

Good agricultural practice – fertilizer application in Germany in the scope of HELCOM recommendations

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Nutrient inputs (nitrogen and phosphorus) into the Baltic Sea by far exceed the natural carrying capacity of the ecosystem. The Baltic Sea Action Plan adopted by HELCOM member states in November 2007 in Krakow therefore among others totals up reduction requirements of phosphorus and nitrogen specified for each sub-region:

	Phosphorus	Nitrogen
Bothnian Bay	0	0
Bothnian Sea	0	0
Gulf of Finland	2,000	6,000
Baltic Proper	12,500	94,000
Gulf of Riga	750	0
Danish straits	0	15,000
Kattegat	0	20,000
Total	15,250	135,000

Tab. 1: *Needed reductions of nutrient inputs into sub-regions of the Baltic Sea (in tons p. a.; according to BSAP, 2007).*

Overall objective of the BSAP is to achieve a Baltic Sea in good environmental status by the year 2021.

Nutrient inputs into the Baltic Sea mainly originate from land-based sources (both point sources and diffuse sources) and enter the sea via surface waters (mainly rivers). For HELCOM member states being also EU-members the EU Water Framework Directive (WFD) sets “good status” of all water bodies as a target to be reached by the year 2015.

Agriculture is by far the main diffuse source of nutrient inputs. With reduction measures being successfully taken at point sources, e. g. improvements in the municipal waste water treatment systems and the introduction of phosphorus free laundry detergents, the share of agriculture in the remaining pollution gradually increases, thus bringing agriculture more and more into the focus of public environmental awareness and strengthening the need for efficient reduction measures also in this sector.

The HELCOM Convention (Annex III, Part II) specifies 6 recommended “regulations” in fighting environmental pollution from agriculture. Basic principles are Best Environment Practice (BEP) and Best Available Technology (BAT). For HELCOM member states being also members of the European Union the Nitrates Directive¹ and the Water Framework Directive sets a framework for national legislation and action plans. In Germany the Nitrates Directive has been implemented into national law by the fertilizer law (Düngegesetz) and the ordinance on fertilizer application (Düngeverordnung), which sets detailed and **precise legal requirements** for good agricultural practice as regards the application of fertilizers. The old “Düngeverordnung” passed in 1996 has been translated into English²; in 2007 an amendment was necessary and set into force. Unfortunately up to the moment an

¹ Directive 91/676/EEC

² But unfortunately is no longer available.

English translation of the amendment is not yet available. For the German original version see www.gesetze-im-internet.de/bundesrecht/d_v/gesamt.pdf.³

Basic points of the German “Düngerordnung” in the light of HELCOM Annex III Part II (and referring to the according respective chapters there) are:

1. General provisions

Fertilizers may only be applied according to good agricultural practice as laid down in the Düngerordnung. The regulations are **compulsory** and part of statutory law, which means farmers who do not follow some parts of the regulations will be fined, e. g. (für Präsentation Tabelle mit Ordnungswidrigkeiten erstellen!). Compliance with the “Düngerordnung” is also controlled within the scope of cross compliance. In case of non-compliance farmers risk to lose part of their direct payments.

One of the basic ideas of the Düngerordnung is that **animal excrements are not waste but valuable fertilizers**, which means they are not just disposed off to get rid of them but applied efficiently in plant nutrition according to the site and the plants need. Thus as much mineral fertilizer as possible should be replaced by the available amount of animal manure. Efficient use of animal manure as fertilizer optimizes yields, minimizes environmental impacts and saves energy and greenhouse gas emissions (as the mineral fertilizer production in chemical industry via the Haber Bosch Process consumes a lot of energy and thus causes carbon dioxide emissions which enhance global warming).

2. Plant nutrients

2.1 Animal density

There is no direct ratio fixed between the number of animals on the farm and the amount of land available for spreading manure; but indirectly the limit values for tolerable total nitrogen and phosphorus input per hectare originating from animal excrements establish a correlation between animals and land (see 2.7). Large intensive livestock farms must have contracts with enough other farms (plant growers) to show the area is sufficient to apply their manure as fertilizers within the scope of good agricultural practice and the limits for nutrients. Currently a regulation⁴ is being prepared obliging large intensive livestock farms with small agricultural area to keep records on their manure exports to other farms. Thus it should enable controlling authorities to track down the pathway of nutrients “from cradle to grave” to safeguard their transport and distribution between farms and finally their application according to good agricultural practice.

2.2 Location and design of farm animal houses

Farm animal houses must be designed and authorized according to Construction Law (Baurecht; in all cases) to avoid conflicts with neighbours and groundwater pollution. Farms under the scope of the IPPC-Guideline⁵ additionally need an authorization (permit) under the Federal Law of Immissions (Bundesimmissionsschutzgesetz, clean air act), which implements Best Available Technology (BAT)

³ Please mind there are two ordinances in regard of fertilizers with different scopes: The „Düngerordnung“ referred to in this presentation defines good agricultural practice in the application of fertilizers. Another ordinance, the “Düngemittelverordnung” sets standards to the quality of fertilizers (among others limit values for pollutants like Cd) being placed on the market.

⁴ called „Verbringungsverordnung“ (Ordinance on transport and distribution of manure between farms).

⁵ i.e. more than 40 000 poultry places, more than 2 000 fattening pigs or more than 750 mating sows including piglets. Directive 2008/1/EC of the European Parliament and the Council of 15 January 2008 concerning integrated pollution prevention and control (IPPC-Directive).

laid down in the according Reference Document (BREF “*Intensive rearing of pigs and poultry*”) passed within the so-called “Sevilla-Process”. The BREF is available in English⁶ and German⁷. It contains about 300 pages and is currently under revision according to Art. 17(2) of the IPPC-Directive. Federal Environment Agency is the coordinating authority of the revision process in Germany.

Farm animal houses must keep a minimum distance to sensitive ecosystems, according to their size, number of animals and ammonia emissions. Ammonia concentrations around intensive livestock farms are calculated by a computer model (AUSTAL 2000). Farms with more than 10 000 kg ammonia emissions p.a. are registered in the Pollutant Release and Transfer Register, whose data are publicly accessible (www.prtr.de) according to European law.

2.3 Construction of manure storage

Storage capacity for manure must be sufficient for **at least 6 months**, as in most parts of Germany there is no need for fertilization between end of September (e. g. winter cereals) and early April (e.g. grassland, rape). To avoid ammonia emissions manure must be covered during storage. Cattle manure normally forms a natural floating cover. Pig manure needs either a solid cover or at least a 10 cm layer of small cut straw as a floating cover. Chicken manure has to be dried immediately (preferably via an aerated manure belt) and kept dry (by a roof to keep off rain) to stop all enzyme activities converting ureic acid into ammonia.

Germany will probably not meet the limits of the so-called NEC-Directive⁸ of the EU. In this directive Germany has got a maximum (limit value) of 550 kt/a for ammonia emissions (national emission ceiling), which we might exceed by 11% according to latest calculations. The EU-COM has sent a so-called pilot request to Germany and asked for additional ammonia abatement measures to meet the NEC-Directive. Therefore we have discussions about tightening the regulations on ammonia emissions and a new mitigation programme for ammonia abatement (e.g. by compulsory solid covers for all manure containers and immediate incorporation of manure into the soil).

2.5 Agricultural wastewater and silage effluents

Agricultural wastewater and silage effluents are generally collected and transferred into the manure tanks. For the construction of watertight floors and side walls of such tanks we have two technical guidelines published by the DIN⁹ (the German branch of ISO¹⁰). These documents are integrated into the legal requirements (namely guidelines DIN 1045 and DIN 11622). The legal requirements are currently under revision in the light of the European Water Framework Directive (WFD). In the past it was up to the federal states to pass regulations for manure and silage effluent tanks; now (after changes in our constitution) the Federal Government has become the competent body and will pass a regulation valid for whole Germany to safeguard equal standards for groundwater protection over whole Germany.

2.6 Application of organic manures

Spreading of animal manure is prohibited on arable land from 1st of November till 31st of January, on grassland from 15th of November till 31st of January. Spreading is also prohibited if the soil is covered with snow (5 cm), frozen, flooded or water saturated (non-compliance will be fined). To minimize

⁶ <http://eippcb.jrc.ec.europa.eu/reference/irpp.html>.

⁷ www.bvt.umweltbundesamt.de/sevilla/kurzue.htm.

⁸ Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants.

⁹ Deutsches Institut für Normung. Technical guidelines for watertight manure tanks are DIN No. 1045 and DIN No. 11622.

¹⁰ International Standardization Organization.

ammonia losses spreading should be done close to the soil with modern, low emission device. Unfortunately it was politically not possible to make best available technology compulsory for spreading of manure. The Düngeverordnung (ordinance on fertilizer application) only demands “the generally accepted rules of technology” which is weaker. Obsolete techniques are listed in an annex, and these techniques of spreading are forbidden. The annex is continually growing, but transition periods are rather long to give farmers enough time for investments into modern technology. Some federal states are running incentive programmes under the “second pillar of the CAP” and provide funds for farmers who invest into modern manure technology (under axis 1 of EAFRD-regulation, to increase competitiveness).

2.7 Application rates for nutrients

Nutrients generally must be applied according to the plants need, the expected yields and site-specific parameters (like soil type and local climate). Soil analyses for phosphate are compulsory every 6 years, analyses for potassium, magnesium and pH-value are strongly recommended (and normally carried out with the same soil samples as the phosphate analyses). Fertilizer requirements are identified from analyses using regionalized tables for the evaluation of soil supply status.

For nitrogen several methods are in use to predict fertilizer needs from soil N_{min} analysis or electro-ultrafiltration (EUF).

From environmental point of view modern farmers with a good educational background generally apply mineral nitrogen efficiently and according to BEP. Problems mainly arise from improper handling of animal manure, therefore the Düngeverordnung has special chapters concerning the application of animal manure. Total nitrogen via animal excrements **is limited to 170 kg/ha p.a. according to the Nitrates Directive; on grassland the local authorities may allow on request up to 230 kg/ha**, if certain basic preconditions are met to avoid water and air pollution. In these cases spreading is only allowed using modern low emission device such as dragging hose or injection techniques.

Farmers have to keep records on their nutrients and calculate balances (otherwise they get a fine). The tolerable annual nitrogen surplus (surface balance according to OECD, i.e. without ammonia losses. FEA prefers farm gate balances!) on farm level has been lowered from **90 kg/ha to 60 kg/ha**.¹¹ Currently we are within the transition period.

For phosphate (P₂O₅) the tolerable annual¹² surplus is **20 kg/ha**.

2.8 Winter crop cover

Fertilizer application in autumn is only allowed to winter crops or to avoid nutrient imbalances in cases of straw remaining on the field and is limited to **40 kg/ha of ammonia** or **80 kg/ha of total nitrogen** to minimize nitrate leaching during winter.

A partial winter crop cover is regarded necessary to fight soil erosion, not nutrient leaching. According to Cross Compliance at least **40%** of a farm must be covered with plants during winter, or plant residues from harvest (harvest leftovers) may not be ploughed in before 15 February.

2.9 Water protection measures and nutrient reduction areas

Whole Germany is regarded as a vulnerable zone in the sense of the Nitrates Directive, i. e. good agricultural practice is compulsory over the whole territory. Main reason for this strict interpretation of

¹¹ sliding average over 3 years. The 60 kg/ha limit value has started with the fertilizer year of 2009, which means the average of 2008, 2009 and 2010. As the data of 2010 will be available around autumn of 2011, the surplus for 2009 will be calculated towards the end of 2011.

¹² i. e. average over the last 6 years.

the Nitrates Directive are not nutrient inputs into the Baltic Sea but into the **Wadden Sea** in the North Sea, which is a world nature heritage site and very sensitive to nutrient overloads. The other states with shares of the Wadden Sea, i. e. Denmark and the Netherlands, have similar regulations. To provide equal rights and to avoid market distortions regulations meant to protect the Wadden Sea have been extended over whole Germany.

Additionally the Düngeverordnung establishes general **buffer zones of 3m** along surface waters. Fertilizer application is generally forbidden in these zones, unless certain precision technique is used for spreading (in this case 1 m is tolerable). For slopes (more than 10%) buffer zones are up to **10m**, and fertilizers have to be directly incorporated into the soil to prevent water pollution via surface runoff.

2.10 Ammonia emissions

Manure must be incorporated into the soil on arable land as soon as possible. Unfortunately there is no exact time limit in the Düngeverordnung, so this is a rather soft and weak point. There is scientific evidence that most of the Ammonia is released during the spreading procedure itself (especially if this is done in an obsolete way using old fashioned technique) or within the first hour afterwards. Tightening of this regulation is one of the possibilities to further reduce ammonia emissions in Germany.

As Germany will probably not meet the limits set by the NEC-Directive and already received a letter from the EU-Commission on this issue, the government currently considers additional measures and an ammonia reduction programme to avoid problems with the EU-COM and possible fines.

Air purification device on large animal farms (usually a combination of wet and acidic scrubbers and biofilters) are not regarded as general BAT, but only used based on single case decisions in areas with high animal density (to enable permits to enlarge existing stables or to build new ones). Technical air purification with currently available concepts need closed or nearly closed stables (which are questionable in respect to animal welfare), centralized air suction systems and high amounts of energy. Research and development is done on systems with sub-floor suction of waste gas. In these systems waste gas is collected between the manure pit surface and the slotted floor of the stable, where ammonia concentration is highest, thus providing a higher efficiency, lower costs per avoided t of ammonia, cleaner air in the stable and better animal welfare.

4. Environmental permits

Environmental permits are given according to the requirements specified in chapter 2.2 (see above). Unfortunately up to the present it was not possible to integrate large cattle farms into the IPPC Guideline and the Sevilla-Process.

In Germany farms with 600 and more places for cattle have to pass a simplified process to get a permit according to the Federal Law on Immissions (Bundesimmissionsschutzgesetz, clean air act). This simplified process runs without any public participation.

(ergänzen HELCOM-Forderung)

5. Monitoring and evaluation

Implementation of environmental law, monitoring and evaluation is basically within the responsibility of the federal states. Several permanent working groups between the federation and the federal states have been established (e. g. for air quality, for water issues, for soil protection etc.) to collect and provide data for national and international reporting, to exchange ideas and to discuss legal and implementation requirements.

6. Education, information and extension service

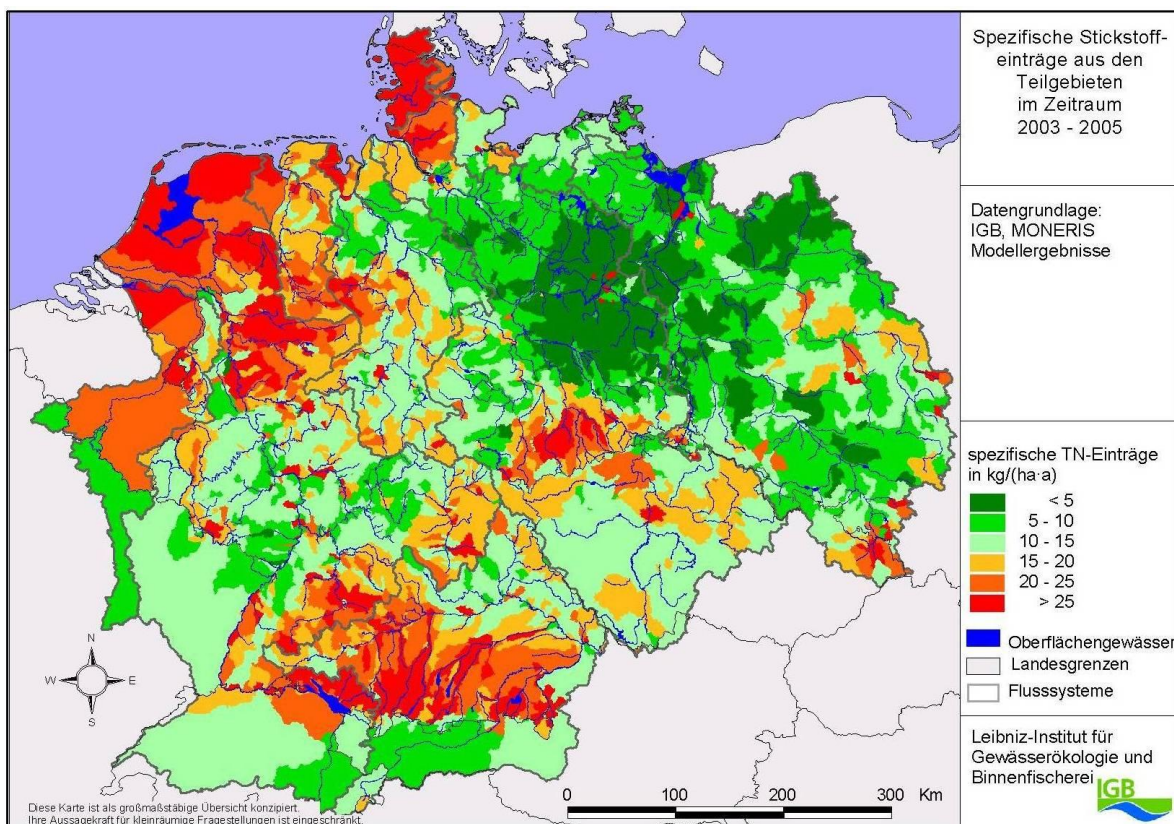
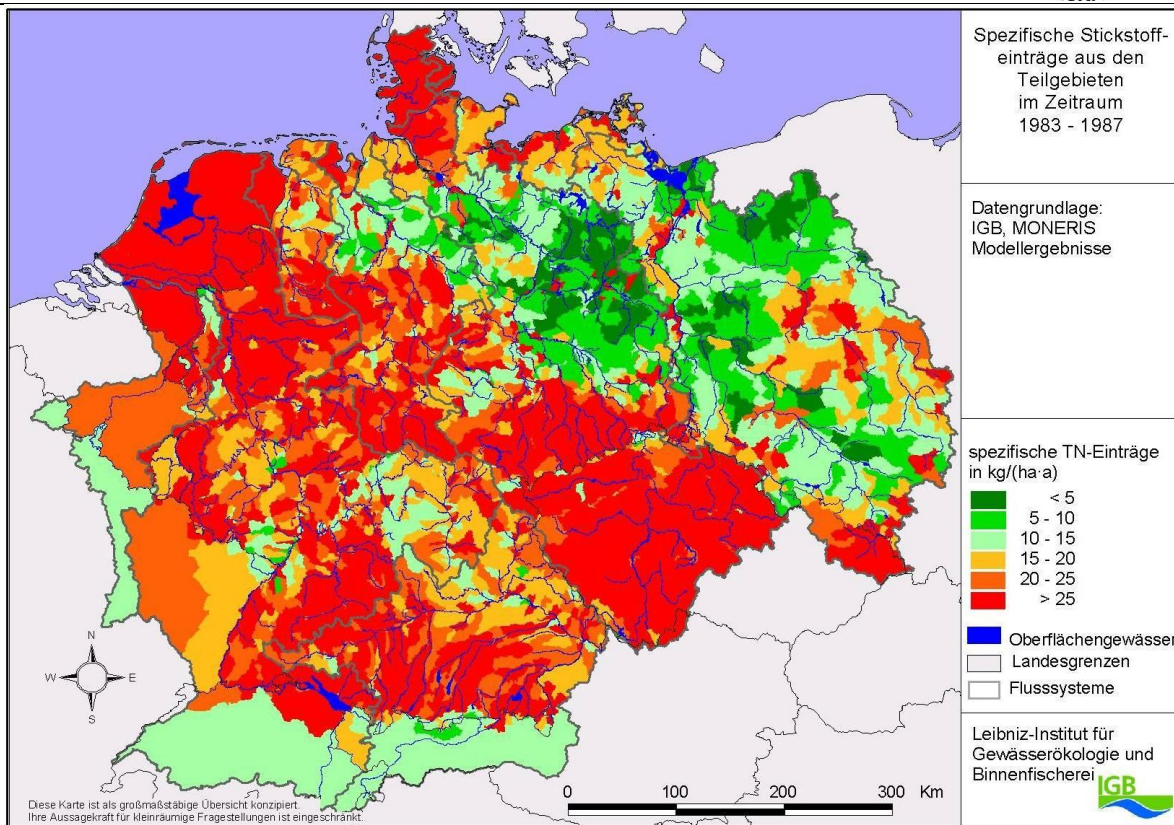
Germany used to have a quite elaborated system of publicly financed advisory and extension services in agriculture. Due to public budget restrictions private extension services are gaining importance. German farmers are regarded as well educated and trained. Due to structural changes and an increase in average farm size the share of farmers holding an academic degree is continually growing. In the new federal states (i. e. former GDR) farms are often large and employ specialists for a number of activities.

Where have we reached so far? Maps published by the Federal Ministry for Environment, Nature Conservation and Nuclear Safety (based on activities and projects by Federal Environment Agency; see appendix) show **significant reductions** of both nitrogen and phosphorus input into surface waters during the last 20 years. These improvements have been achieved by efficient treatment of municipal waste water including P-removal, Introduction of phosphate-free laundry detergents and improved environmental performance of our farmers. Meanwhile about 80% of our surface waters show good chemical status according to the WFD, and it is again possible to swim in most of our rivers. The management plans for river basins and their implementation will require further efforts to reach the overall target, i. e. good status of all our water bodies.

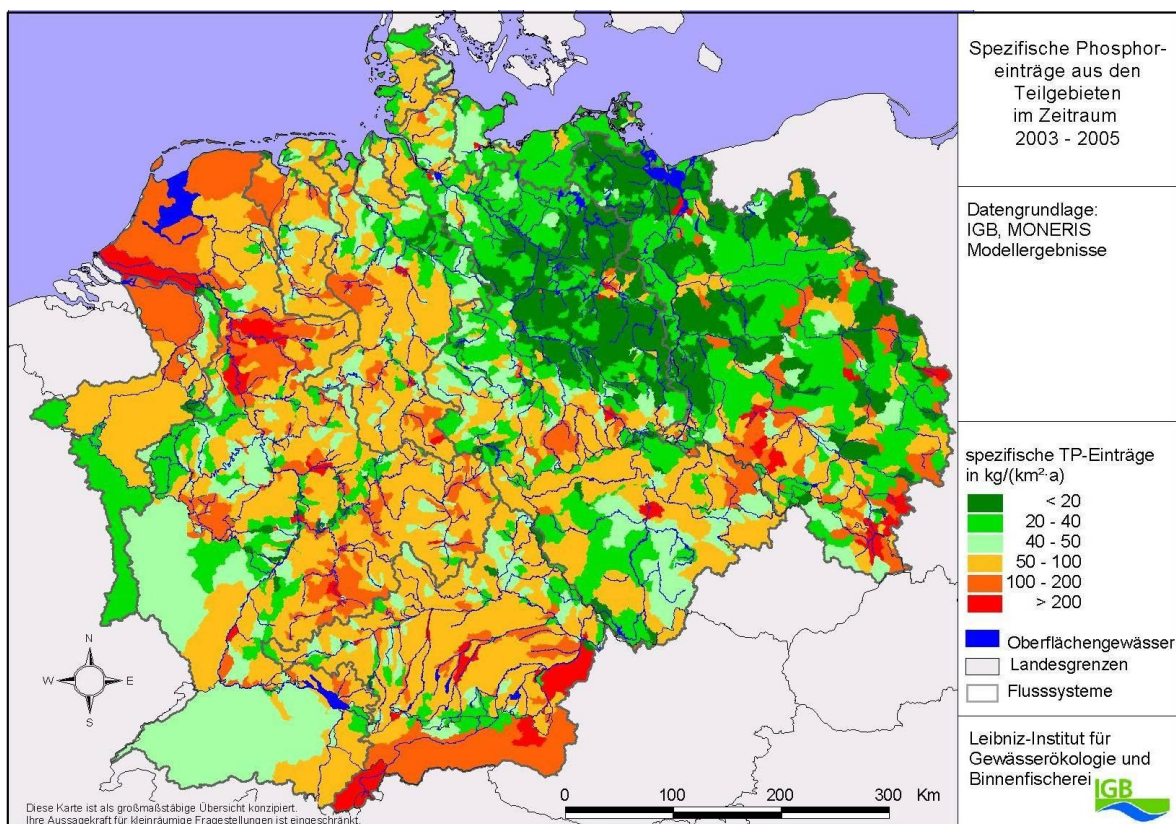
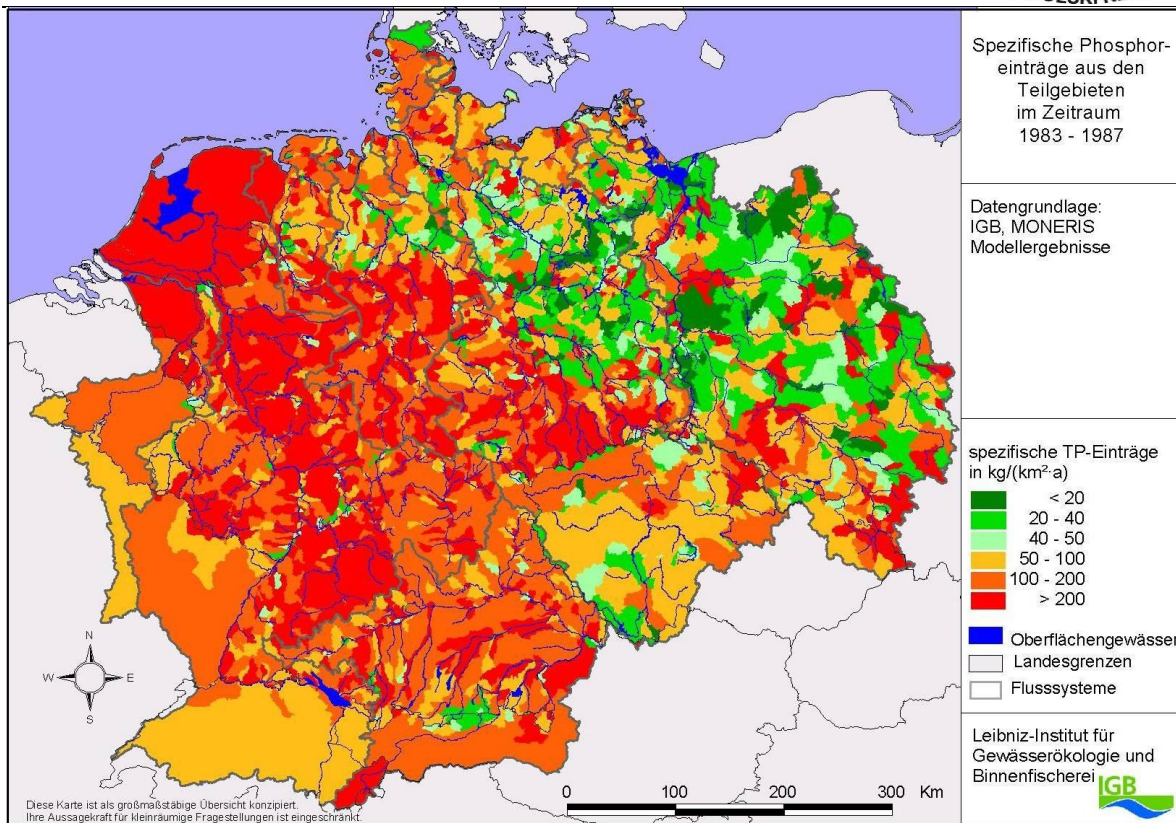
Yet we will not be able to achieve good status everywhere by the year 2015, and further efforts are also needed in the field of agriculture. The ongoing next round of reforms in the CAP hopefully will provide a platform to further integrate environmental aspects into agricultural everyday practice by strengthening the motto „*public money for public goods*“ in respect of both direct payments and rural development measures. Water management is one of the “new challenges” identified by the EU-COM strengthening the importance of efficient measures to improve water quality, among others by reducing nutrient inputs from agriculture. In a communication from the Commission¹³ (to be officially published on 17 November) the EU-COM points out the necessity to enhance “*environmental performance of the CAP through a mandatory greening component of direct payments (i. e. first pillar!) by supporting environmental measures applicable across the whole of the EU territory*”. It has not yet been specified by the Commission to which extend water management and water quality will be improved via the first pillar and/or the second, but measures proposed by the COM for the future first pillar like permanent pasture, green cover, crop rotation and ecological set-aside would considerably contribute to this objective. The ultimate target of the BSAP, i.e. good status of the whole Baltic Sea, will come closer as a consequence of improved water quality in rivers and lakes, and **agriculture will clearly have to play a key role** in this process.

Appendix: nitrogen and phosphorus inputs into surface waterbodies according to WFD (basins, no administrative borders) in 1985 and 2005. Model calculations using MONERIS (modelling nutrient emissions into river systems).

¹³ Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: „The CAP towards 2020: meeting the food, natural resource and territorial challenges of the future.“ Brussels, 29/09/2010, COM (2010) version finale.



Picture 1: nitrogen inputs into surface waterbodies according to the Water Framework Directive 1983-1987 (average, above) and 2003-2005 (average, below).



Picture 2: Phosphorus inputs into surface waterbodies according to the WFD 1983-1987 (average, above) and 2003-2005 (average, below).