

Electronic Journal of Polish Agricultural Universities is the very first Polish scientific journal published exclusively on the Internet, founded on January 1, 1998 by the following agricultural universities and higher schools of agriculture: University of Technology and Agriculture of Bydgoszcz, Agricultural University of Cracow, Agricultural University of Lublin, Agricultural University of Poznan, Higher School of Agriculture and Teacher Training Siedlce, Agricultural University of Szczecin, and Agricultural University of Wroclaw.



**ELECTRONIC
JOURNAL
OF POLISH
AGRICULTURAL
UNIVERSITIES**

**2003
Volume 6
Issue 1
Series
HORTICULTURE**

Copyright © Wydawnictwo Akademii Rolniczej we Wrocławiu, ISSN 1505-0297
IWANISZYNIEC P. 2003. LOCALIZATION OF MAIN FRUIT-GROWING REGIONS AGAINST THE BACKGROUND OF
ECOLOGICALLY THREATENED AREAS *Electronic Journal of Polish Agricultural Universities*, Horticulture, Volume 6, Issue 1.
Available Online <http://www.ejpau.media.pl>

LOCALIZATION OF MAIN FRUIT-GROWING REGIONS AGAINST THE BACKGROUND OF ECOLOGICALLY THREATENED AREAS

Piotr Iwaniszyniec

Department of Environmental Protection and Management, Agricultural University of Poznań, Poland

[ABSTRACT](#)
[INTRODUCTION](#)
[MATERIALS AND METHODS](#)
[RESULTS](#)
[DISCUSSION](#)
[CONCLUSIONS](#)
[REFERENCES](#)

ABSTRACT

On the area of Poland there occur regions with excessive pollution of the natural environment, therefore, there is a risk of producing fruits containing harmful chemical components. The objective of this work was the determination of the degree of such risk.

A map was prepared showing the borders of "Areas of Ecological Endangerment", borders of communes with excessive pollutions determined in 1984 and localization of industrial plants particularly harmful for the environment.

In 1995, among 109 fruit-growing communes producing significant amounts of fruits in 7 main fruit-growing regions, only 12 were within the borders of excessive pollution. The moderate number of orchards exposed to excessive pollution minimizes the risk of fruit production with excessive content of contaminants.

Key words: fruit-growing regions, areas of ecological endangerment, industrial plants particularly harmful for environment

INTRODUCTION

Technological progress is frequently associated with significant transformations of natural environment. It is particularly visible in case when industrial plants are concentrated on small areas. The activity of such plants causes intensive anthropogenic transformation in their surrounding areas called “Areas of Ecological Endangerment” (OEZ), or regions of ecological calamity.

In Poland, there occurs a distinct concentration both of industry and fruit-growing production. The growing of fruit plants on areas exposed to negative effects of industry may cause that the fruits will contain excessive amounts of harmful chemical compounds.

The objective of this work was to define the potential risk of producing such contaminated fruits in the main fruit-growing regions of Poland on the basis of data derived from National Environmental Monitoring (PMŚ).

MATERIALS AND METHODS

The method of the determination of border-lines of seven main fruit-growing regions in Poland (according to the administrative borders of provinces before 1999) was presented in the publication by Iwaniszyniec [5]. According to that method, Radom province was classified as a region with very high fruit production, Lublin and Tarnobrzeg provinces were counted to regions with high fruit production, and Warsaw, Skierniewice, Siedlce and Nowy Sącz provinces were classified as regions with medium fruit production.

In the earlier selected fruit-growing regions, communes were separated which have a deciding importance in fruit production. For this purpose, the agral inventory was utilized [2]. The percentage of area under orchards in each commune was compared with the percentage of the fruit-growing area in the province. In case when the commune fruit-growing area exceeded the average value, the commune was included to the “fruit-growing communes” exerting an effect on fruit production.

A map in 1:4 000 000 scale was prepared showing the areas of ecological endangerment identified in 1984 (OEZ) and the above mentioned [7] main fruit-growing regions. In this elaboration, the results of the National Inspection of Environmental Protection (PIOS) reestimating the areas of Ecological Endangerment (OEZ) were taken into consideration. According to the method adopted by PIOŚ, the following items were determined: level of air pollution (SO_2 , suspended dust, NO_x), surface and underground waters pollution (physico-chemical and bacteriological indices), soil pollution (sulphur compounds, Zn, Cu, Ni, Pb, Cd) and noise level. Communes where the values admissible by the PIOS method were exceeded, were counted either to group C or D. The admissible environmental pollution level is defined by the Regulation of the Minister of the Protection of Environment, Natural Resources and Forestry of 12.02.1990 referring to admissible values of the concentration of contaminating substances in the air. The classification of waters and conditions to be met by sewages discharged to waters or earth and threshold values of metal traces in the superficial soil layer are determined in the guidelines of the Instruction of the Institute of Cultivation, Fertilization and Soil Science in Puławy of 5.11.1992.

A map of the south-eastern part of Poland was prepared showing the main fruit-growing regions, borders of fruit growing communities, borders of communes with excessive pollution (C and D communes) and the localization of point contamination sources of air, soil and waters essential for fruit-growing regions. Graphic program “Arc-View 3.2a” was used and the particular picture layers were placed overlappingly on each other permitting to localize communes belonging to the C and D commune categories and to fruit-growing communes. In this way, orchard areas with potential risk of producing fruits with excessive amounts of contaminations were identified.

In the elaboration, reports of Provincial Inspectors of Environmental Protection (WIOŚ) about the conditions of the environment on the area of the following provinces were utilized: Mazovian province, Lublin, Łódź, Małopolska, Sub-Carpathian and Świętokrzyskie provinces [8, 9, 10, 11, 12, 13]. The reports contain lists of industrial plants (“Lists 80”) particularly harmful for natural environment. A similar national “List 80” has been published by the National Inspection of Environmental Protection on its website www.pios.gov.pl. From the mentioned provincial and national lists, an extract was made referring to the harmful industrial plants located at a distance not exceeding 30 km from the borders of the main fruit-growing regions.

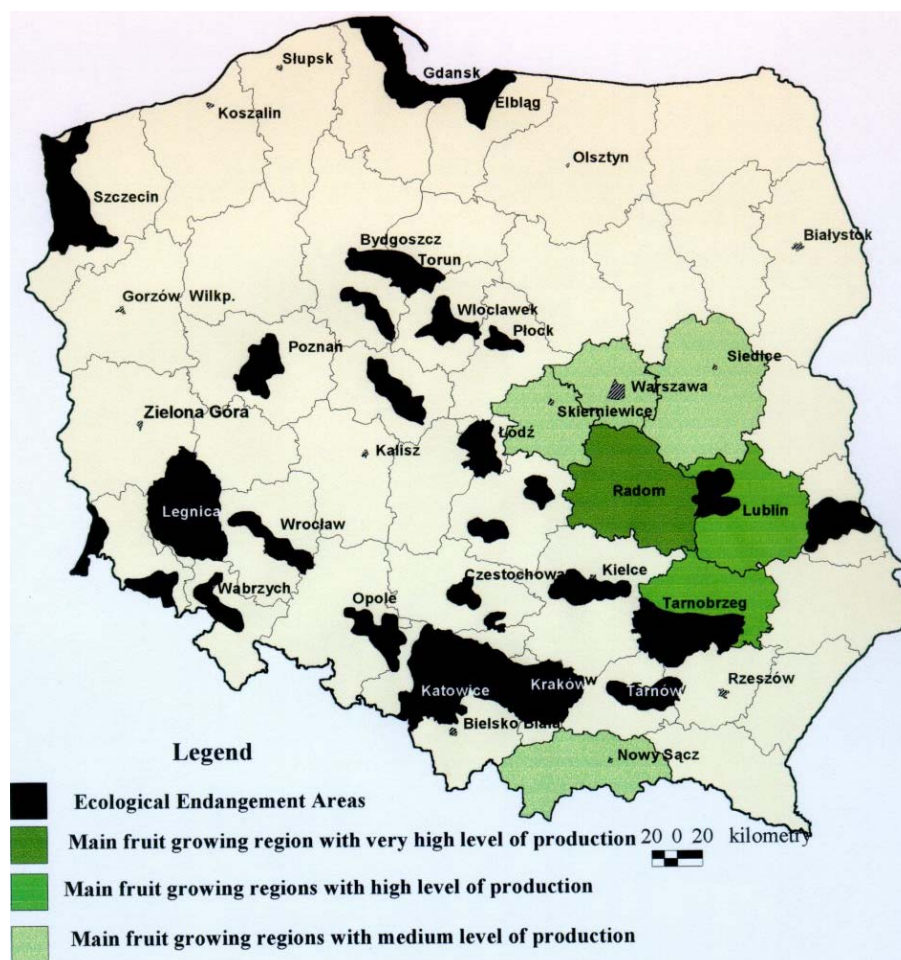
A detailed characteristics of the environmental conditions on the area of the main fruit-growing regions of Poland together with an information about fruit contamination with harmful substances on the basis of PMS studies carried out after 1995 will be presented in successive publications.

RESULTS

Situation in 1984

After several decades of absolute domination of heavy industry in Poland, in 1984, on the areas of the whole country, so called “areas of ecological endangerment” (O EZ) were separated. Over three hundred communes were listed where the levels of environmental contamination exceeded the admissible values. From the area of 27 O EZ covering 11.3% of the total area of Poland (35 220 km²), 73% of dust emissions and over 80% of gas emissions were introduced into the air [3].

Map 1. Localization of fruit-growing regions against the background of areas with ecological endangerment identified in 1984



The localization of 27 O EZ and 7 main fruit-growing regions is shown in [map 1](#). In the 1980-ies, the fruit-growing regions of Lublin and Tarnobrzeg with 16% share in the total apple production were lying partially within the borders of the Tarnobrzeg and Puławy O EZ and were subject to the effects of the Chełm O EZ. The fruit-growing regions of Radom and Skierniewice were in the neighborhood of the Łódź, Tomaszów, Bełchatów O EZ and Kielce O EZ. Among the 27 O EZ, the majority was far from the borders of the main-fruit-growing regions of the country.

Situation in 1995

Effective decrease of the contaminating gas and dust emissions and the development of National Environmental Monitoring (PMŚ) necessitated the revision of the number and the areas of O EZ. The number of water, air and soil sampling points for analyses was increased permitting a more precise determination of the borders of areas with excessive pollution. The “Instruction of Commune Characterization Regarding Environmental

Endangerment” elaborated by the State Inspectorate of Environmental Protection [4] was the basis for OEZ verification. Commune was the administrative unit for the determination of environmental changes. In result of a qualification procedure, 4 groups of communes were separated: group A – practically without any environmental dangers, group B – some anthropogenic activities are present but the admissible contamination values have not been exceeded, group C – excesses of admissible values occur, but because of no monitoring data, their range and intensity cannot be precisely defined, group D – there occur excessive contaminations with identified range and intensity.

Table 1. Classification of towns and communes included in the main fruit-growing regions regarding environmental endangerment (1)

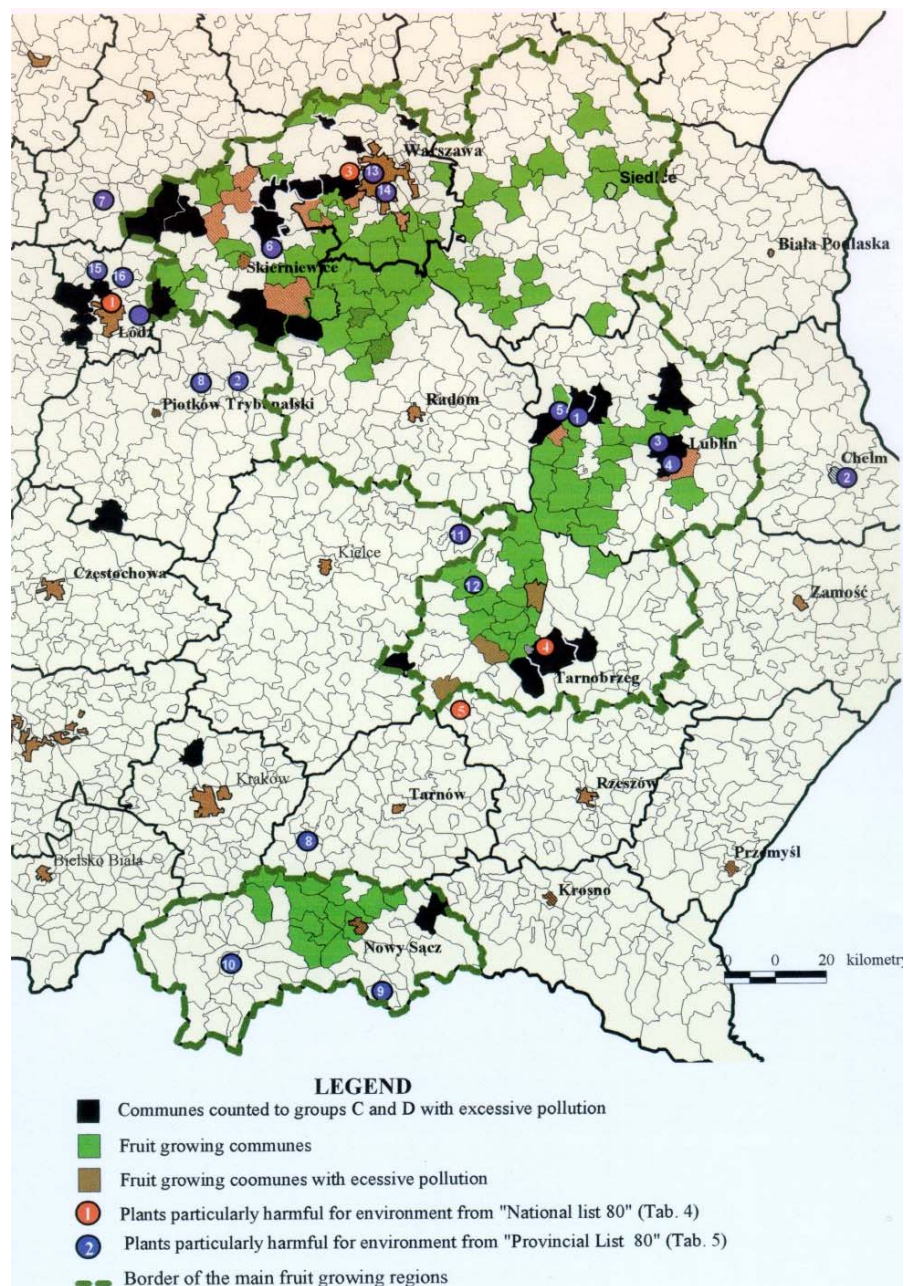
| No. | Main orchard regions | Number of communes in region | Number of communes and cities classified to groups | | | |
|---------|----------------------|------------------------------|----------------------------------------------------|--------------------------|-------------------------------|------|
| | | | A without pollution | B not large pollution | C above-level of pollution | D |
| 1 | Warszawski | 58 | 31 | 11 | 15 | 1 |
| 2 | Lubelski | 57 | 19 | 29 | 6 | 3 |
| 3 | Nowosądecki | 55 | 33 | 21 | 1 | -- |
| 4 | Radomski | 63 | 42 | 21 | -- | -- |
| 5 | Skierniewicki | 44 | 9 | 19 | 16 | -- |
| 6 | Siedlecki | 74 | 74 | 0 | -- | -- |
| 7 | Tarnobrzegi | 53 | 26 | 18 | 6 | 3 |
| Overall | | 404 | 234 | 119 | 44 | 7 |
| | | 100% | 57.9% | 29.5% | 10.9% | 1.7% |

From the number of 300 communes counted to OEZ in the 80-ies, after the re-assessment in 1995, there remained only 144 communes [1]. From 404 communes creating 7 main fruit-growing regions, 44 (10.9%) were included in group C, 7 communes (1.7%) were classified to group D ([table 1](#)). Areas (communes) with excessive contamination were found in 5 of 7 fruit-growing regions. Their detailed list of with group classification is the following:

- in Warsaw fruit-growing region: Warsaw Centre (D), Łomianki (C), Piastów (C), Pruszków (C), Nowy Dwór Mazowiecki (C), Błonie (C), Bielany (C), Ursus (C), Wawer (C), Brwinów (C), Grodzisk Mazowiecki (C), Konstancin-Jeziorna (C), Michałowice (C), Ożarów Mazowiecki (C), Radzymin (C), Zielonka (C).
- in Lublin fruit-growing region: Puławy (town + commune) (D), Lublin (town) (D), Kazimierz Dolny (C), Kurów (C), Lubartów (town + commune) (C), Świdnik (C), Wólka Lubelska (C).
- in Nowy Sącz fruit-growing region includes: Gorlice (town) (C).
- in Skierniewice fruit-growing region: Brzeziny (town) (C), Łowicz (town + commune) (C), Nieborów (C), Rawa Mazowiecka (towns + commune) (C), Sochaczew (town + commune) (C), Żyrardów (C), Biała Rawska (town + commune) (C), Bielawy (C), Nowa Sucha (C), Teresin (C), Wiskitki (C), Zduny (C).
- in Tarnobrzeg fruit-growing region: Dwikozy (C), Łoniów (C), Nowa Dęba (C), Połaniec (C), Sandomierz (town) (C), Stalowa Wola (town) (C), Grębów (D), Staszów (D), Tarnobrzeg (town) (D).

The spatial localization of communes counted to groups C and D occurring on the areas of fruit-growing regions is shown in [map 2](#).

Map 2. Actual state of environmental pollution in the communes of fruit-growing regions



The contaminated area decreased in comparison to the year 1984 and its border lines were changed. In Skierniewice fruit-growing region, where as many as 16 communes were counted to groups C and D, there was a visible negative effect of Łódź, Kutno, Sochaczew, Rawa, Brzeziny and Żyrardów. In Lublin region, a negative influence was exerted by Lublin, Lubartów and Puławy, while in Tarnobrzeg region, there was a negative effect of Tarnobrzeg, Stalowa Wola, Staszów and Połaniec.

The majority of the main fruit-growing regions of Poland are characterized by a distinct regionalization of areas with particular intensity of fruit production. For example, in Radom region, the majority of fruit production is concentrated in the northern part, where 10 fruit-growing communes have concentrated 75% of orchards from the whole region ([table 2](#)). In Tarnobrzeg region, fruit production is concentrated in the western part, and in the regions of Warsaw and Siedlce, orchards are in their southern parts.

Table 2. Characteristics of main fruit-growing regions from the point of view of the regionalization of fruit production (own elaboration on the basis of statistical data [2])

| No. | Main orchard regions | Area of region (ha) | Orchard area in region (ha) | Total number of communes in region | Number of "orchard communes" in region | Area of orchards in region situated in "orchard communes", % |
|---------|----------------------|---------------------|-----------------------------|------------------------------------|----------------------------------------|--------------------------------------------------------------|
| 1 | Warszawski | 378 782 | 12 121 | 58 | 15 | 74.5 |
| 2 | Lubelski | 679 204 | 19 018 | 57 | 20 | 60.1 |
| 3 | Nowosądecki | 557 647 | 11 153 | 55 | 13 | 81.0 |
| 4 | Radomski | 729 420 | 44 495 | 63 | 10 | 75.6 |
| 5 | Skierniewicki | 395 981 | 17 028 | 44 | 15 | 61.4 |
| 6 | Siedlecki | 849 937 | 7 649 | 74 | 19 | 64.7 |
| 7 | Tarnobrzesci | 628 283 | 13 194 | 53 | 17 | 72.1 |
| Overall | | 4 219 254 | 124 658 | 404 | 109 | 70.6 |

Table 3. Fruit-growing communes occurring on areas with excessive contamination [1]

| No. | Fruit growing communes with above-level of environmental pollution | Fruit growing region | Group | Area of commune, ha | Area of orchard, ha |
|---------|--------------------------------------------------------------------------|-------------------------|-------|------------------------|---------------------|
| 1 | Sochaczew | Skierniewicki | C | 2 613 | 162 |
| 2 | Nowa Sucha | | C | 9 034 | 407 |
| 3 | Biała Rawska | | C | 20 841 | 2584 |
| 4 | Nieborów | | C | 10 329 | 506 |
| 5 | Dwikozy | Tarnobrzesci | C | 8 580 | 429 |
| 6 | Łonów | | C | 8 699 | 244 |
| 7 | Polaniec (miasto i gmina) | | C | 7 492 | 172 |
| 8 | Michałowice | Warszawski | C | 3 488 | 206 |
| 9 | Konstancin Jeziorna | | C | 7 828 | 517 |
| 10 | Grodzisk Mazowiecki | | C | 10 703 | 557 |
| 11 | Kazimierz Dolny | Lubelski | C | 7249 | 384 |
| 12 | Świdnik | | C | 2035 | 92 |
| Overall | | | | 98 891 | 6 260 |

Table 4. Intensity of anthropogenic changes on the area of fruit-growing communes occurring on areas with excessive contaminations

| No. | Communes | Environmental component | | | | |
|-----|---------------------|-------------------------|---------------|-------------------|------|-------|
| | | air | surface water | underground water | soil | noise |
| 1 | Nieborów | bd | 2 | 1 | 1 | bd |
| 2 | Biała Rawska | 1 | 1 | 1 | 1 | 1 |
| 3 | Sochaczew | bd | 2 | 0 | 1 | bd |
| 4 | Nowa Sucha | bd | 2 | 1 | 0 | bd |
| 5 | Dwikozy | bd | 2 | 1 | 0 | 1 |
| 6 | Łonów | 1 | 1 | 2 | 0 | 0 |
| 7 | Polaniec | 0 | 1 | 2 | 1 | 1 |
| 8 | Michałowice | 0 | 2 | 1 | bd | 1 |
| 9 | Konstancin Jeziorna | 0 | 2 | bd | bd | 1 |
| 10 | Grodzisk Mazowiecki | 0 | 2 | 1 | bd | 1 |
| 11 | Kazimierz Dolny | 1 | 1 | 0 | 0 | 1 |
| 12 | Świdnik | 0 | 0 | 1 | 1 | 1 |

where:

bd. – no data;

0 – no excessive values, or sporadically insignificantly excessive values,

1 – there occur long-lasting excessive values of permissible level with average range and intensity,

2 – there occur continuous excessive values of permissible level with high range and intensity.

From the total 109 fruit-growing communes being included in 7 main orchard regions, only 12 communes were found within the borders of excessive contaminations counted to groups C and D ([table 3](#), [map 2](#)). In the 12 mentioned communes covering totally 98 891 ha, orchards occupy an area of 6 260 ha making 5% of the total area of orchards in 7 orchard regions, or 2.2 % of the total orchard area in Poland. On these areas, the greatest contaminations occur primarily in surface and underground waters, less frequently in the air and soil ([table 4](#)).

Effect of plants particularly harmful for fruit-growing regions

Excessive environmental pollution is usually connected with a close localization of industrial plants with a particularly high impact on natural environment. It refers mainly to the emissions of dusts and gases to the atmosphere.

In 1990, in the all-Polish daily paper “Rzeczpospolita”, thanks to the effort of the State Inspectorate of Environmental Protection, the so called “National List 80” was published for the first time. It included 80 industrial plants particularly harmful for natural environment. Following the example of the mentioned list, some time later, work was started on the preparation of “Provincial Lists 80”. Until 2001, from the “National List 80”, several tens of industrial plants were eliminated. On the 30th of August 2001, the list included 47 plants. On the provincial lists, in 2000, there were still 441 plants (www.pios.gov.pl).

The localization of harmful industrial plants on the area of fruit-growing regions, or in a distance not exceeding 30 km from their borders is shown in [map 2](#), and they are listed in [tables 5](#) and [6](#). The list contains 5 industrial plants from the “National List 80” and 17 plants from “Provincial Lists 80”.

Table 5. Extract from the national list of industrial plants exerting particularly harmful effect on the main fruit-growing regions of Poland. State on the 30.08.2001 (www.pios.gov.pl)

| No. on map 2 | Name of plant | Localization | |
|--------------|-----------------------------------------|---------------------|-----------------|
| | | city | former province |
| 1 | Zakłady Przemysłu Barwników “Boruta SA” | Zgierz | łódzkie |
| 2 | Zakłady Włókien Chemicznych | Tomaszów Mazowiecki | piotrkowskie |
| 3 | Elektrociepłownia “Siekierki” | Warszawa | warszawskie |
| 4 | Kopalnia siarki “Machów” | Tarnobrzeg | tarnobrzeskie |
| 5 | Elektrownia im. T. Kościuszki S.A. | Połaniec | rzeszowskie |

Table 6. Extract from provincial lists of industrial plants exerting particularly harmful effect on the main fruit-growing regions of Poland [8, 9,10, 11, 12, 13]

| No. on map 2 | Name of plant | Localization | |
|--------------|--------------------------------------------------------|--------------------|-----------------|
| | | city | former province |
| 1 | Zakłady Azotowe “Puławy” S.A. | Puławy | lubelskie |
| 2 | Cementownia “Chełm” S.A. | Chełm | lubelskie |
| 3 | Elektrociepłownia “Lublin-Wrotków” Sp. z o.o | Lublin | lubelskie |
| 4 | Elektrociepłownia “GIGA” Sp. z o.o. | Świdnik | lubelskie |
| 5 | Ciepłownia w Dęblinie | Dęblin | lubelskie |
| 6 | Energetyka Ciepła Sp. z o.o. | Skierniewice | łódzkie |
| 7 | Przedsiębiorstwo Energetyki Ciepłej | Kutno | łódzkie |
| 8 | Zakład Przetwórstwa Hutniczego “Stalprodukt” | Bochnia | małopolskie |
| 9 | Przedsiębiorstwo Gospodarki Komunalnej | Muszyna | małopolskie |
| 10 | Zakład Gospodarki Komunalnej i Mieszkaniowej | Nowy Targ | małopolskie |
| 11 | Huta “Ostrowiec” | Ostr.Świętokrzyski | świętokrzyskie |
| 12 | Przedsiębiorstwo Gospodarki Komunalnej i Mieszkaniowej | Opatów | świętokrzyskie |
| 13 | Huta Lucchini Sp. z o.o. | Warszawa | mazowieckie |
| 14 | “Ursus-Media” Sp. z o.o. | Warszawa | mazowieckie |
| 15 | Zespół Elektrociepłowni w Łodzi S.A. | Łódź | łódzkie |
| 16 | “Energetyka - Boruta” Sp. z. o.o. | Zgierz | łódzkie |
| 17 | Ciepłownia “Ustronna” | Łódź | łódzkie |

In the fruit-growing region of Tarnobrzeg, or in its immediate neighborhood, there are 2 particularly harmful plants of national rank. The above plants have a diversified effect on the quality of orchard production. For example the sulphur mine “Miechów” (object No 4 in [table 5](#)) causes pollution of surface and underground waters, while the power plant in Połaniec in the same region (object No 5 in [table 5](#)) and the power plant in

Siekierki in Warsaw region, because of the combustion of mineral fuels, have a high emission of gases and dusts. On the area of the most important fruit-growing region of Radom, there are no particularly harmful industrial plants.

DISCUSSION

The decreased range of excessively contaminated areas distinctly minimizes the risk of fruits originating from polluted areas and containing excessive contents of harmful chemical compounds. In the regions of Radom and Siedlce, where about 1/3 of the total amount of apples is produced in the scale of the country, there are no endangered areas.

In the number of 404 communes that are included in 7 fruit-growing regions, 51 (12%) are counted to groups C and D. Only 12 of them occur within the fruit-growing communes. Their total area covering 98 891 ha makes only 2,3% of the total area of all fruit-growing regions, and the area of all orchards localized on that terrain (6 260 ha) makes 5% of the total orchard area in the regions ([table 3](#)).

The selected fruit-growing communes with excessive pollution can be regarded as areas with potential risk of producing fruits with excessive content of contaminants. Nevertheless they all have been counted to group C ([table 3](#)). They are areas where the insufficient number of monitoring data does not permit to define precisely the borders of the harmful effects of industry. The phenomenon of carrying over of gas contaminations to significant distances should be also taken into consideration. The greatest anthropogenic transformations refer primarily to surface and underground waters. The contaminations present in them affect in a minor degree the quality of orchard production.

Since 1990 progress has been recorded in the limitation of the contaminating emissions to the atmosphere. The mentioned processes in connection with the limited area of orchards on areas with excessive pollution minimize the risk of producing fruits in the main fruit-growing regions of the country with amounts of contaminants that could be harmful to the health of consumers.

CONCLUSIONS

1. In the period from 1984 to 1995, the area of terrains strongly contaminated was distinctly decreased.
2. Among 488 industrial plants from the national and provincial list of the particularly harmful ones, 19 (3.9%) are localized within fruit-growing regions or in their direct neighborhood.
3. In 1995, among 109 fruit-growing communes deciding about fruit production in 7 main fruit-growing regions, only 12 communes were found within the borders of areas with excessive contamination.
4. A small part of the total area of orchards occurring on terrains with excessive contamination minimizes the risk of producing fruits with excessive content of contaminants.

REFERENCES

1. GIOŚ, 1995. Klasyfikacja gmin pod względem występowania zagrożeń środowiska. Weryfikacja obszarów ekologicznego zagrożenia [Classification of communes regarding environmental endangerment]. Warszawa [in Polish].
2. GUS, 1998. Gminy w Polsce w 1996 roku [Communes in Poland]. Warszawa [in Polish].
3. GUS, 1984. Obszary ekologicznego zagrożenia w Polsce [Areas of Ecological Endangerment in Poland]. Warszawa [in Polish].
4. PIOŚ, 1995. Instrukcja klasyfikacji gmin pod względem występowania zagrożeń środowiska [Instruction of commune's classification regarding environmental endangerment]. Warszawa [in Polish].
5. Iwaniszyniec P., 2000. Zanieczyszczenie środowiska naturalnego w głównych rejonach sadowniczych Polski [Pollution of environment in the main fruit growing regions in Poland]. Roczniki AR w Poznaniu. Ogrodnictwo. Część II. CCCXXIII. 31, 81-86 [in Polish].
6. Lista zakładów najbardziej uciążliwa dla środowiska w skali kraju (stan na 30.08.2001 r.) [The national list of industrial plants exerting particularly harmful effect on environment]. GIOŚ. www.pios.gov.pl [in Polish]
7. Kassenberg A., Marek M. J., 1986. Ekologiczne aspekty przestrzennego zagospodarowania kraju [Ecological aspect of spatial management of country]. PWN. Warszawa [in Polish].
8. WIOŚ, 1999. Raport o stanie środowiska na obszarze województwa małopolskiego [The state of the environment in małopolska voivodship]. BMŚ. Kraków [in Polish].
9. WIOŚ, 2000a. Stan środowiska w województwie podkarpackim [The state of the environment in podkarpackie voivodship]. Rzeszów [in Polish].
10. WIOŚ, 2000b. Raport o stanie środowiska w województwie łódzkim [The state of the environment in łódzkie voivodship]. BMŚ. Łódź [in Polish].
11. WIOŚ, 2001a. Stan środowiska w województwie mazowieckim [The state of the environment in mazowieckie voivodship]. BMŚ. Warszawa [in Polish].
12. WIOŚ, 2001b. Stan środowiska w województwie świętokrzyskim w roku 2000 [The state of the environment in świętokrzyskie voivodship. BMŚ. Kielce [in Polish].
13. WIOŚ, 2001c. Stan środowiska w województwie lubelskim [The state of the environment in lubelskie voivodship]. BMŚ. Lublin [in Polish].

Piotr Iwaniszyniec
Department of Environmental Protection and Management
Agricultural University of Poznań
159 Dąbrowskiego Street, 60-594 Poznań, Poland
tel (+48 61) 848-79-09
e-mail: piotriw@au.poznan.pl

[Responses](#) to this article, comments are invited and should be submitted within three months of the publication of the article. If accepted for publication, they will be published in the chapter headed 'Discussions' in each series and hyperlinked to the article.

[\[BACK\]](#) [\[MAIN\]](#) [\[HOW TO SUBMIT\]](#) [\[SUBSCRIPTION\]](#) [\[ISSUES\]](#) [\[SEARCH\]](#)
