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Estimation of selected agri-environmental indicators in farms located in direct influence zone on Natura 2000 area Dąbrowy Krotoszyńskie (PLH300002)

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Abstract: *Estimation of selected agri-environmental indicators in farms located in direct influence zone on Natura 2000 area Dąbrowy Krotoszyńskie (PLH300002)*. The aim of this paperwork was the potential risk assessment from farming for natural-valuable ecosystems in Natura 2000 area, based on selected production and environment indicators. There were selected 75 farms located in Dąbrowy Krotoszyńskie (PLH300002) and in zone of direct effect on the NATURA 2000 area, in the Wielkopolska province. In the research data from years 2004–2011 were used. Dąbrowy Krotoszyńskie are located in two nitrogen vulnerable zone's (NVZ) – Orla river, Czarna Woda and Kuroch rivers. Average size of 75 farms chosen to research was 37.8 ha. All of farms led plant and animal production. In the structure of livestock species predominated cattle (62.1%). Pork accounted for 36.6% share. To hear the current threat to the quality of surface waters from agricultural production for the 26 representative farms were calculated NPK nutrients balance by "on field surface" methodology. The results showed the average balance of nutrients surplus, the group analyzed on the level 121.9 kg $N \cdot ha^{-1}$ and 47.1 kg $K \cdot ha^{-1}$, which indicates that macro-components are unsustainable management. Content of phosphorus did not exceed standards. One of the basic environmental indicators in agriculture is a load of farmland nitrogen from manure produced by livestock kept on the farm. Of the 75 surveyed farms only 12% exceeded the recommended standard 170 kg $N \cdot ha^{-1}$, while in 56% of farms had amount not exceeding 100 kg $N \cdot ha^{-1}$. In the paper were analyzes the status and the needs for structures to store manure. From the 75 studied farms, only seven had the right size concrete structure for storing solid manure for a period of six months. As many farmers had a suitable tank for liquid manure. Concrete for solid manure did not have 18% of farmers and 73%, there was no tank for liquid manure. This demonstrates the high negligence in this area and the potential risk of migration of nutrients to the environment.

Key words: Natura 2000, Dąbrowy Krotoszyńskie, non-pointed pollution, agri-environmental indicators

INTRODUCTION

Intensive farming, irrational and set to profit maximization, consuming large amounts of artificial production means, like fertilizers, manures and industrial feeds comes to changes in environment (OECD 2008). Changes in plant and wild animals diversity are the most dangerous, also surface water eutrophication, acidification of soil or water pollution (Kajak 1994, Kupiec and Zbierska 2006, Kupiec 2007, Ławniczak et al. 2008). In Europe, as a result of soil over-rich with nitrogen, moors massively die. But agriculture areas are in many examples a refuge for rare plant and animal species, which adjust their development to

treatments made in agriculture, and thanks to them they survived. In time of Poland's transition from centrally-controlled economy to European Union, agri-environment politic in country was not priority. By the removal of government support for agriculture, contribute to reduction of some production means use, like plant protection products, fertilizers or energy. This resulted a drop of agriculture production intensity, and because of that this sector's pressure on environment has decreased. In 1990 had introduced some pro-environment actions, like so-called Green Lungs of Poland which was voluntary project in order to protect natural--valuable agricultural areas in north-east Poland. First National Environmental Policy had introduced in 1991 principles which regulates water and soil protection. However, the Nature Conservation Act from 1995 establishes protection of agricultural genetic resources in country. Very important step was to initiate European Ecological Network Natura 2000, in order to keep wildlife heritage. The Network comprising Special Protection Areas – SPAs (in Polish legislative OSO) based on so-called Bird Directive (79/409/EEC) and Special Areas of Conservation – SACs (in Polish legislative SOO) based on so-called Habitats Directive (92/43/EEC).

The aim of this paperwork was the potential risk assessment from farming for natural-valuable ecosystems in Natura 2000 area, based on selected production and environment indicators.

MATERIAL AND METHODS

There were selected 75 farms located in Dąbrowy Krotoszyńskie and in zone of direct effect on the Natura 2000 area in the Wielkopolska province (Figs 1, 2). In the research data from years 2004–2011 were used. Details about land structure, plant and animal production or infrastructure were obtained directly from farms, based on special questionnaire. Part of data came from community office, from identify cards of farms. This cards are prepared for implementing so--called Nitrates Directive (91/676/EEC) and Action program in nitrogen vulnerable zones (NVZs). Chosen farms were different in size, production and specialization. Enclosures were located in 23 places and 9 communes (Dobrzyca, Kobylin, Koźmin Wielkopolski, Krotoszyn, Ostrów Wielkopolski, Raszków, Rozdrażew, Sulmierzyce, Zduny). In the paperwork animal production in farms

FIGURE 1. Localization of Natura 2000 area Dąbrowy Krotoszyńskie in Poland

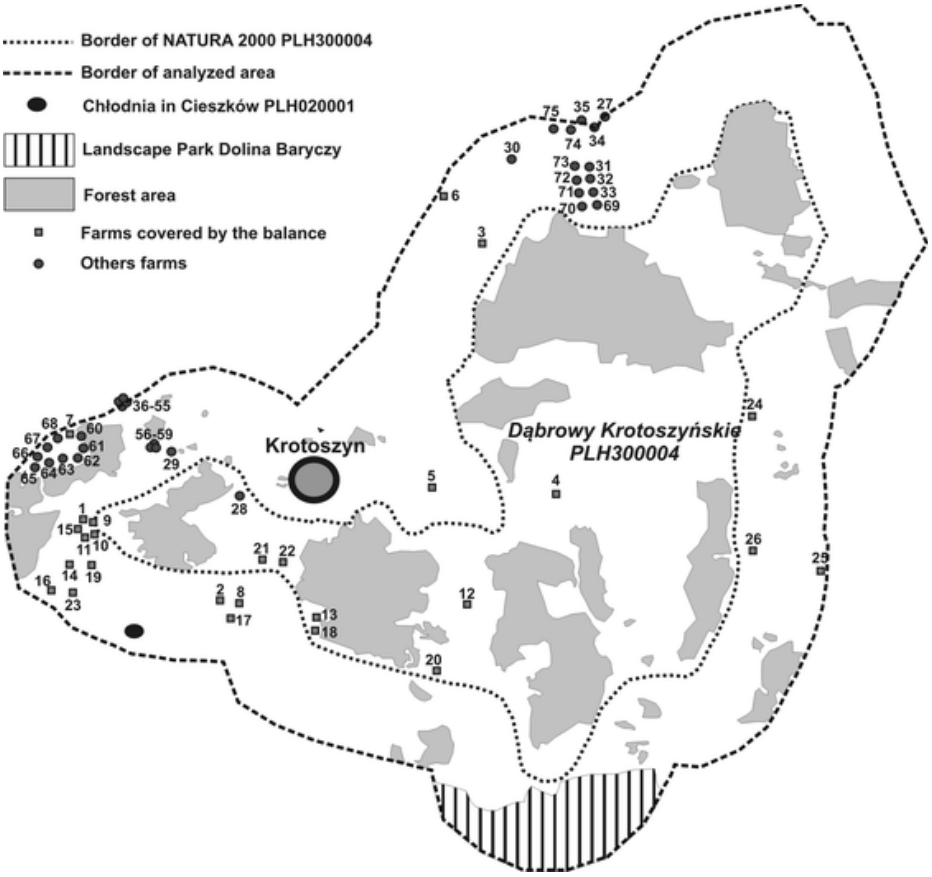

FIGURE 2. The analyzed zone of Natura 2000 area Dąbrowy Krotoszyńskie with farms location

was analyzed (manures policy, storage of manures, nitrogen application). To recognize potential risk assessment of environment quality from agri-production, first of all surface and underground water, for 26 chosen representative farms the balance of nutrients (NPK) was counted with "field surface balance" method, used in many countries in different modifications (Oenema 1999, Kupiec and Zbierska 2012). This balance included:

– input: use of fertilizers, manures, biological nitrogen fixation by papilionaceous plants in field crops and on the grassland, nitrogen fixation by soil microorganisms, deposit atmosphere's nutrients;
– output: taking of nitrogen with yields (main and by-product);
– surplus (= input – output) – losses calculated of balance sheet included emission of ammonia from farming fertilizers, nitrogen losses from denitrification, nutrient leaching from fertilizers.

The balance of owned buildings to manures storage analyze was made with environmental unit of farms rapid of identification system (SSI), worked up to estimate farms influence on environment (Raport… 2011). It was cataloged the occurrence and size of concrete for solid manures and tanks for liquid manures and counted demand for these constructions on the basis of inventory according to animals average year balance (Rozporządzenie… 2002, Rozporządzenie… 2005). Lack of that constructions were referenced to point scale (Table 1). In the scale included tolerance to 5% from optimal demand for buildings to magazine manures, resulted from changes in inventory. The assessment for constructions to magazine separately solid and liquid manures was made.

TABLE 1. Point scale SSI for farm risk assessment in owned constructions for manures storage

Range of the size shortages of constructions (%)	Points
≤ 5	0
6–15	1
16–25	2
26–35	3
36–45	4
46–55	5
> 55–99	6
Lack of constructions, 100	7

Quantity of produced manures was counted basing on animals average year balance according to guidelines from Ministry of the Environment Ordinance dated from 18 May 2005 (Rozporządzenie… 2005).

The content of nutrients in bought and applied mineral fertilizers was estimated with information given by producers. Nutrients content in own production and purchased manures was counted according to Mazur and Górski (under Wrześniowski et al. 1997). Biological N_2 fixation by various species of *Rhizobium* bacteria living in symbiosis with papilionaceous plants was calculated on the basis of symbiotic nitrogen binding coefficients obtained from literature data (Gorlach and Mazur 2002). The amount of nitrogen bound by free-living microorganisms in the soil was assumed by Fotyma and Mercik (1995). The size of atmospheric nutrients deposition for the examined regions was adopted on the basis of the total NPK fall (GUS 2010).

The content of nutrients in the main crops, by-products and catch crops was adopted from information obtained on farms, literature data, tables of food chemical composition and recommendations for practice (Czarnik et al. 1986, Piekarska and Łoś-Kuczera 1990, Kostuch 1996, Sady 2000, Elmadfa and Muskat 2003, Furgał-Dzierżuk et al. 2003, Kunachowicz 2005) or own analyses.

Calculations of ammonia emission in animal production were carried out according to recommendations for Poland based on model of RAINS – regional air pollution information and simulation (Klimont and Brink 2004). Losses of NH_3 were calculated depending on animal species and technology of their rearing taking into consideration emissions in animal housing facilities, during storage and agricultural utilisation

of manures as well as on pastures and cattle yards. Emissions of N_2O following denitrification as well as NH_3 release from mineral fertilizers were calculated using coefficients elaborated by Polish researchers (Fotyma and Mercik 1995, Skiba et al. 1997). The level of the nutrients losses as a result of leaching from the soil was calculated according to Roszyk and Spiak (1999) as well as Fotyma and Mercik (1995).

RESULTS AND DISCUSSION

Natura 2000 area Dąbrowy Krotoszyńskie (PLB300007) was under the Ministry of the Environment Ordinance from 12 January 2011 in case of Special Protection Areas[1]. The area of 34,245.3 ha is one of the bigger and better known oak forest complexes in Europe. In Dąbrowy Krotoszyńskie there are six reserves: Baszków (3.6 ha), Buczyna Helenopol (42 ha), Dąbrowa Smoszew (9.8 ha), Dąbrowa near Biadki Krotoszyńskie (16.6 ha), Miejski Bór (29.2 ha), and Mszar Bogdaniec (22 ha). Additionally, 88% of area is covered with Landscape Protected Area Dąbrowy Krotoszyńskie Baszków-Rochy (55,800 ha). The Natura 2000 area Dąbrowy Krotoszyńskie is covered almost completely with area of Site of Community Importance – SCI (in Polish legistative OZW) – Dąbrowy Krotoszyńskie (PLH300002). This zone was approved in 2007 and it occupies 34,225.2 ha. On its area 12 types of habitats defined in Enclosure I of Council Directive 92/43/EEC are affirmed, therein 3 as priority. Besides that, this area is located in close neighborhood to one of the most valuable ornithologist areas – bird habitat of European importance E54 (Dolina Baryczy PLH020041). Dąbrowy Krotoszyńskie is located in two NVZ areas – Orla river, Czarna Woda and Kuroch rivers. Orla is right-bank tributary of Barycz, and subjected area appointed in catchment has 1,165.61 km^2. NVZ in catchments of Czarna Woda and Kuroch rivers, which are also right-bank tributaries of Barycz river, contain 232.84 km^2.

Main threats for analyzed Natura 2000 zone are modifications of water relations, inept forest management, intensive and irrational agri-management. The biggest problems registered in this region are: complete removal of woody debris from forest, planting trees monocultures, ground dehydration as a result of inept land reclamation, problems with regeneration oak forests, agri-production intensification and extensive using of meadow gathering.

Average size of 75 farms chosen to research was 37.8 ha. Analyzing land-use structure, it is needed to pay attention to avery big share of arable grounds, riding around 86.9% (Table 2). Participation of grassland was about 10%. Also was not convenient as regards diversity of cultivated plants and their participation. In analyzed region farmers mostly planted cereal plants on their land, and these ones shared 96% of sown area. Apart from cereals and cereal mixes it were cultivated industrial plants (2%), fodder plants (1%) and others – roots, leguminous plants, small-seeded papilionaceous and vegetables.

[1] Journal of Laws of the Republic of Poland – Dz.U. 2011 nr 25, poz. 133.

TABLE 2. Chosen elements of analyzed farms characteristic

Parameter	Unit	Range	Average
Farm's area	ha	2.8–650.0	37.8
Tilllands	ha	2.3–525.0	32.6
	%	50.0–100.0	86.9
Grassland	ha	0.0–87.0	4.0
	%	0.0–45.8	10.3
Woods	ha	0.0–14.0	0.5
	%	0.0–25.0	1.5
Others-lands	ha	0.0–24.0	0.5
	%	0.0–6.7	0.6
Livestock – summary	LSU	4.4–505.6	41.8
	LSU·ha^{-1}	0.1–7.7	1.5
Cattle	LSU	0.0–332.2	26.0
	LSU·ha^{-1}	0.0–4.6	0.9
Pigs	LSU	0.0–173.4	15.3
	LSU·ha^{-1}	0.0–3.4	0.5
Other animals	LSU	0.0–13.1	0.5
	LSU·ha^{-1}	0.0–2.1	0.04

36.6%. In farms also horses were provided (1%) and hens, goats, turkeys, ducks, sheep and pigeons (summary around 0.3%). Research introduced in this paperwork showed that in group of 75 analyzed farms, located in Natura 2000 area and in direct influence zone on Dąbrowy Krotoszyńskie, inappropriate agricultural practices were observed, bounded with animal excrements management (Table 3). The main problem was lack or inefficient size of constructions for manures storage. As it is shown in Table 3 the level of farms danger, followed from lack of buildings to store manures, was high; 70% of farms had the highest score (14–15 points), which showed that there were a shortage in size of concrete constructions for solid manures and capacity of tanks for liquid manures. In spite of exceeded norms for density of livestock, quantity of nitrogen broughted from manures was over norm (> 170 kg N·ha^{-1}) in only 12% of farms.

TABLE 3. Rank of threat, resulting from lack of appropriate amounts of constructions for manures storage

Indicator of threat	Increasing of threat →											
Obtained points	0	1	3	4	6	7	8	10	11	12	13	14
Share of farms with determined sum of points (%)	7	1	1	3	3	4	4	3	1	3	53	17

Animal production was characterizing not high diversity in animal species. The average density of livestock was 1.4 LSU (livestock unit) per 1 ha. In species structure of provided animals the highest was cattle (62.1%). The swine had

High potential threat to natural ecosystems in analyzed area could be irrational nutrients management (NPK). The nitrogen balance counted in 26 representative farms showed surplus reaches as far as 450 kg N·ha^{-1} (Table 4). The maximum

TABLE 4. Structure and results of nutrients (NPK) balance in 26 selected farms

Specification	Amount of nutrient (kg·ha^{-1})											
	nitrogen – N				phosphorus – P				potassium – K			
	mean	min.	max.	**s**	mean	min.	max.	**s**	mean	min.	max.	**s**
Input												
Mineral fertilizers	91.5	0.0	172.4	62.2	6.7	0.0	25.4	8.1	26.4	0.0	86.0	25.2
Manures – own production	97.9	9.8	283.4	68.9	16.6	1.9	44.9	11.6	89.7	8.5	282.3	64.3
Manures – purchased	9.5	0.0	109.7	22.5	2.5	0.0	30.0	6.1	6.5	0.0	69.0	14.7
Deposition	14.5	14.4	16.0	0.4	–	–	–	–	15.1	5.0	15.9	2.9
Fixation by free-living soil microorganisms	10.0	10.0	10.0	0.0	–	–	–	–	–	–	–	–
Symbiothic fixation	2.1	0.0	25.5	5.3	–	–	–	–	–	–	–	–
Input – summary	225.6	65.4	549.2	115.3	25.8	4.7	82.3	18.1	137.6	51.4	369.8	78.7
Output												
Main crops	77.0	23.0	167.4	37.5	14.2	3.1	30.7	6.8	38.1	3.4	154.7	34.3
By-products and catch crops	26.7	0.8	62.0	15.5	5.1	0.2	12.8	3.1	52.4	1.6	118.3	29.8
Output – summary	103.7	27.9	212.9	47.1	19.4	3.3	38.4	8.9	90.4	11.9	237.2	52.9
Surplus (Input – Output), including	121.9	–102.6	449.5	116.0	6.4	–28.8	62.9	19.0	47.1	–88.1	292.7	83.8
Denitrification from mineral fertilizers	1.5	0.0	2.8	1.0	–	–	–	–	–	–	–	–
Leaching from mineral fertilizers	5.5	0.0	10.3	3.7	0.5	0.5	0.5	0.0	5.2	5.2	5.2	0.0
NH_3 emission from mineral fertilizers	5.9	0.0	11.0	4.0	–	–	–	–	–	–	–	–
NH_3 emission from manures	11.4	0.0	37.2	8.8	–	–	–	–	–	–	–	–
Others*	97.6	–139.8	410.8	110.7	5.9	–29.3	62.5	19.0	41.9	17.1	242.4	83.8

s – standard deviation, * including immobilization.

nitrogen balance should not go over 30 kg N·ha^{-1} (Kodeks… 2004), meanwhile from 26 analyzed farms there was in 20 with over norm balance. The average nitrogen balance was near to 122 kg N·ha^{-1}. A little bit better looked the phosphorus balance (Table 4). Soil in analyzed area were rich in this nutrient, so phosphorus balance should be close to zero. The average balance for this macro-component showed surplus 6.4 kg P·ha^{-1}. In 12 from 26 farms the norm were exceeded. The maximum balance was around 63 kg P·ha^{-1}. The potassium balance also showed big exceed and was running at 47.1 kg K·ha^{-1} (Table 4). In 14 from 26 farms noticed that established norms were exceeded (15 kg K·ha^{-1}) – soil in this area is usually not rich in this nutrient. The maximum noticed balance was 292.7 kg K·ha^{-1}.

Quality of surface water in analyzed area for many years is on dissatisfying level. Because analyzed region is a typical agricultural area, intensive and irrational agriculture could be the main cause of bad water condition. These days there is government monitoring on protected areas in range of habitat or species protection, for which maintenance or improvement of water condition is very important in their protection. Water monitoring for protected areas in analyzed ground shows moderate ecologic potential. Evaluation of a body of surface water Orla from Rdęca, and Rdęca in Dąbrowy Krotoszyńskie zone in 2010–2012 the operational monitoring showed also moderate ecological potential (Table 5). For both analyzed bodies of surface water the condition is bad, because of not-fulfilled requirements for protected areas. The problem of pointed pollution is already almost solved, still intensive farming and not normed water and savage management poses high danger in this region for quality of surface and underground water as well. Research conducted in years 2007–2010 at four monitoring points in river basins of Orla, Czarna Woda and Kuroch, within which is situated analyzed Natura 2000 area, showed exceeded indicators of eutrophication in almost all cases (Table 6).

In farming, the quality of water is directly connected with nutrients management. One of methods to research correctness of nutrients management is to prepare balance and analyze its structure and results. Input of balance showed that quantity of entered nutrient was the biggest in produced in farms manures. Participation of nitrogen entered this way to 26 farms was as high as 45.4%. Almost the same nitrogen was applied to farms with fertilizers (42.5%). Per 1 ha on agricultural land the amount of nitrogen from manures was about 98 kg N·ha^{-1}. In relation to requirements referred to as absorption of macro-components from main crop and by-products (summary around 104 kg N·ha^{-1}) it is almost enough amount to cover plants needs from this source. Similar situation was in case of potassium, where average quantity of nutrient applied from solid and liquid manures was 89.7 kg K·ha^{-1}. Farmers took out potassium with yields from fields quantity about 90.4 kg K·ha^{-1}. Participation of potassium from fertilizers in input was 19.2%, so it was not to high. In phosphorus case this nutrient

TABLE 5. Assessment of bodies of surface water localized on Natura 2000 area Dąbrowy Krotoszyńskie in 2010–2012 (WIOŚ 2012)

Name of estimated BoSW	Name of check-point	Class of biological elements	Class of hydromorphological elements	Class of physical and chemical elements	Class of physical and chemical elements – specific synthetic and non-synthetic pollutants	Ecological potential	Protected areas for the protection of aquatic species of economic importance and protected areas for the protection of habitats or species (total score)	Protected areas that are uniform water bodies intended for recreational purposes, including bathing	Protected areas sensitive to eutrophication caused by pollution from municipal sources and nitrogen vulnerable zones (total score)	Assessment of compliance with the requirements for protected areas	Ecological potential for protected areas	State of BoSW
Orla from source to Rdęca (PLRW60001714639)	Żydowski Potok – Baszków	III	II	BGP	II	moderate	N	–	N	N	moderate	bad
	Borownica – Jutrosin											
	Orla – Baszków											
	Orla – Dubin											
Rdęca (PLRW600017146499)	Rdęca – Jutrosin							N				

BoSW – a body of surface water; BGP – below good potential; N – unfulfilled requirements.

TABLE 6. Violation of water quality standards on nitrate vulnerable zones (Program… 2012)

River	Check-point	Year	NO_3 max. ($mg \cdot l^{-1}$)	NO_3 mean ($mg \cdot l^{-1}$)	N-NO_3 mean ($mg \cdot l^{-1}$)	N_{og} mean ($mg \cdot l^{-1}$)	P_{og} mean ($mg \cdot l^{-1}$)
Orla	km 52.6 – Baszków	2007	107.00	38.79	8.82	10.98	1.04
		2008	134.53	31.50	7.16	9.37	1.28
		2009	135.42	45.37	10.16	12.50	0.97
		2010	81.11	46.34	10.48	13.00	0.46
Żydowski Potok	km 1.2 – Baszków	2007	98.17	33.86	7.69	14.06	0.82
		2008	91.64	27.66	6.29	13.96	1.45
		2009	103.61	40.32	9.16	15.79	0.69
		2010	62.55	34.92	7.89	13.19	0.49
Borownica	km 0.6 – Jutrosin	2007	40.82	12.88	2.93	4.70	0.13
		2008	33.00	8.89	2.02	3.74	0.17
		2009	48.37	10.99	2.50	4.18	0.17
		2010	28.40	14.56	3.29	6.30	0.15
Kuroch	km 0.5 – Uciechów	2007	71.70	23.42	5.30	8.58	0.46
		2008	57.58	16.21	3.67	7.31	0.64
		2009	64.72	21.30	4.82	7.69	0.53
		2010	no data	no data	no data	no data	no data
Czarna Woda	km 3 – Wrocławice	2007	77.90	25.81	5.83	6.77	0.14
		2008	74.80	28.49	6.43	7.46	0.16
		2009	no data	no data	no data	no data	no data
		2010	no data	no data	no data	no data	no data

Underlined measurements – limits of eutrophication indicators are exceeded.

was brought to fields mainly with manures (64.3%). But quantity of phosphorus, which had been bringing this way only with phosphorus from fertilizers (summary from fertilizers: 23.3 kg $P \cdot ha^{-1}$), was complementing deficiencies due to collection of components with main crop and by-products (19.4 kg $P \cdot ha^{-1}$). According to Toczyński et al. (2013), optimum balance for nitrogen in the Wielkopolska province was within 55.9––65.9 kg $N \cdot ha^{-1}$. Scope of optimal balance for phosphorus was about –3.5–1.5 kg $P \cdot ha^{-1}$ and potassium 12.8–17.8 $K \cdot ha^{-1}$. In case of 26 analyzed farms the average balance for these three nutrients was outside the recommended norms. For nitrogen and potassium these exceeds were significant. Excess of nitrogen and phosphorus in environment affect mostly on water eutrophication. To big surplus of nitrogen can also affect to acidification of water and soil or to reduction biodiversity of plant organisms, indirectly

also to animals (Jadczyszyn et al. 2004, Oszlànyi et al. 2004). Nitrogen increases susceptibility of trees to stress factors, and because of NO_2 emission could be the reason of the greenhouse effect and formation of ozone hole phenomenon. Potassium migrated to water in higher quantity in special cases can also effect on their eutrophication (Ławniczak et al. 2010). Besides downloading potassium from soil by plants, the big part of it is loss from agricultural production as result of erosion. These factors causes by depletion of resources soil potassium.

Lack of transgression caused by excessive animals livestock, and hence too much of nitrogen applied to fields with animal excrements by analyzed farmers leads to the conclusion that reason of water pollution in analyzed area has other support than manures fertilization. One of the most important problems, besides not balanced nutrients management, can be storage of manures. These days the valid program of activities for Wielkopolska province, introduced under Regional Director Regulation of Water Management Board in Poznań from 17 August 2012[2]. Recommends sealed tank as place to store liquid manures. In case of solid manure it should be concrete or other, specially made from sealed and impervious place of storage. This place should be protected from leaching to water or to ground. It means that there is no obligation to have concrete constructions to store manures storage. It is allowed to store manures from 1st March to 31th October, but not longer than for 12 weeks on heap directly on ground. In these cases heaps must be located outside the land depressions, on possibly flat area, slope maximum to 3%, on not sandy and wet terrain, at the distance greater than 20 m from shore line of surface water. Farmers are obligated to locate heap in other place, when there is manure re-submission on heat in next growing season. Previous long-term authors observations in this province shows continued non-compliance with these recommendations. In many places manure was storaged for whole growing season, also in winter time. The heaps location was not correct, for example in flooded areas or in direct neighborhood to surface water.

[2] Journal of Laws of the Wielkopolskie Voivodeship – Dz.U. Woj. Wlkp. 2012, poz. 3601.

CONCLUSIONS

1. From chosen agri-environmental coefficients the biggest problem in Dąbrowy Krotoszyńskie (PLH300002) zone was incorrect size or lack of constructions for manures storage. Lack of obligations to have these kind of constructions and control of that could be the reason of higher risk of pollutions migration to environment.
2. Nutrients management in chosen farms in analyzed area was irrational. Macro-components surplus made in agricultural production, mostly nitrogen and potassium, could be the reason of changes not only in water ecosystems, but also in land ecosystems, because of their pointed concentration in environment.
3. Despite of high participation cattle in species herd structure, the sharing of grassland in land-use structure of analyzed farms was only 10%. Lack

of buffer zone, which the grassland is, especially in river catchment could increase erosion process and nutrients leaching to surface water.

4. Exceeded livestock density of animals occurring in many farms is not involved with exceeds in nitrogen and manures quantity, used on fields. Exceeds in livestock density was mostly kept in save range.

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Streszczenie: *Ocena wybranych wskaźników rolniczo-środowiskowych gospodarstw rolnych zlokalizowanych w strefie bezpośredniego oddziaływania na obszar Natura 2000 Dąbrowy Krotoszyńskie (PLH 300002)*. Celem pracy była ocena potencjalnego zagrożenia wód powierzchniowych na obszarze Natura 2000 ze strony gospodarki rolnej na podstawie wybranych wskaźników produkcyjno-środowiskowych. Do badań wytypowano 75 gospodarstw rolnych, umiejscowionych w strefie bezpośredniego oddziaływania na obszar Natura 2000 Dąbrowy Krotoszyńskie (PLH300002) w województwie wielkopolskim. W badaniach wykorzystano dane z okresu 2004–2011. Badany obszar niemal w całości położony jest w granicach obszaru szczególnie narażonego na zanieczyszczenia związkami azotu ze źródeł rolniczych (OSN) w zlewni rzeki Orli. Wielkość badanych gospodarstw wahała się od 2,8 do 805 ha. Średnia powierzchnia gospodarstw wyniosła 37,8 ha. Wszystkie gospodarstwa rolne prowadziły produkcję roślinną i zwierzęcą. W strukturze gatunkowej inwentarza przeważało bydło (62,1%). Trzoda stanowiła 36,6% udziału. Dla rozpoznania aktualnego zagrożenia jakości wód powierzchniowych ze strony produkcji rolniczej dla 26 reprezentatywnych gospodarstw rolnych obliczono bilans biogenów NPK metodą „na powierzchni pola". Wyniki bilansu składników wykazały średnią nadwyżkę, w grupie analizowanych gospodarstw, na poziomie 121,9 kg $N \cdot ha^{-1}$ i 47,1 kg $K \cdot ha^{-1}$, co wskazuje na nieracjonalną gospodarkę tymi składnikami. Saldo bilansu fosforu mieściła się w normie. Jednym z podstawowych wskaźników środowiskowych w rolnictwie jest obciążenie gruntów rolnych azotem z nawozów naturalnych, wytworzonych przez zwierzęta gospodarskie utrzymywane w gospodarstwie. Spośród 75 badanych gospodarstw tylko 12% przekraczało zalecaną normę 170 kg $N \cdot ha^{-1}$, przy czym w 56% gospodarstw była to ilość nieprzekraczająca 100 kg $N \cdot ha^{-1}$. W pracy przeanalizowano również stan i zapotrzebowanie na budowle do przechowywania nawozów naturalnych. Spośród 75 analizowanych gospodarstw tylko siedem miało odpowiedniej wielkości płytę do przechowywania obornika przez 6 miesięcy, tyle samo miało odpowiedni zbiornik na płynne nawozy naturalne. Płyty obornikowej nie miało 18% rolników, a w 73% przypadków w gospodarstwie nie było zbiornika na płynne nawozy naturalne. Świadczy to o dużych zaniedbaniach w tym zakresie oraz potencjalnym ryzyku migracji biogenów do środowiska.

Słowa kluczowe: Natura 2000, Dąbrowy Krotoszyńskie, zanieczyszczenie obszarowe, wskaźniki rolniczo-środowiskowe

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