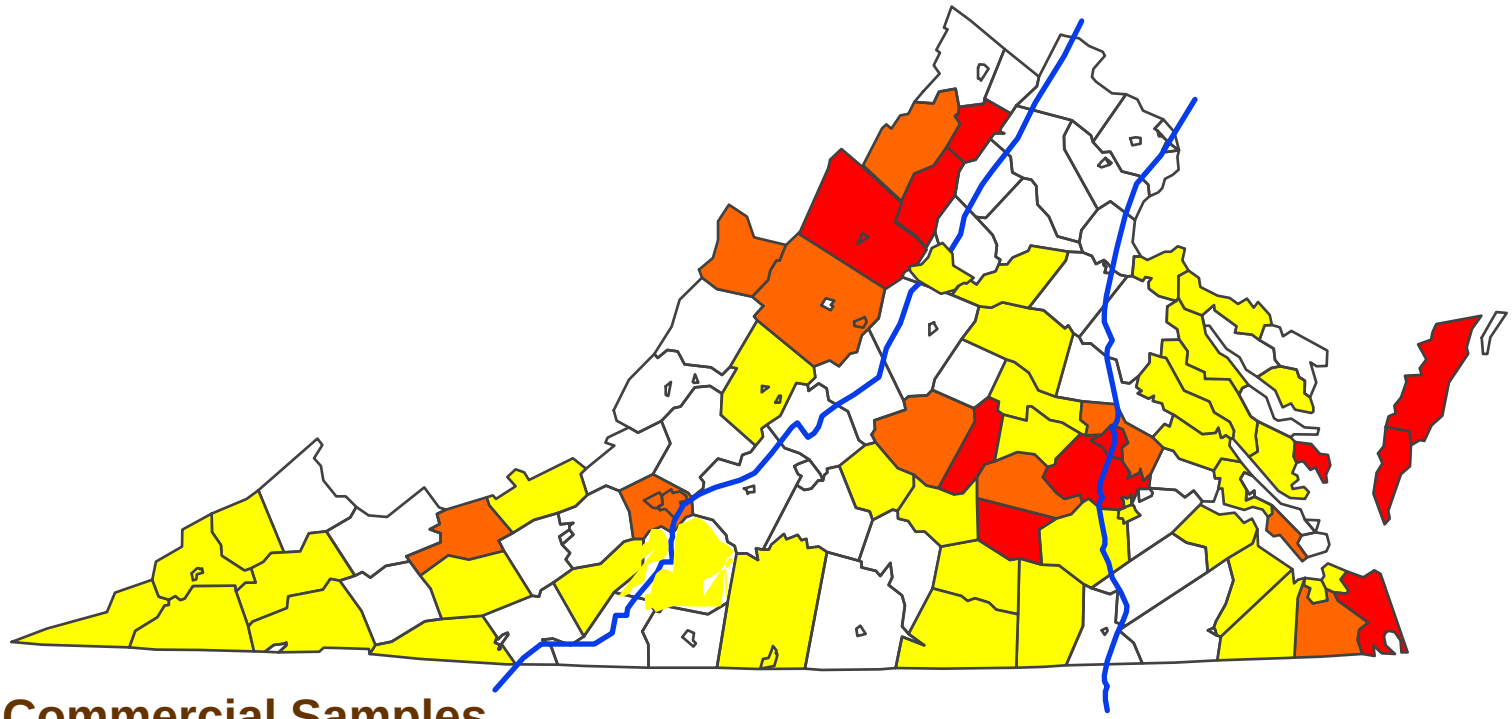
Regulations focus on manure management

Manure P Surplus:(Manure P – Crop Removal)



Maguire et al., 2007

Agronomic Soil Test P in Virginia for years 2004-2006. (% soils rated "Very High")



92,303 Commercial Samples

≥10%-Yellow

≥20%-Orange

≥33%-Red

Virginia regulations: "no discharge" permit required

- for Animal Feeding Operations with <u>liquid waste</u>
  300 or more Animal Units
  - 200 mature dairy cattle (milked or dry)
  - 300 slaughter and feeder cattle
  - 750 swine (over 55 lbs)
  - 150 horses
  - 3000 sheep or lambs
  - 16,500 turkeys (11,000 dry)
  - 30,000 layers or broilers (20,000 dry)

  1 "Animal Unit" = 1000 lbs live weight

Decision Example for Ridge and Valley

P MANAGEMENT FOR ALL ORGANIC NUTRIENT SOURCES

N-BASED ZONE

20% saturation line

110 lb/A or 55 ppm

DCR ENVIRONMENTAL THRESHOLD 1X P REMOVAL ZONE

35% saturation line **324 lb/A or 165 ppm**

P-INDEX (VARIABLE) ZONE

P Index Score is calculated based on field-specific factors including soil test P, erosion estimate, distance to stream, etc.

Score	P Loss Risk	Management Strategy
0 to 30	Low	N-based
31 to 60	Medium	P-based: 1.5x crop removal
61 to 100	High	P-based: 1x crop removal
Over 100	Very High	Zero P

65% saturation line **All crops/tillage**

1050 lb/A or 525 ppm

ZERO P ZONE

P is 0 to 55 ppm, we can manage for N

P is 55 to 162 ppm, we can apply as much P as the crop will remove

P is 162 to 525 ppm, we use the P-Index

P is above 525 ppm, we cannot apply any P

Impact on Virginia

- Current regulations aimed at preventing buildup of soil test P to 'excessive' levels and no P additions to soils already there
- ~85% manure transported off regulated farms, but this is not covered by regulations (not the case in other states)
- Much cost sharing of BMPs
- Starting to see more P Indicies run due to fertilizer price

Impact on Chesapeake Bay

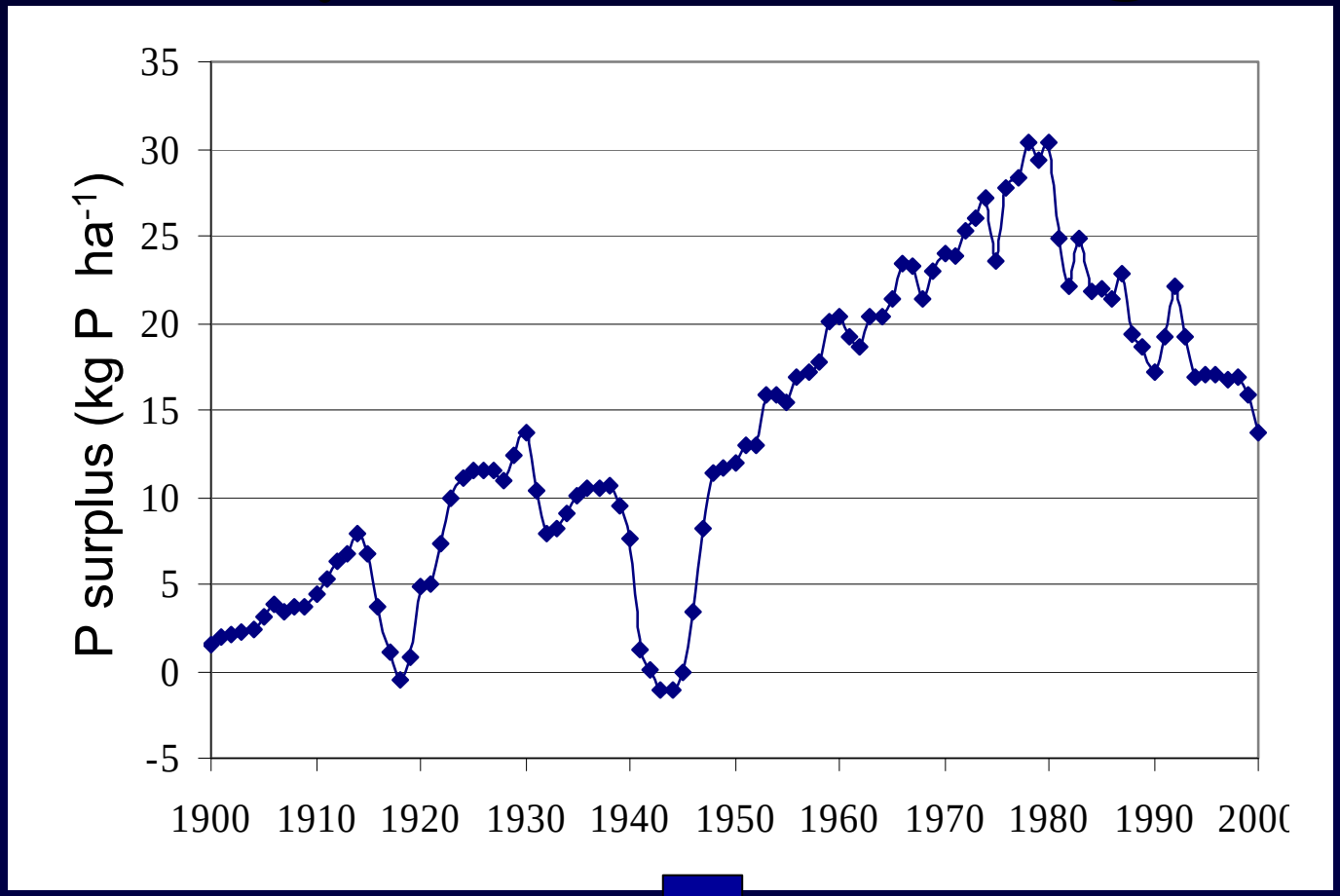
- Phosphorus loading to the Chesapeake Bay decreased from 12,318 Mg P yr^{-1} to 8,863 Mg P yr^{-1} over ~20 years, with further reductions (to 5,818 Mg P yr^{-1}) needed by 2010
- Great collaborative efforts between regulators, farmers, environmentalists continuing

The Denmark Experience

Mitigation of nutrient losses from Danish agriculture

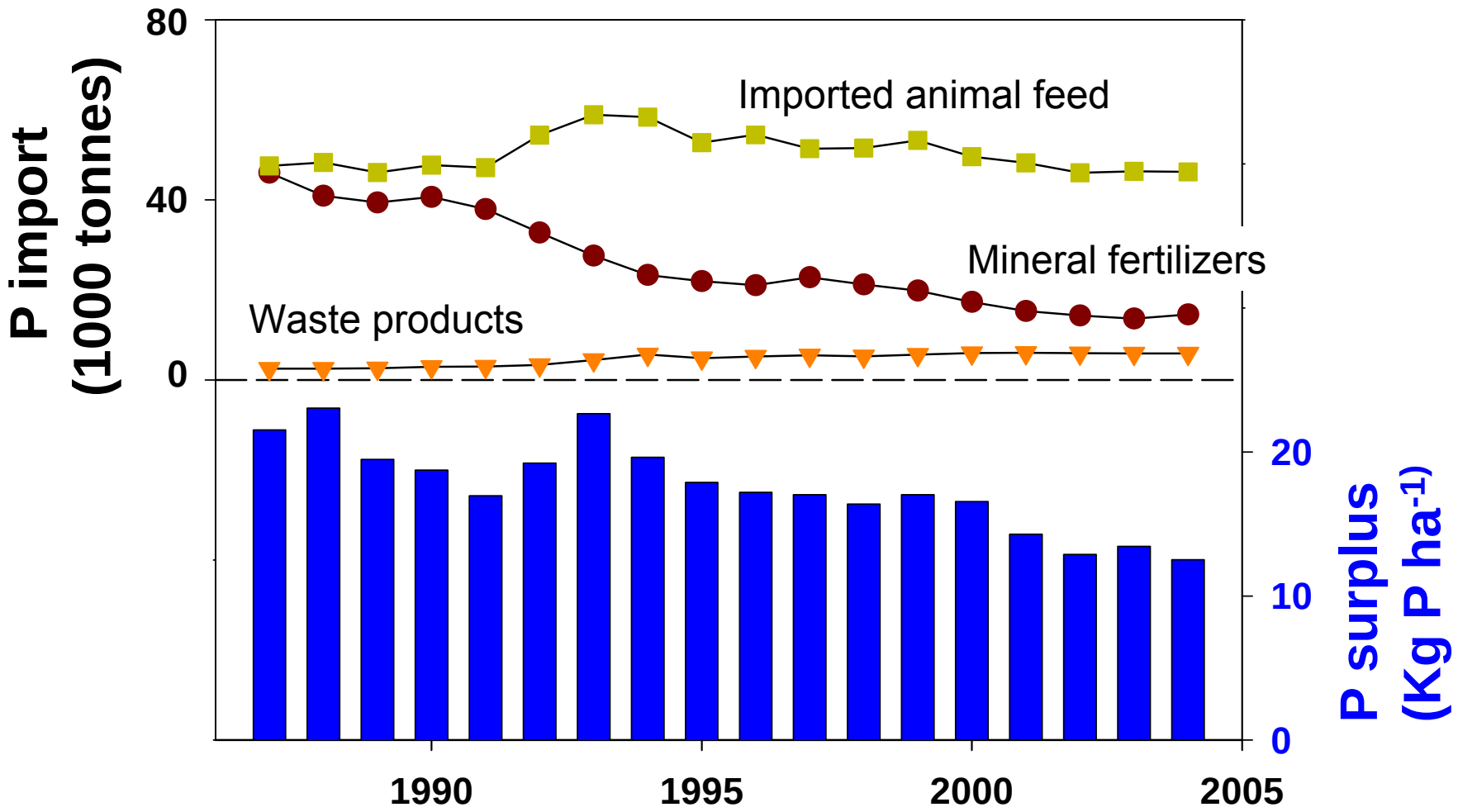
- Examples of implemented regulations:
  - Ban on direct discharge from farms
  - Restrictions on animal density
  - Regulations regarding manure storage capacity, handling, timing of application, application method
  - Mandatory accounting on nutrients
  - Tax on feed phosphates
  - Buffer zones, wetlands and afforestation

The P surplus in Danish agriculture



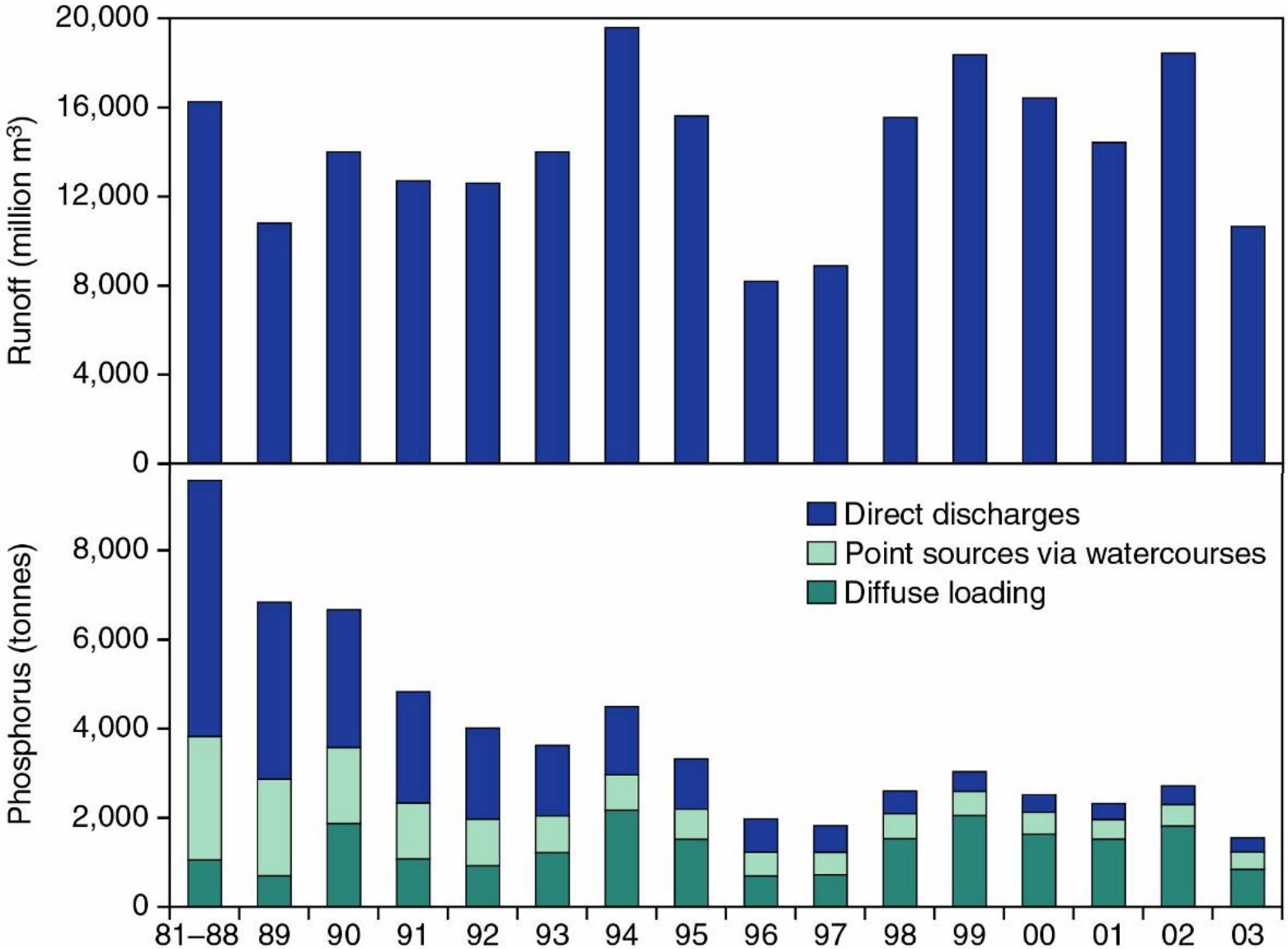
1.4 Mg P ha^{-1} has accumulated on agricultural land

The P surplus in Danish Agriculture



(Kyllingsbæk, 2005)

Runoff and P discharge in Denmark



(Bøgestrand, J., 2005)

Effects of regulations in DK

- P surplus in agriculture has declined
  - from 23 kg P ha^{-1}in 1985 to 13 kg ha^{-1} in 2002
  - …. but there is still a surplus
- P utilisation in agriculture has improved
  - From 32 % in 1985 to 52 % in 2002
- It is still not possible to detect changes in diffuse P losses as estimated by monitoring data from surface waters

The Future

- Bufferzones
- Further reductions in the P surplus
  - Low P feeding strategies
  - Processing of animal manure
- Site specific regulation of agricultural activity based on a Danish national P index tool?

What do all of these approaches have in common?

- All approaches include an aspect of moving towards mass balance of P inputs and outputs, whether through P based nutrient management plans, reduced fertilizer use etc. Also need to target critical source areas
- Feed management is cost effective, even where not regulated
- Water quality is not perfect, but we're moving in the right direction and need to keep it up
- Production has been maintained or increased

What can we learn from this?

- Where water quality is impaired and voluntary actions don't work, regulations are inevitable
- Be proactive in educating farmers etc (e.g. turf) on BMP implementation
- Regulations need to be science based, so we need to be involved
  - E.g. SERA17 position papers
  - Involvement may or may not be fun