



המשרד להגנת הסביבה



الوزارة لحماية البيئة
Israel Ministry of Environmental Protection

Examining the correlation between air emissions and a socioeconomic index

Ministry of Environmental Protection

EcoTraders Ltd

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Introduction

Daily human activities cause emissions of pollutants into the air, such as transportation, industrial activity, electricity generation, etc. These emissions have negative effects on human health and the environment, causing financial costs, which are not considered when performing the operation. Since these costs are not imposed on the operator of the activity but constitute a financial burden on the public, they are called "external costs". The external costs vary from polluter to polluter and depend on the source of the emission: mobile, stationary, marine, etc. The external costs in this work are used as a means of representing the emissions into the air, since it is not possible to add up the quantities of emissions of different pollutants to each other, but the external costs resulting from their emissions can be added up in currency terms.

The socio-economic index is a tool developed by the Central Bureau of Statistics (CBS) as an index to characterize the local authorities in Israel according to the socio-economic level of their population. This index helps to identify areas of prosperity and areas of distress and may help to improve the policies of the central government towards the local authorities. The index is calculated based on demographic data, standard of living, education and training, employment, unemployment, and pensions. The authorities are classified according to ten clusters where cluster 1 indicates the lowest socio-economic level and cluster 10 indicates the highest socio-economic level. The index updated based on the population census data, which is carried out every few years.

The purpose of this work is to examine the relationship between the level of air emissions in a local authority¹, and its socio-economic index. The level of emissions into the air is expressed by the external cost of emissions in New

¹ [Inventory of pollutant emissions into the air for 2018, Ministry of Environmental Protection.](#)

Israeli shekels (NIS)². This relationship is examined for the following types of emissions:

1. Industry and electricity generation.
2. Animal breeding - barns, chicken coops, flats and piggeries.
3. Burning of vegetal agricultural waste (some of it is permitted and most of it is illegal) and burning wood for home heating.
4. Burning of mixed municipal waste – illegal activity.
5. Landfills and WWTP.

Emissions into the air from transportation are not included in this work since no connection is expected between the location of emissions from transportation and the socio-economic index, but rather the peripheral index.

Since the local authorities in Israel are divided into three types, the relationship between emissions and the socio-economic index will be examined separately for each municipal status (municipality, local council and regional council). This assumes that the characteristics of the municipal class influence the correlation.

Clarifications:

1. The emissions in this report do not include greenhouse gases, since their effect is not local.
2. This report refers to the location of the emission into the air and not to the dispersion of the pollutants in the air or to the population exposed to the pollutants.
3. The external costs for the pollutants that were used are presented in Appendix 1. The classification of the emission sources in the emissions

² [External costs of air emissions from all sources in Israel, Ministry of Environmental Protection 2021](#)(Heb. Only)

inventory, for the purpose of calculating the external costs, is detailed in Appendix 2.

4. In this work we used the socio-economic index data published by the CBS for 2015. Since the index is published at the settlement level, to create an index at the level of the local authority, a weighted average of the indicators of the settlements in each local authority was calculated, based on the size of the population in each settlement.

Study Findings

This work is not intended to define the reason for the connection between the level of emissions into the air and the socio-economic index, but to examine whether such a connection exists. The conclusions below offer a possible explanation for the results, but to confirm them, a follow-up study must be carried out to test the causal relationship.

Looking at the distribution of emissions according to socio-economic index in all local authorities, most emissions are found in municipalities with socio-economic index 6. In fact, this is 47% of all emissions into the air included in this work. However, a major influencing factor on this distribution is the two coal-fired power plants - Orot Rabin in Hadera with an external cost of approximately NIS 2.5 billion, and Rotenberg in Ashkelon with an external cost of NIS 753 million. The socio-economic index of Hadera and Ashkelon is 6 and 5 respectively. Therefore, in order not to deviate the data of the clusters in which the stations are located, the coal stations were removed from the data in the rest of this work.

Chart 1 - Total external cost in all types of local authorities by emission source and socio-economic index, (millions of NIS/year)

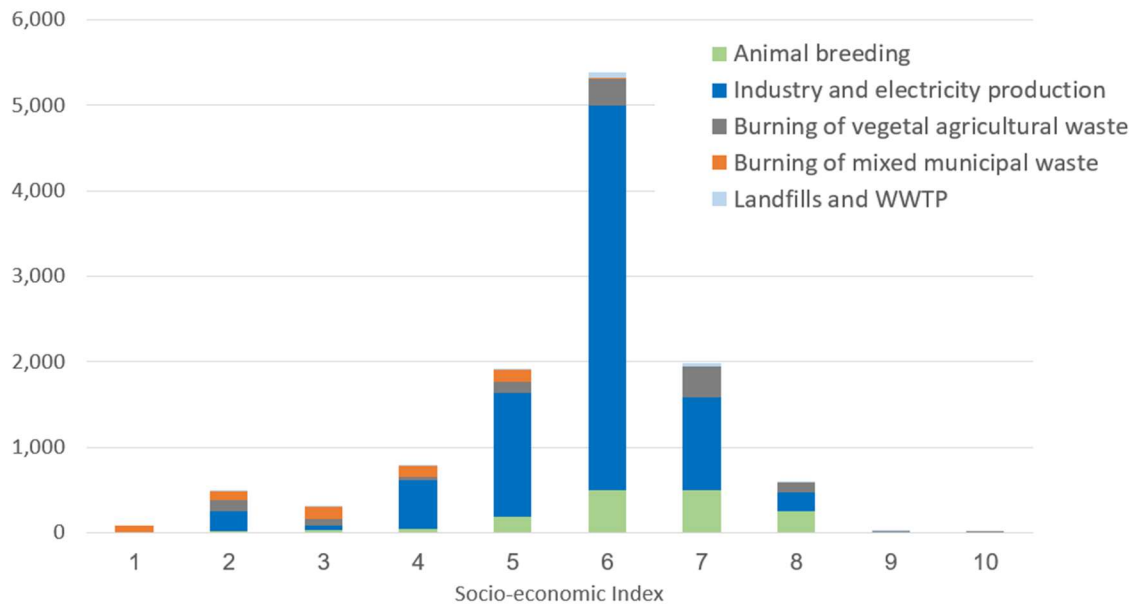


Chart 2 - Total external cost in all types of local authorities by emission source and socio-economic index, excluding coal power plants (millions of NIS/year)

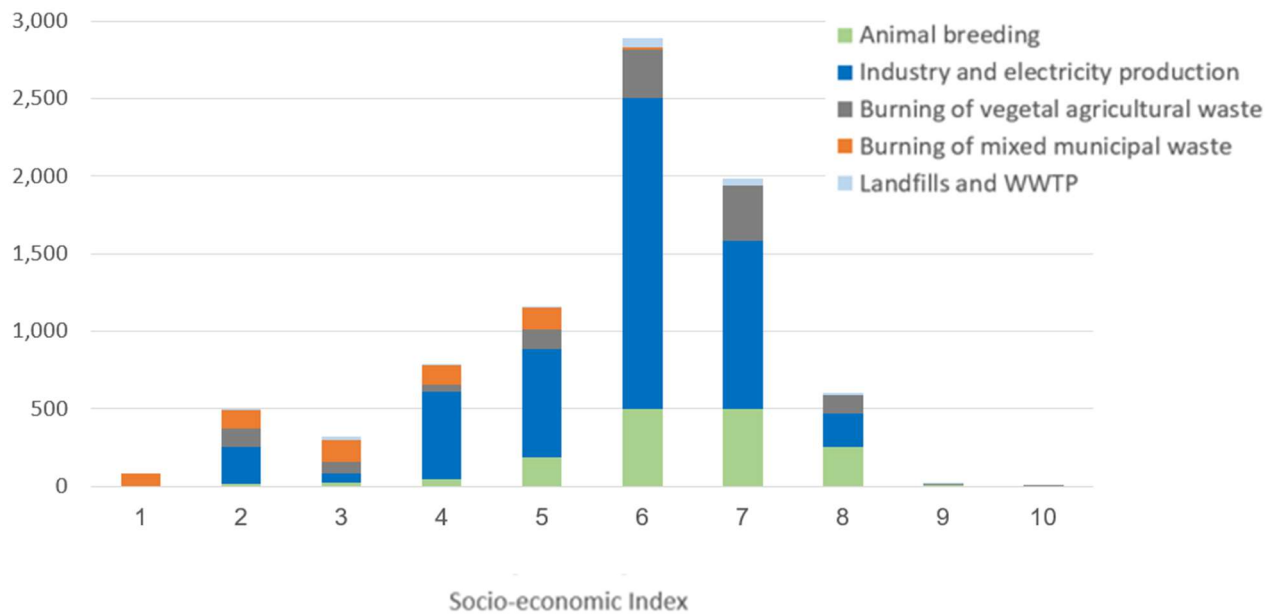


Chart 3 - Average external costs in all types of local authorities by emission source and socio-economic index (millions of NIS/year)

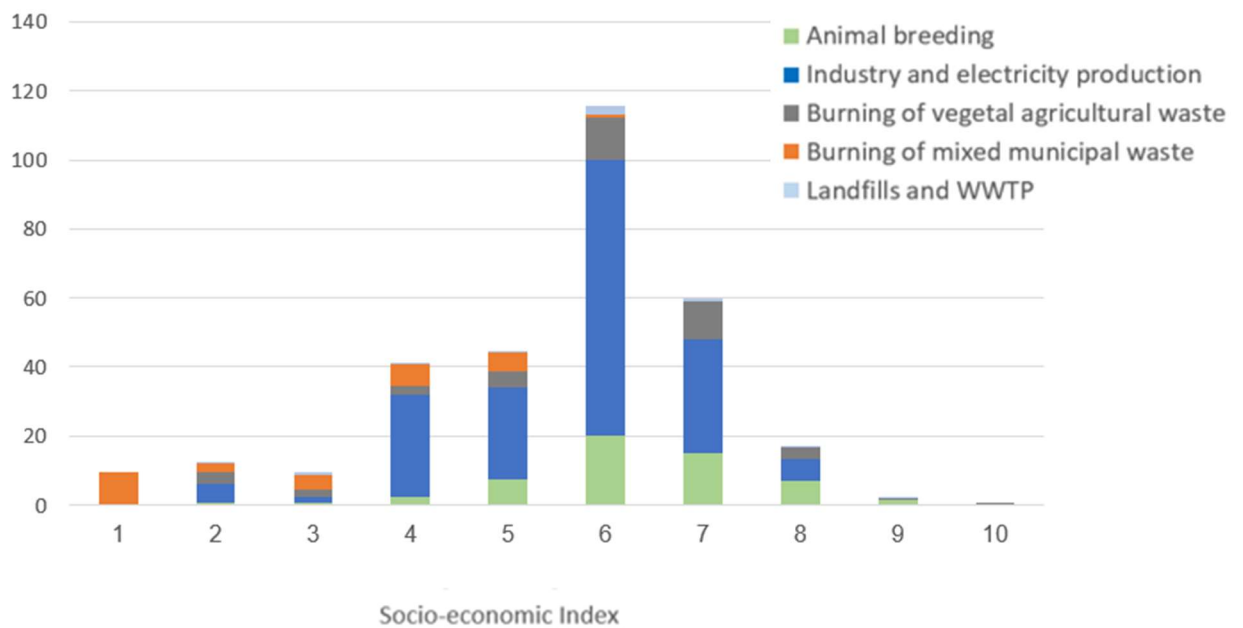
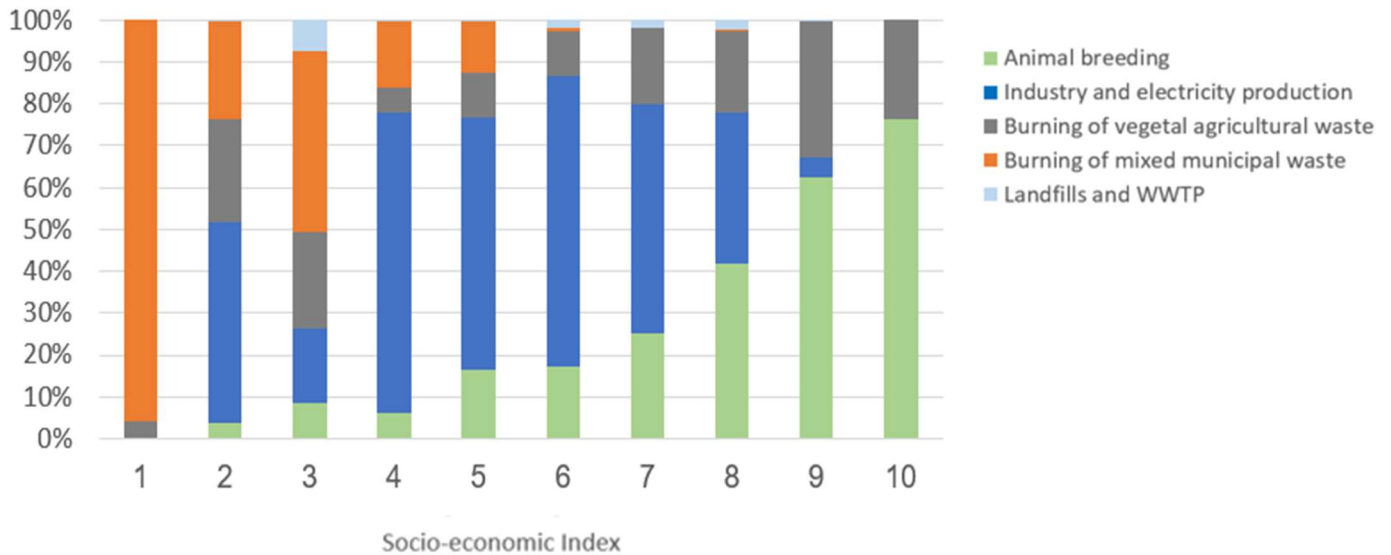


Chart 4 - Percentage of external cost in all types of local authorities by emission source and socio-economic index



However, since there are significant variations in the characteristics of the types of local authorities such as area and population, the findings must be examined separately according to the types of authorities - regional councils, municipalities, local councils, as detailed below.

Regional Councils

A regional council in Israel is a form of local government that unites, from a municipal point of view, several rural or community settlements in a certain geographical area. The area of a regional council includes the settlements within its area and the area between them. The area does not include urban settlements with their own local authority.

Chart 5 - Average external costs in regional councils by emission source and socio-economic index (millions of NIS/year)

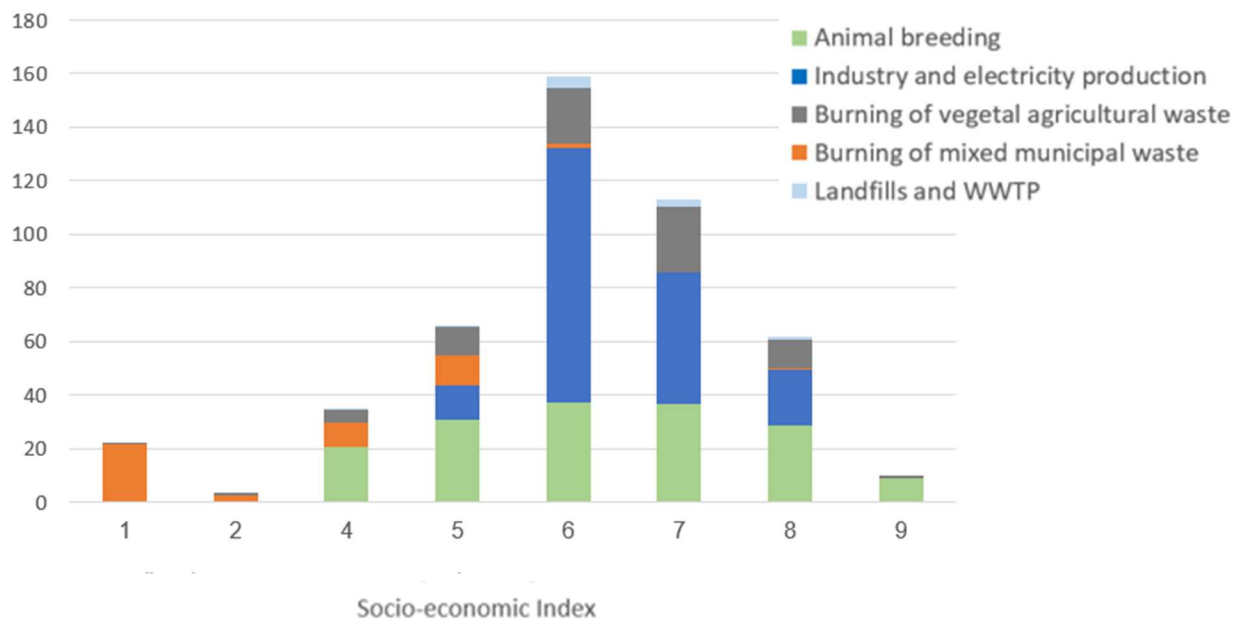


Chart 6 - Total external cost in regional councils by emission source and socio-economic index, (millions of NIS/year)

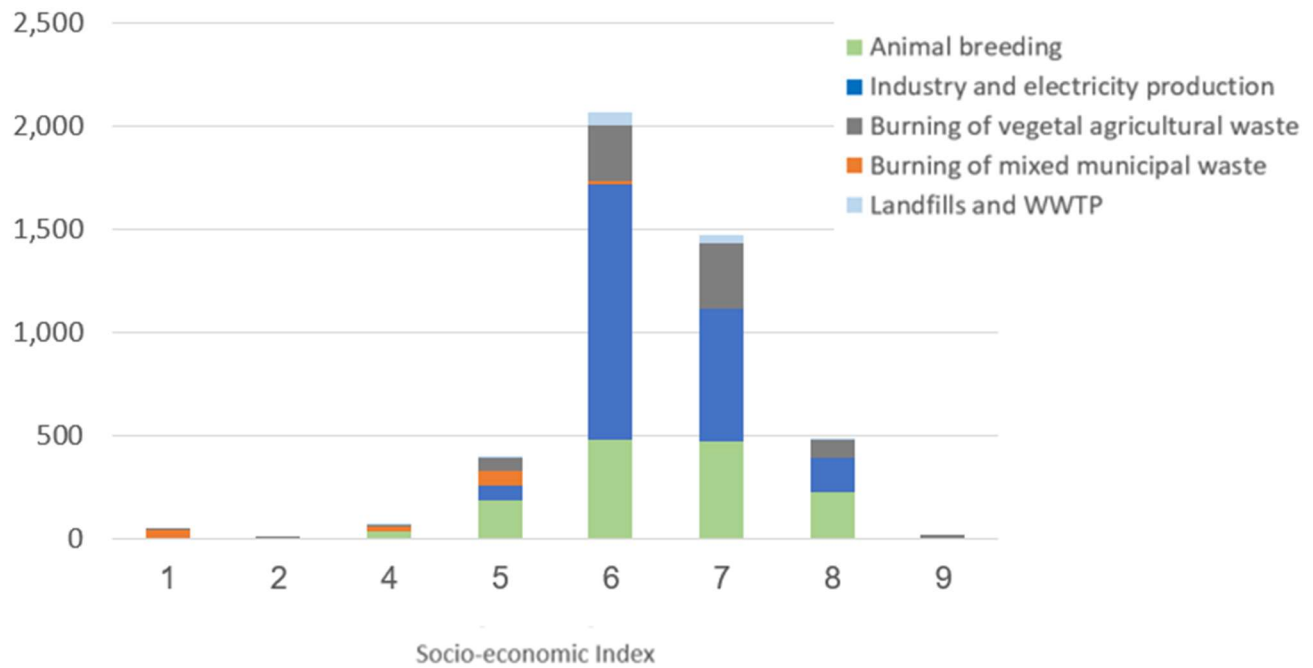
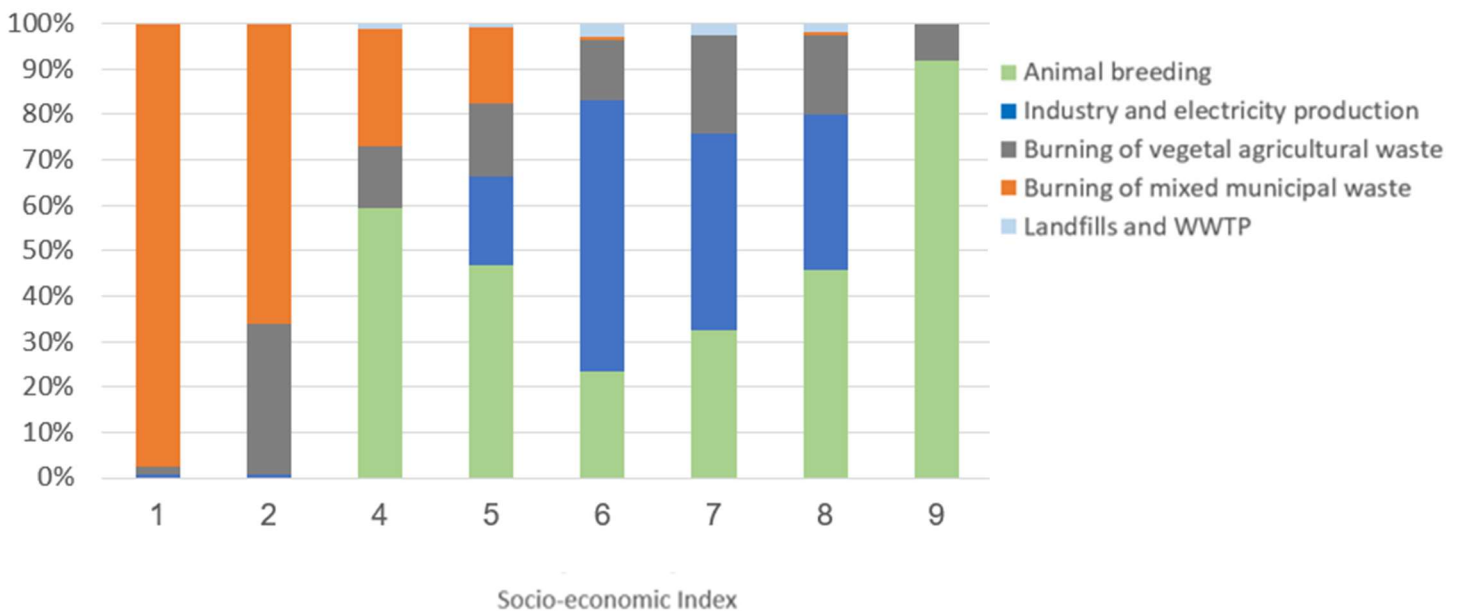


Chart 7 - Percentage of external cost in regional councils by emission source and socio-economic index



Only 0.78 million people live in regional councils. 58% of them live in the municipalities in index 6 and 7 where the level of emissions is the highest.

As expected, in the areas of regional councils the level of emissions is higher than in municipalities and local councils. An explanation for this is that the area of regional councils is extensive, therefore these councils have extensive industrial and agricultural activity.

In regional councils, the high level of emissions exists in index 6 and 7. Most of the emissions come from industry and electricity generation, about a third comes from animal agriculture and about 15% comes from burning plant waste. As mentioned, this situation is explained by the extensive territory of the regional councils and the great economic activity in them.

The level of emissions in the regional councils in socio-economic index 1 to 4 is relatively low. An explanation for this may be the lack of employment areas, which is the cause, on the one hand of a lack of jobs and a low socio-economic index, and on the other hand, of the lack of emission sources. Most of the emissions that do occur in these regional councils are due to the illegal burning of municipal waste and animal agriculture. We note in this context that all the regional councils in clusters 1 and 2 include an Arab or Druze population.

The level of emissions in regional councils in socio-economic index 9 is relatively low. A possible explanation is the high real estate value that pushes polluting activities away from these areas and encourages non-polluting uses. Also, the population living in these regional councils has financial capacity, which allows the residents to choose to live in a place far from emission sources, to prevent the establishment of new emission sources near the place of residence and to act to eliminate existing emission sources.

Municipalities

A municipality in Israel is a type of local government that applies to urban settlements with over 30,000 inhabitants.

Chart 8 - Average external costs in municipalities by emission source and socio-economic index (million NIS/year).

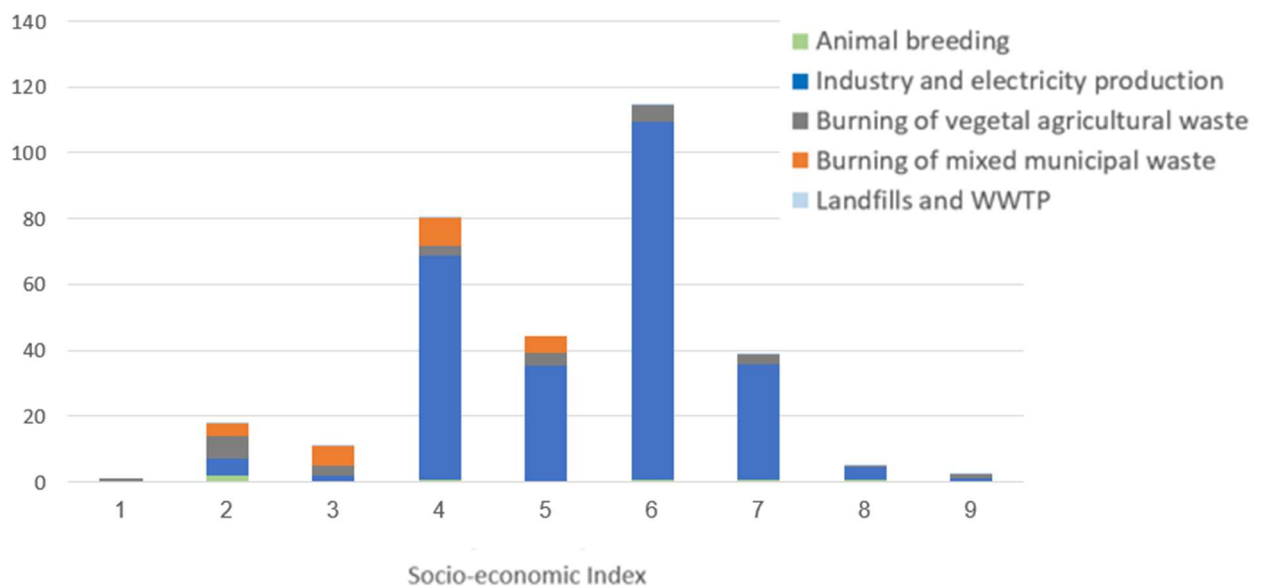


Chart 9 - Total external cost in municipalities by emission source and socio-economic index (million NIS/year)

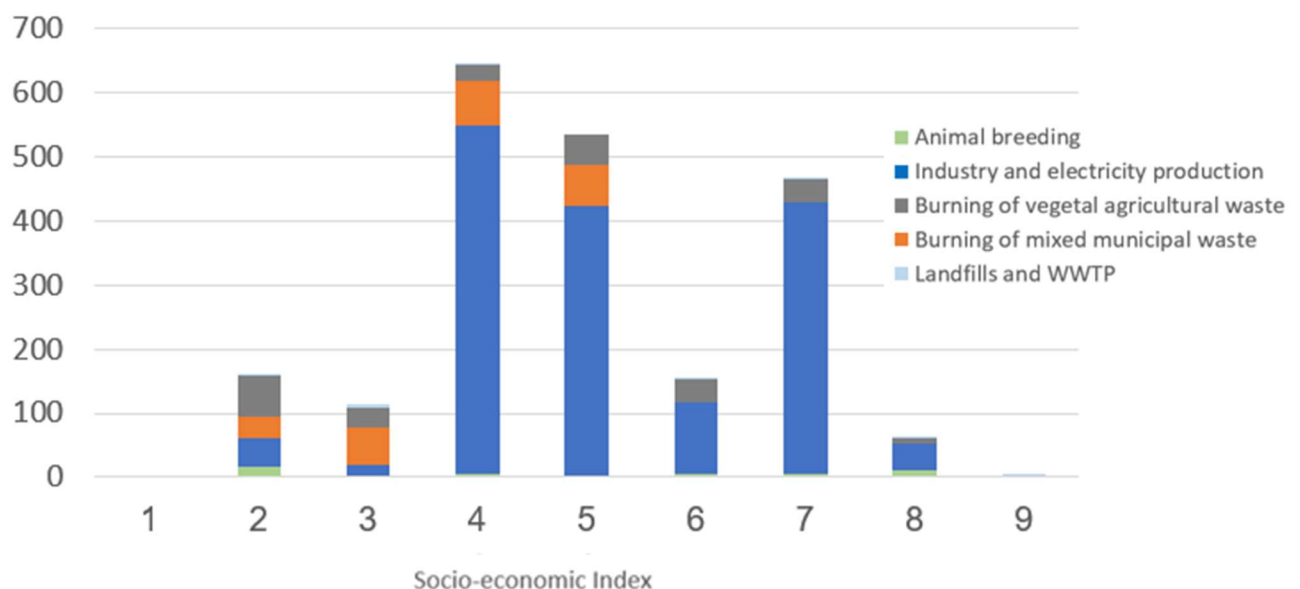
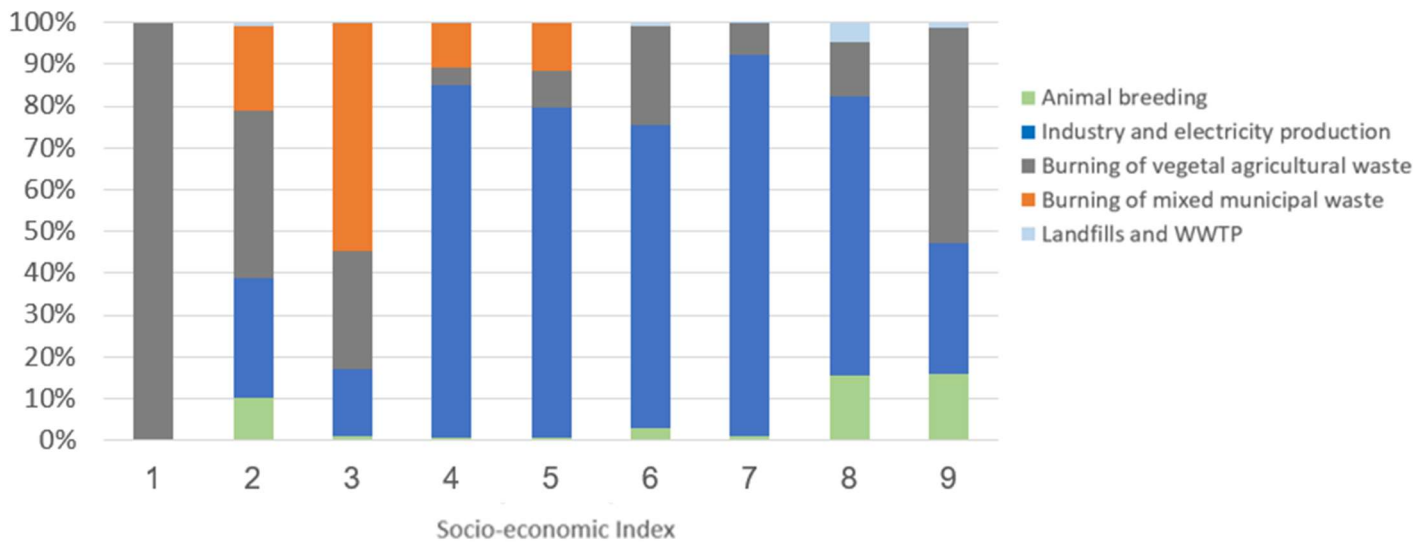


Chart 10 - Percentage of external cost in municipalities by emission source and socio-economic index



About 6.6 million people live in the municipalities. 50% of them are in municipalities with a socio-economic index of 4 to 7 where the level of emissions is high.

In the cities, the relatively high level of emissions occurs in index 4 to 7. A significant part of the emissions in these cities are from industry and electricity generation. A possible explanation for the relatively high level of emissions in the middle class is that this class determines its place of residence according to the employment opportunities on the one hand and cannot financially afford to distance itself from polluting areas on the other hand.

The emission level is relatively high in cities with a socio-economic index of 4 (8 cities in this group - Ramla, Dimona, Acre, Arad, Kiryat Gat, Migdal Haemek, Tiberias, Tira). These cities have old employment areas that include industry that raise these cities from the low indices on the one hand, but on the other hand are sources of emissions into the air.

The level of emissions in municipalities in socio-economic index 1 to 3 is low. As mentioned regarding regional councils, also in municipalities, an explanation

for this may be the lack of employment areas, a situation that causes a lack of jobs and a low socio-economic index, on the one hand, and the absence of emission sources, such as industry, on the other hand. A significant part of the emissions that do occur in these municipalities are illegal burning of municipal waste and burning of plant waste. Most of the municipalities in ratings 1 to 3 are inhabited by an Arab or Druze population.

The level of emissions in municipalities with a socio-economic index of 8 to 9 is relatively low, like this phenomenon in the regional councils. A possible explanation is the high value of real estate in the municipalities, which pushes polluting activities away from these areas and encourages non-polluting uses. Also, the population living within the boundaries of these cities has the option of choosing to live in a place far from emission sources, prevent the establishment of new emission sources near their residences, and act to eliminate the emission sources the existing ones.

Local Councils

A local council is the smallest unit of local government in Israel and includes settlements whose number of inhabitants is less than 30,000 people.

Chart 11 – Average external costs in local councils by emission source and socio-economic index (million NIS/year)

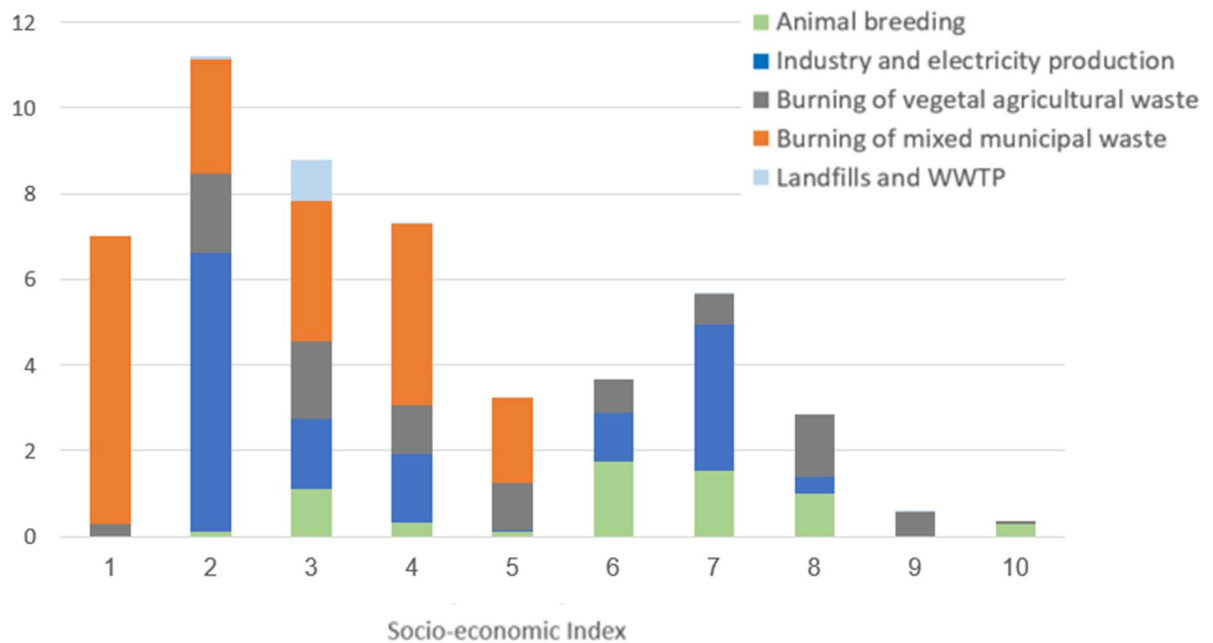


Chart 12 – Total external cost in local councils by emission source and socio-economic index (million NIS/year)

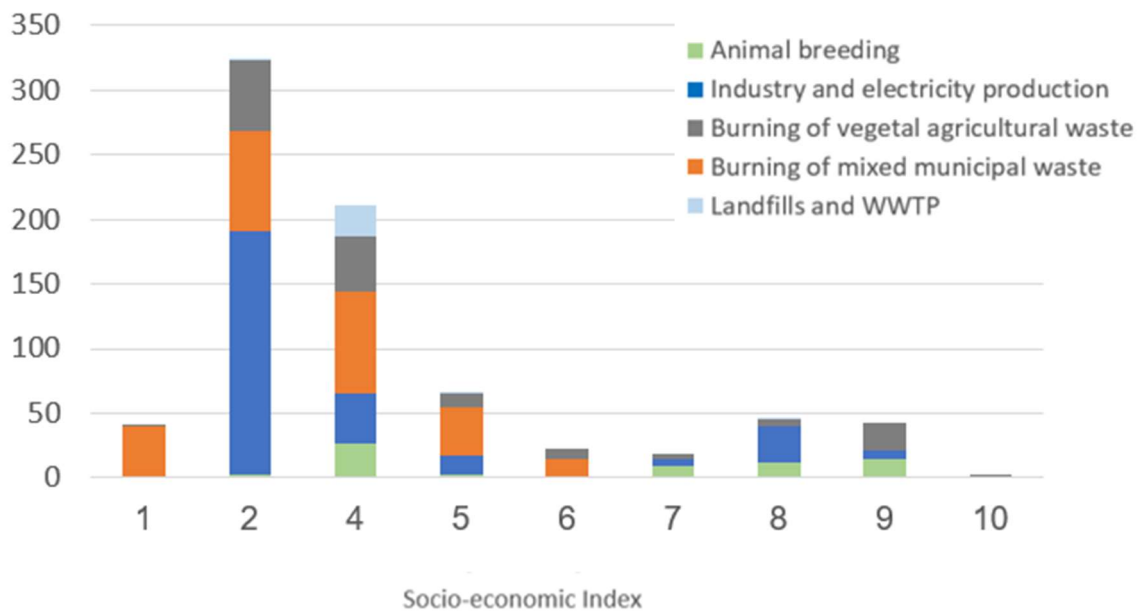
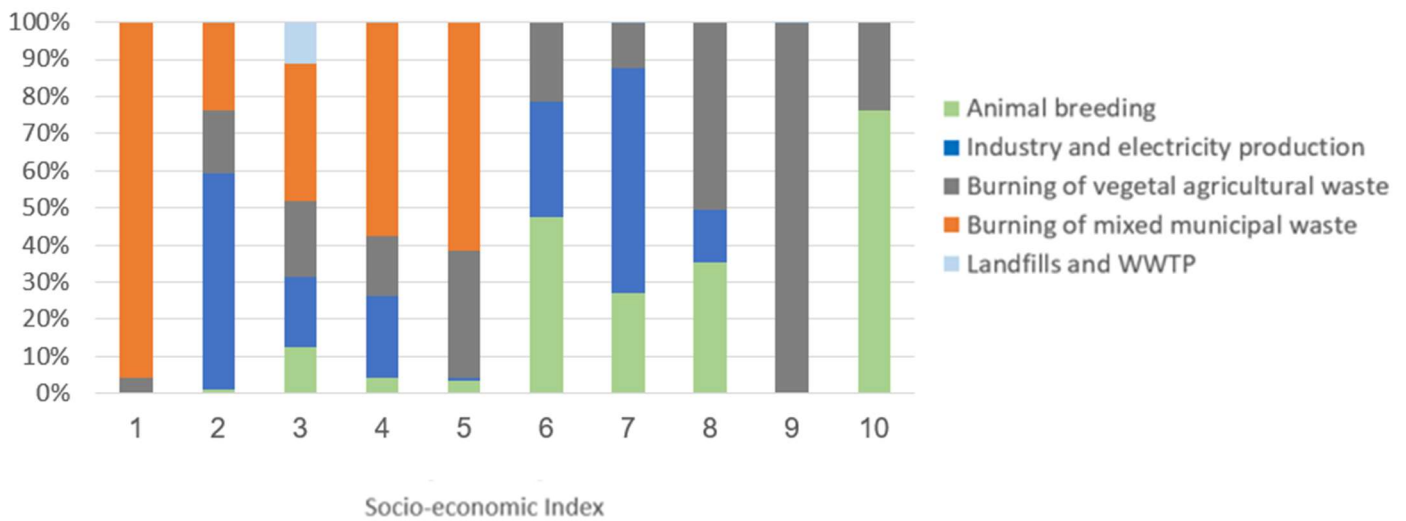


Chart 13 – Percentage of external cost in local councils by emission source and socio-economic index



1.2 million residents live in local councils. 63% of them live in councils with socio-economic index 1 to 4 where the level of emissions is high.

In local councils, the area is small, and the number of residents is small, therefore there is no potential for many emission sources and accordingly the level of emissions is relatively low.

Although the emission level in local councils is relatively low, it is evident that the lower the socio-economic index, the higher the emission level (index 1 to 4). The main cause of the high emissions in the lower clusters is the illegal burning of municipal waste. Most of the local councils in Index 1 to 4 have an Arab or Druze population.

Further information about local authorities in Israel

The research was done for the 227 local authorities in Israel that have a socio-economic index. Chart 14 shows the number of local authorities in each socio-economic index according to the type of authority. As shown in chart 14, regional councils tend to have a high socio-economic index, while local councils tend to have a low socio-economic index. The municipalities are relatively evenly distributed across the indices.

Chart 14: Number of local authorities by socio-economic index and type of authority

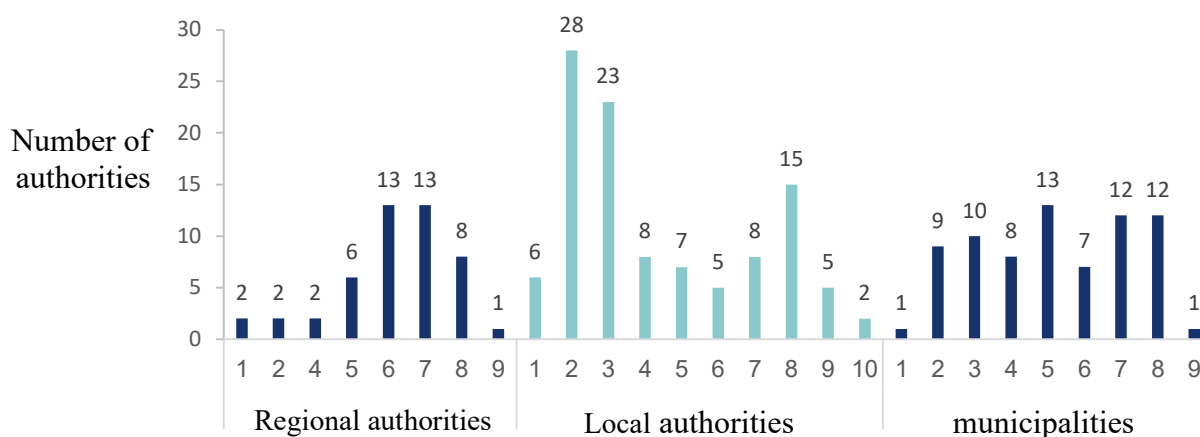
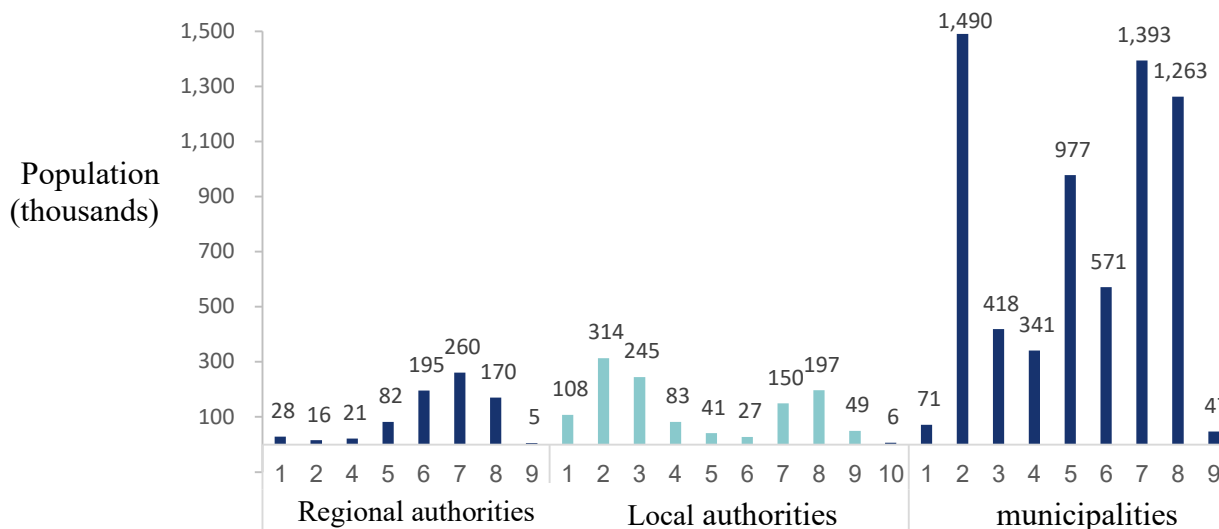


Chart 15: Population in local authorities by socio-economic index and type of authority



Appendix 1: External costs of the pollutants

Table 1 - External cost for the year 2019 in terms of NIS per ton of emissions

Stationary emission source (Under 100 m)	Stationary emission source (Above 100 m)	Pollutant
118,208	54,529	NO _x
85,381	39,259	SO _x
323	323	CO
103,803	47,812	NH ₃
151,738	77,010	PM ₁₀
270,760	124,536	PM _{2.5}
16,773	8,539	PM _{co}
7,217	7,217	NMVOC

Table 2 - External costs for the other pollutants (NIS per ton)

External cost	Pollutant
5,396	Benzene
88,698	Formaldehyde
13,794	1,3 - Butadiene
38,447	benzo a pyrene
3,473,728	As
116,353,040	Hg
448,549	Ni
19,931,782	Pb
3,912,160	Cd
88,698	CH ₂ O

Appendix 2: Classification of emission sources for external cost calculation

emission sources	Classification for external cost calculation
Industry	Stationary emission source - emission below or above 100 m (depending on the factory)
Electricity Generation	Stationary emission source - emission below or above 100 m (depending on the power plant)
WWTP	Stationary emission source - emission below 100 m
Landfills	
chicken coops	
dairy farms	
Flats and piggeries	
Open burning of municipal waste (mixed, agricultural, and vegetable waste)	
Burning wood for home heating	
Burning charcoal	
Residencial uses	
Forestry	
Gas stations	