جامعة القدس
Al-Quds University

Earth and Environment Department

Coal Making Study in Yabad

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A video about coal industry in Yabad

Location:


US Dept of State Geographer
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Image Landsat
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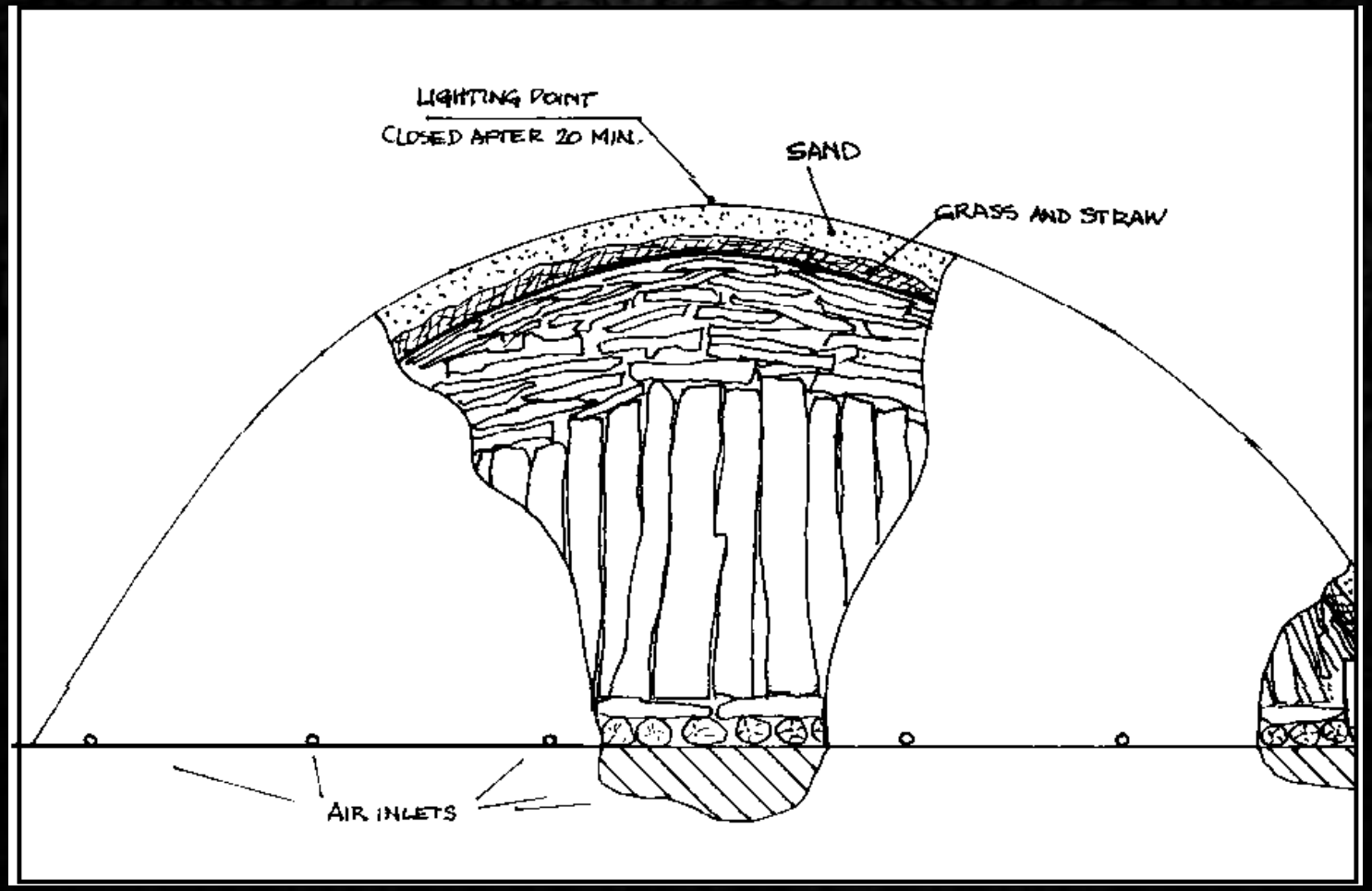
Coal Industry History

- Coal production is an old industry; it has been there for decades. Yabad is considered the capital of coal production in Palestine.
- This industry contributes to more than 30% of the town's income; it consigns the sole source of income for hundreds of families in Yabad and the surrounding villages knowing that there are more than 200 facilities in the village.

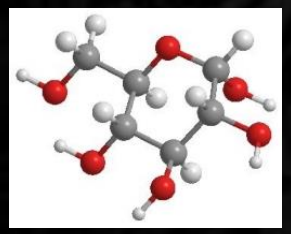
How to make Charcoal:

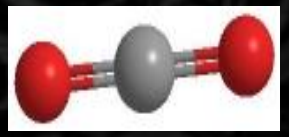
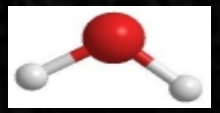


From wood to charcoal chemically:

- When burning, wood reacts with Oxygen, which is contained in air:

$$C_{42}H_{60}O_{28} + 22\ O_2 \longrightarrow 42\ CO + 30\ H_2O$$



What is charcoal?

Carbonization

$$2C_{42}H_{60}O_{28}$$

Wood (mixture of hemicellulose, cellulose, and lignin)

$$3C_{16}H_{10}O_2 + 28H_2O + 5CO_2 + 3CO + C_{28}H_{34}O_9$$

Biocarbon | water | carbon dioxide | carbon monoxide | pyrolysis tars

From wood to charcoal chemically:

As the wood is heated in the retort it passes through definite stages on its way to conversion into charcoal. The formation of charcoal under laboratory conditions has been studied and the following stages in the conversion process have been recognized.

First stage at 20 to 110°C

The wood absorbs heat as it is dried giving off its moisture as water vapour (steam). The temperature remains at or slightly above 100°C until the wood is bone dry.

Second stage at 110 to 270°C

Final traces of water are given off and the wood starts to decompose giving off some carbon monoxide, carbon dioxide, acetic acid and methanol. Heat is absorbed.

Third stage at 270 to 290°C

This is the point at which exothermic decomposition of the wood starts. Heat is evolved and breakdown continues spontaneously providing the wood is not cooled below this decomposition temperature. Mixed gases and vapours continue to be given off together with some tar.

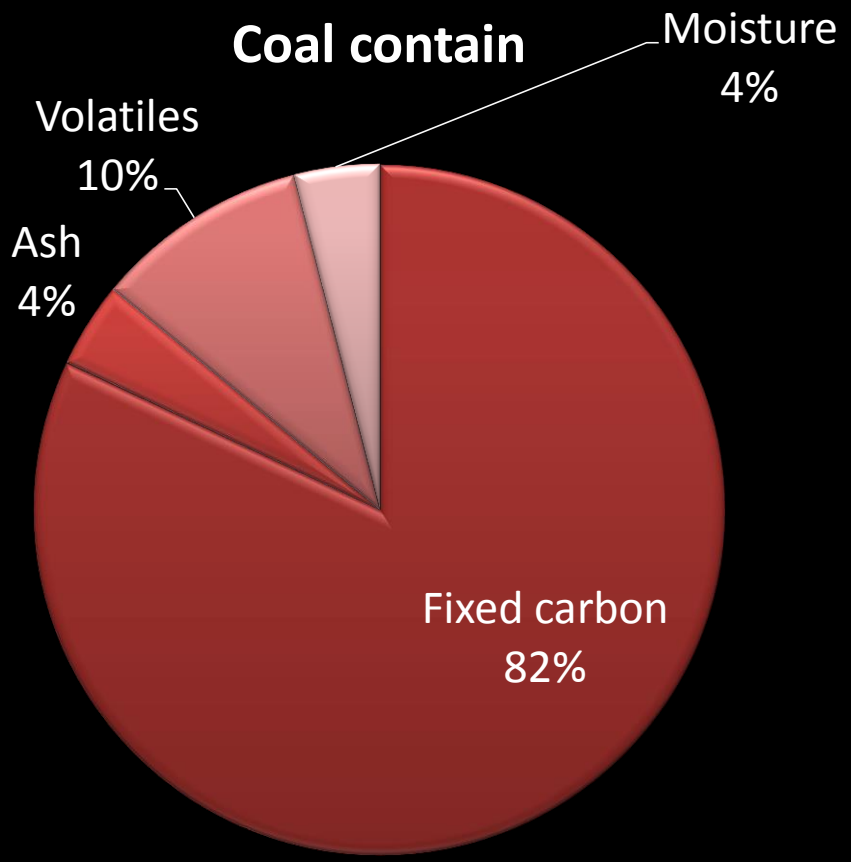
Fourth stage at 290 to 400°C

As breakdown of the wood structure continues, the vapours given off comprise the combustible gases carbon monoxide, hydrogen and methane together with carbon dioxide gas and the condensable vapours: water, acetic acid, methanol, acetone, etc. and tars which begin to predominate as the temperature rises.

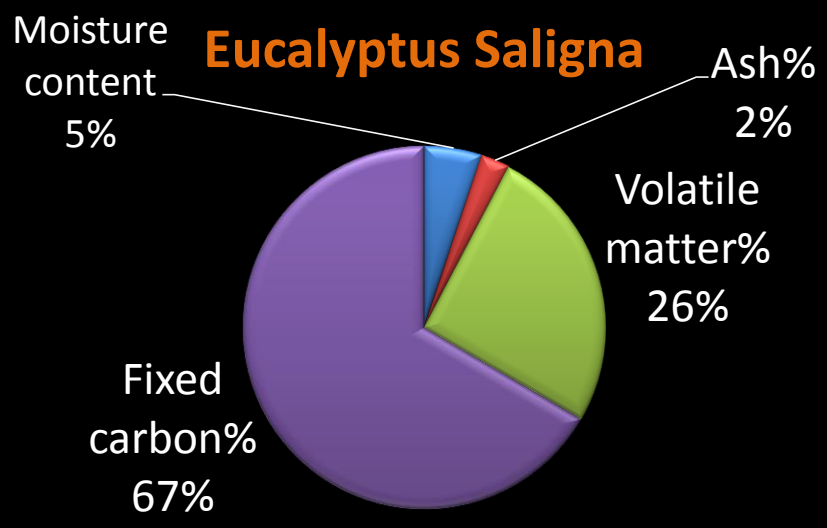
Fifth stage at 400 to 500°C

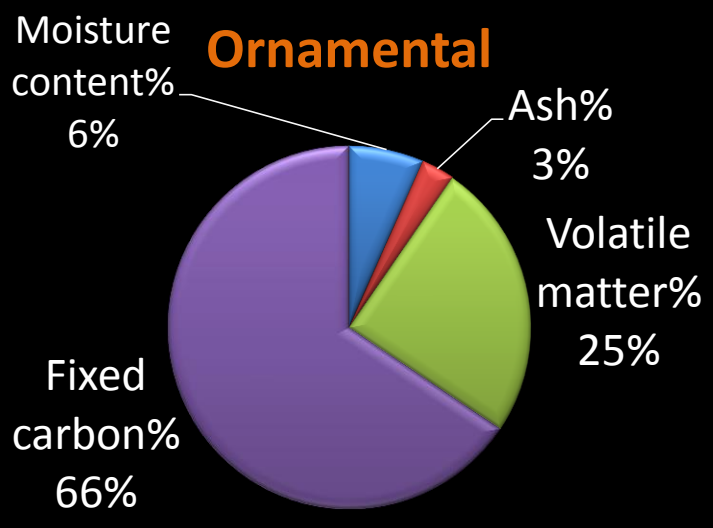
- At 400°C the transformation of the wood to charcoal is practically complete. The charcoal at this temperature still contains appreciable amounts of tar, perhaps 30% by weight trapped in the structure. This soft burned charcoal needs further heating to drive off more of the tar and thus raise the fixed carbon content of the charcoal to about 75% which is normal for good quality commercial charcoal.
- To drive off this tar the charcoal is subject to further heat inputs to raise its temperature to about 500°C, thus completing the carbonization stage.

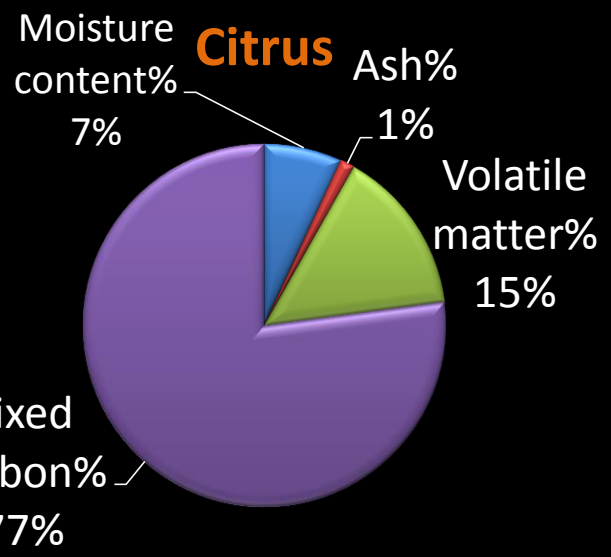
Coal Contain

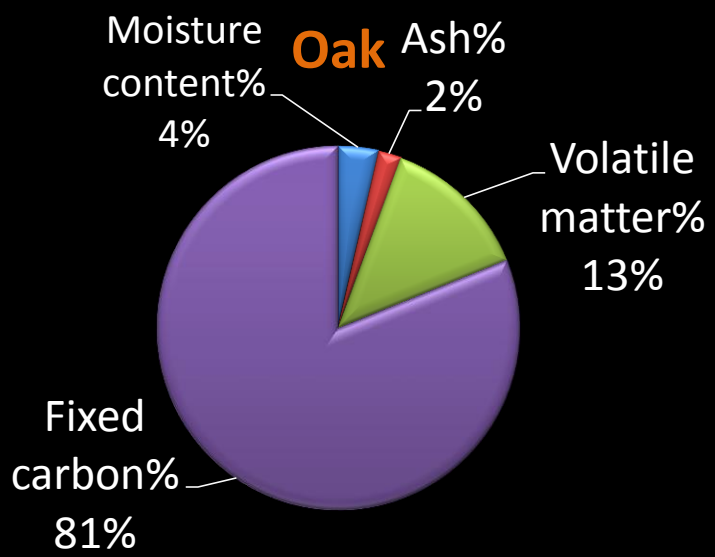


Charcoal efficiency

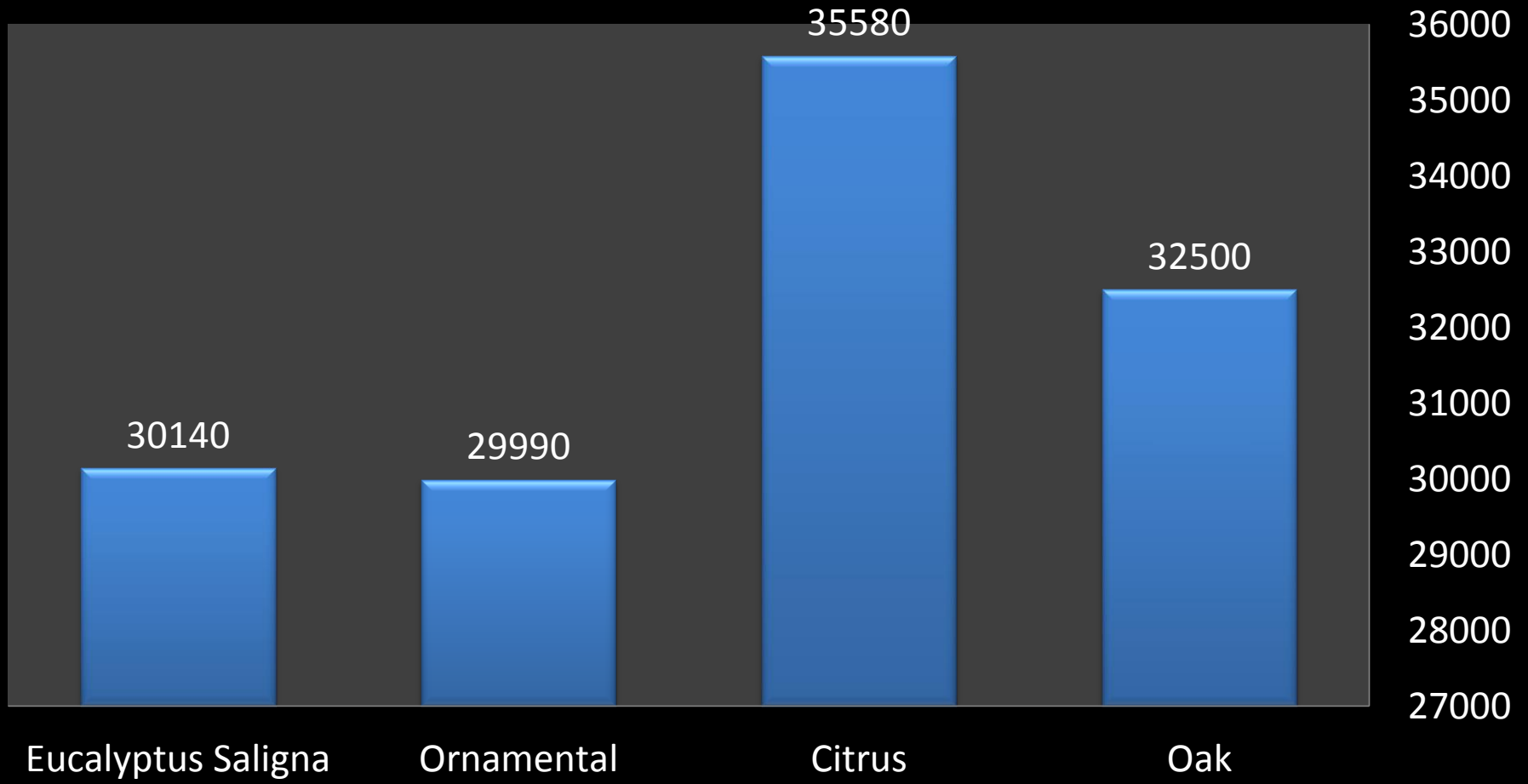








Charcoal efficiency (Gross calorific value kJ/kg Oven dry basis)



coal Releases to the Environment

- Charcoal releases higher levels of carbon monoxide and volatile organic compounds (VOCs) that contribute to the formation of smog – which harms not just the environment, but also human health.
- Specific organic compounds that may be found in charcoal kiln emissions include ethane, methane, ethanol, and polycyclic organic matter (POM). If uncombusted, tars may solidify to form PM emissions, and pyro acids may form aerosol emissions.

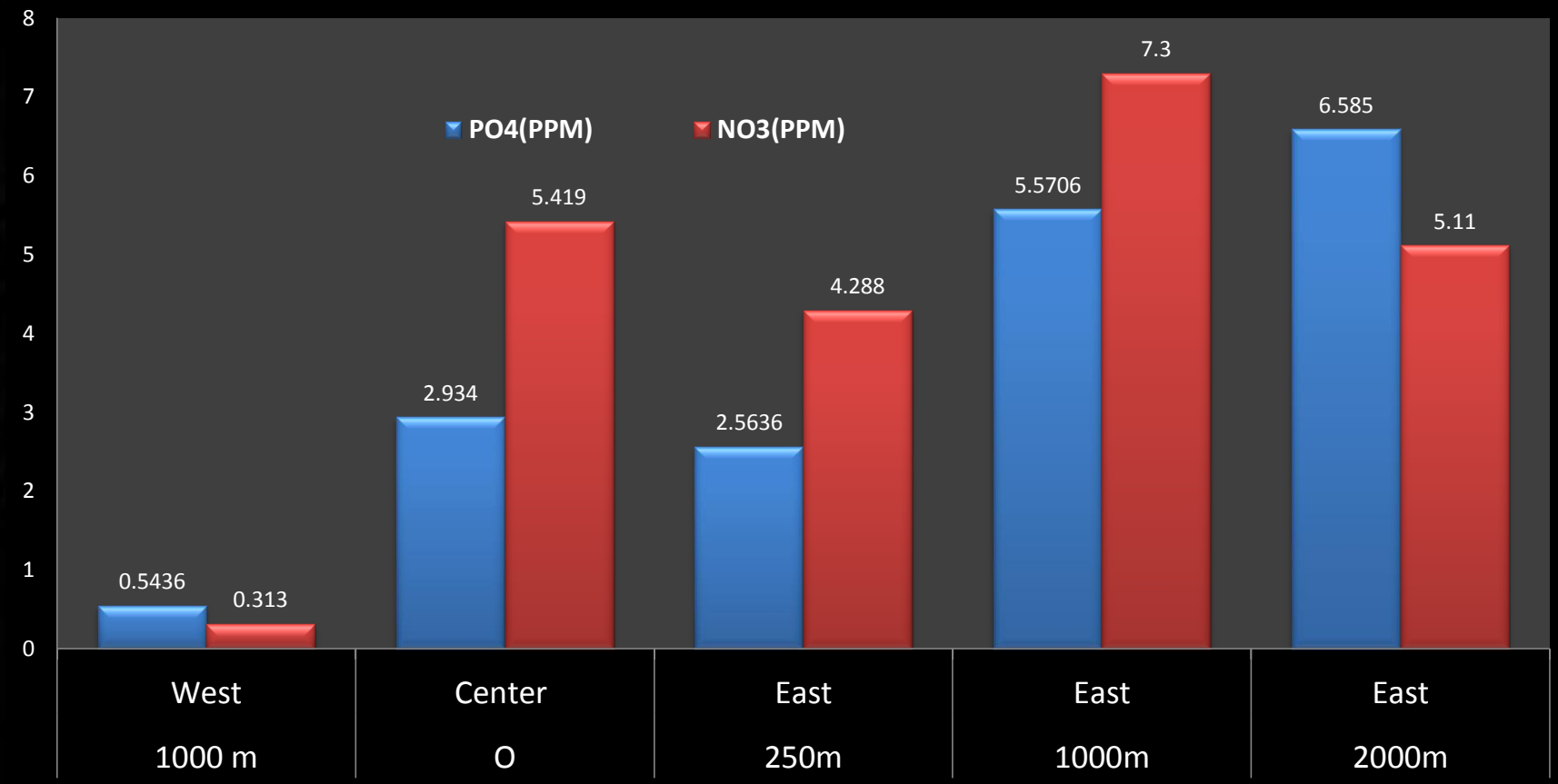
Contaminated environmental

Contaminated environmental	Amount (ton/Year)
Small particles	8760
Carbon monoxide	1314
Hydrocarbons.	438
Nitrogen oxides	8760
Sulfur oxides	1665

Soil analyses

type	Unit	Num1	Num2	Num3	Num4	Num5	Num6	Num8	Average
Distance	m	0	250	1000	2000	1000	1000	1000	
Direction		Center	East	East	East	West	North	South	
pH		8.46	8.53	7.91	8.71	8.31	8.54	7.71	8.31
Conductivity	us	111	62.3	106.1	42.2	70	52.6	44.3	69.785
TDS Salinity	ppm	66.6	37.6	63.5	25.5	41.9	31.5	26.6	41.885
SO4	ppm	602.3	256.088	465.3	224.75	122.38	139.99	507.76	331.22
PO4 (Total)	ppm	58.226	35.242	152.306	355.48	64.355	55.16	88.9	115.66
PO4 (organic)	ppm	55.292	32.6784	146.735	348.895	63.8114	53.403	87.733	112.65
PO4 (inorganic)	ppm	2.934	2.5636	5.5706	6.585	0.5436	1.757	1.167	3.0172
NO3	ppm	5.419	4.288	7.3	5.11	0.313	0.554	1.539	3.5032
NO2	ppm	2.424	3.3337	2.9989	3.494	1.002	3.0977	3.314	2.8093
NH4	ppm	20.59	27.05	28.47	43.01	23.95	88.70	38.56	38.618
Organic nitrogen	ppm	3540	4500	5290	3295	2715	3930	3997	3895.2

NO3 & PO4


8
7
6
5
4
3
2
1
0
PO4(PPM)
NO3(PPM)
0.5436
0.313
2.934
5.419
2.5636
4.288
5.5706
7.3
6.585
5.11
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Center
O
East
250m
East
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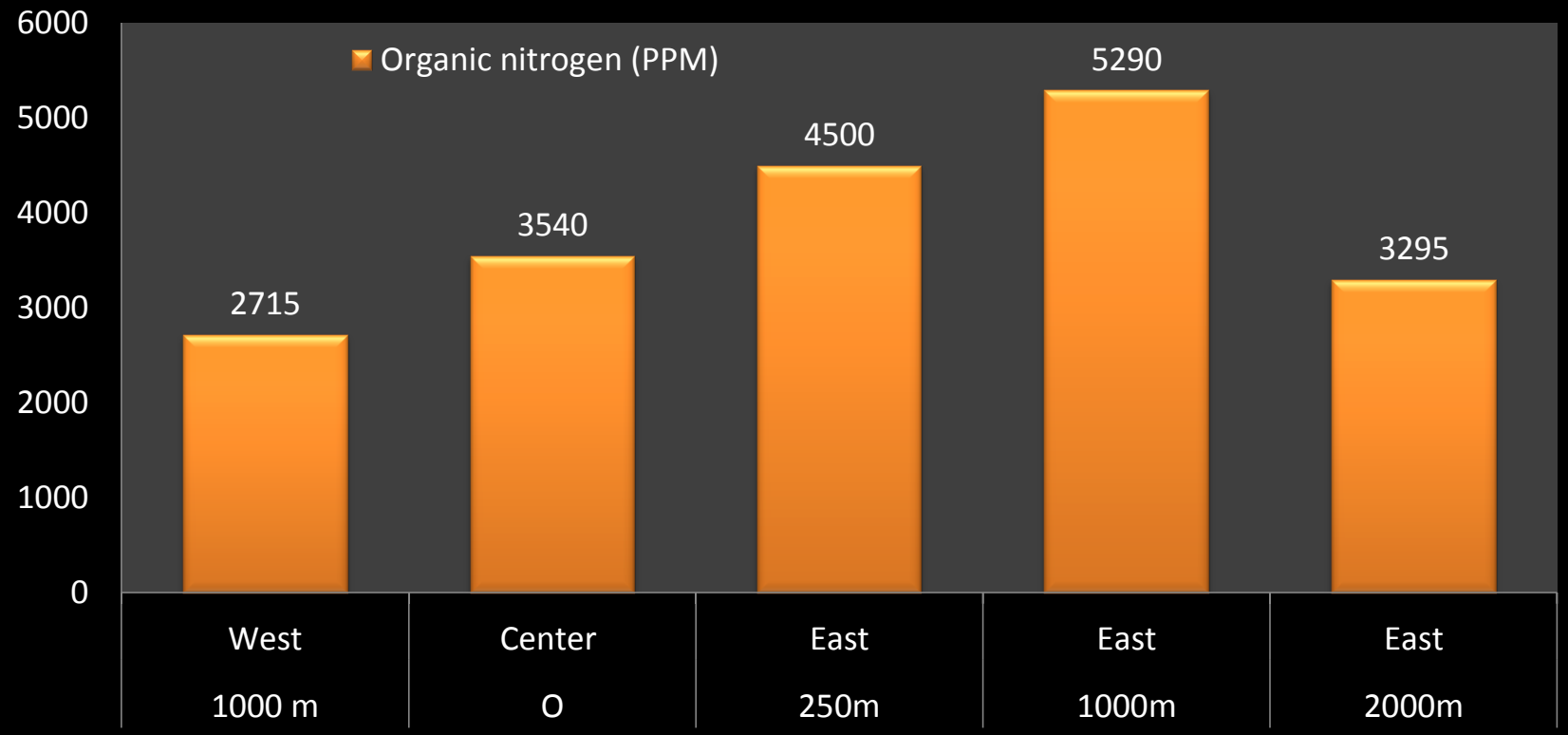
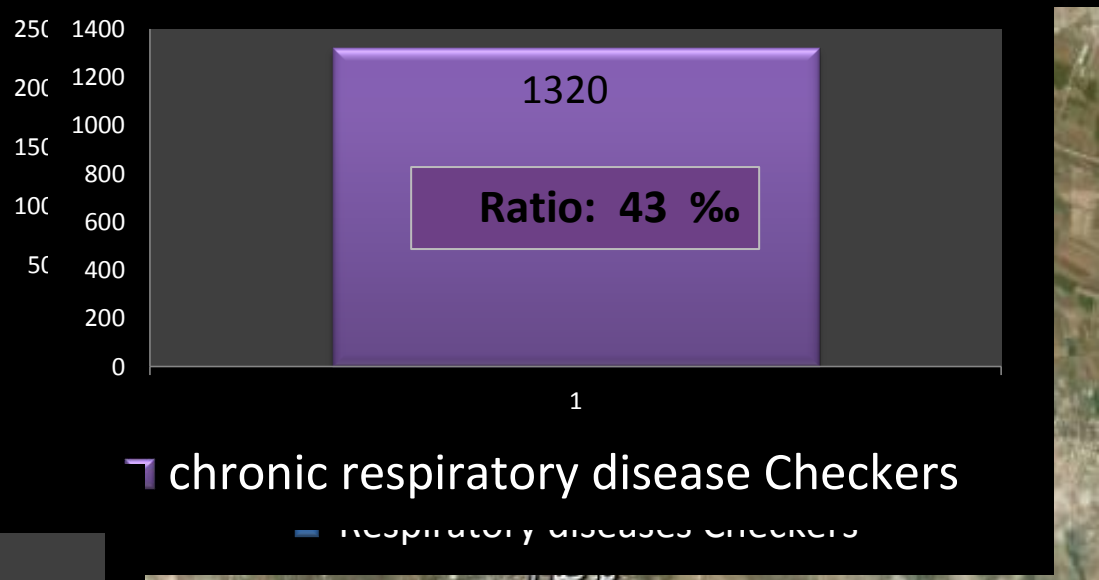
East
2000m

Organic Nitrogen

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1320
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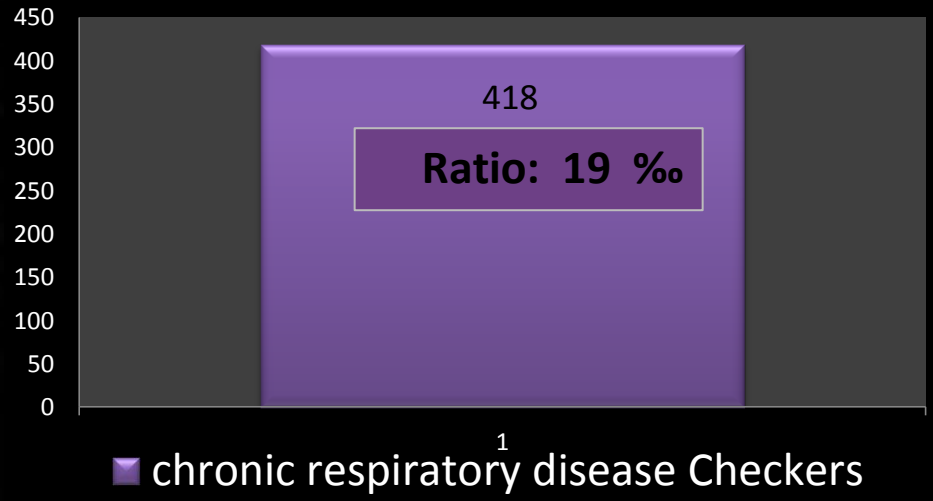
1
chronic respiratory disease Checkers


450
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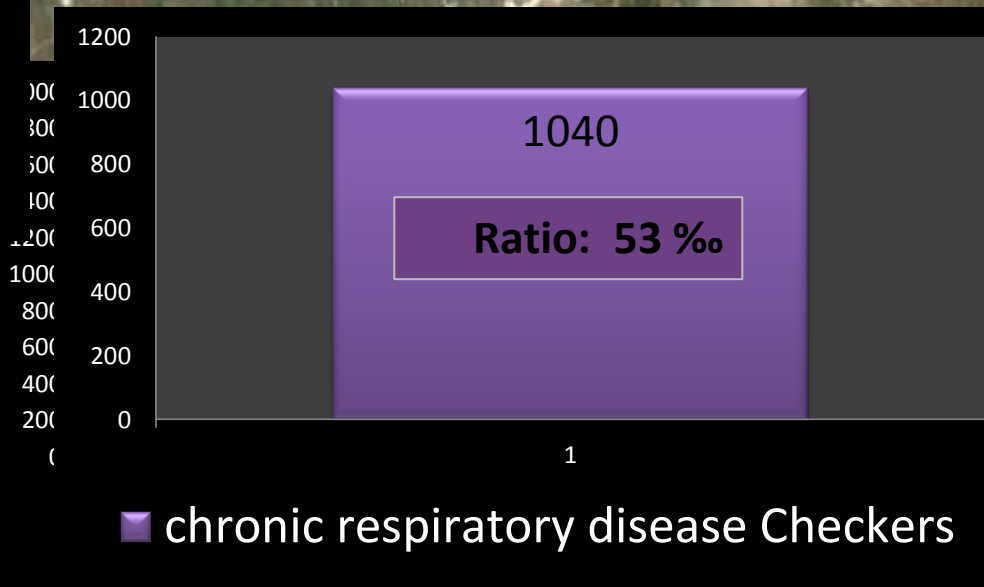
418
Ratio: 19 ‰
1
chronic respiratory disease Checkers


عرابة


1200
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800
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0
1040
Ratio: 53 ‰
1
chronic respiratory disease Checkers

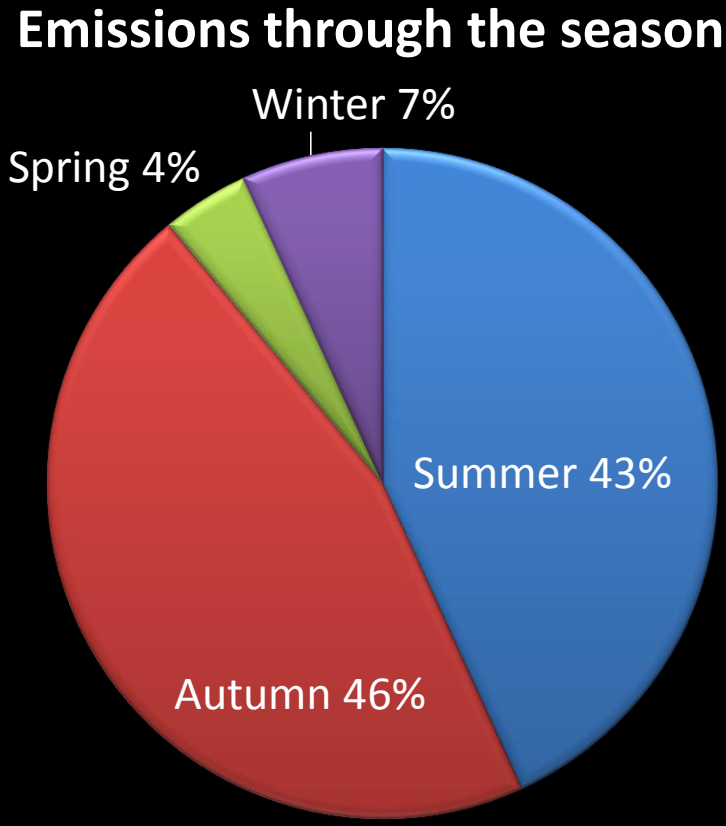
Questionnaires Analysis

Two types of questionnaires were distributed to Yabad people.

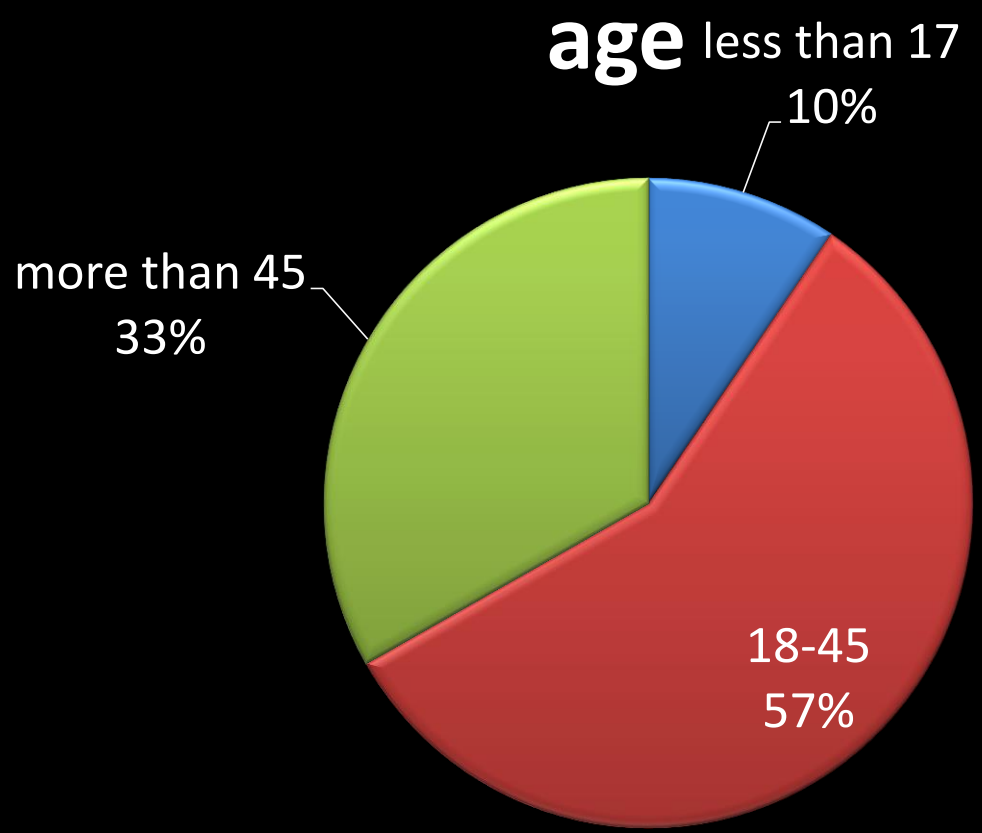
- 50 copies of worker questionnaire were distributed to the coal worker.
- 150 copies of Yabad people questionnaire were distributed.

The results were as follows

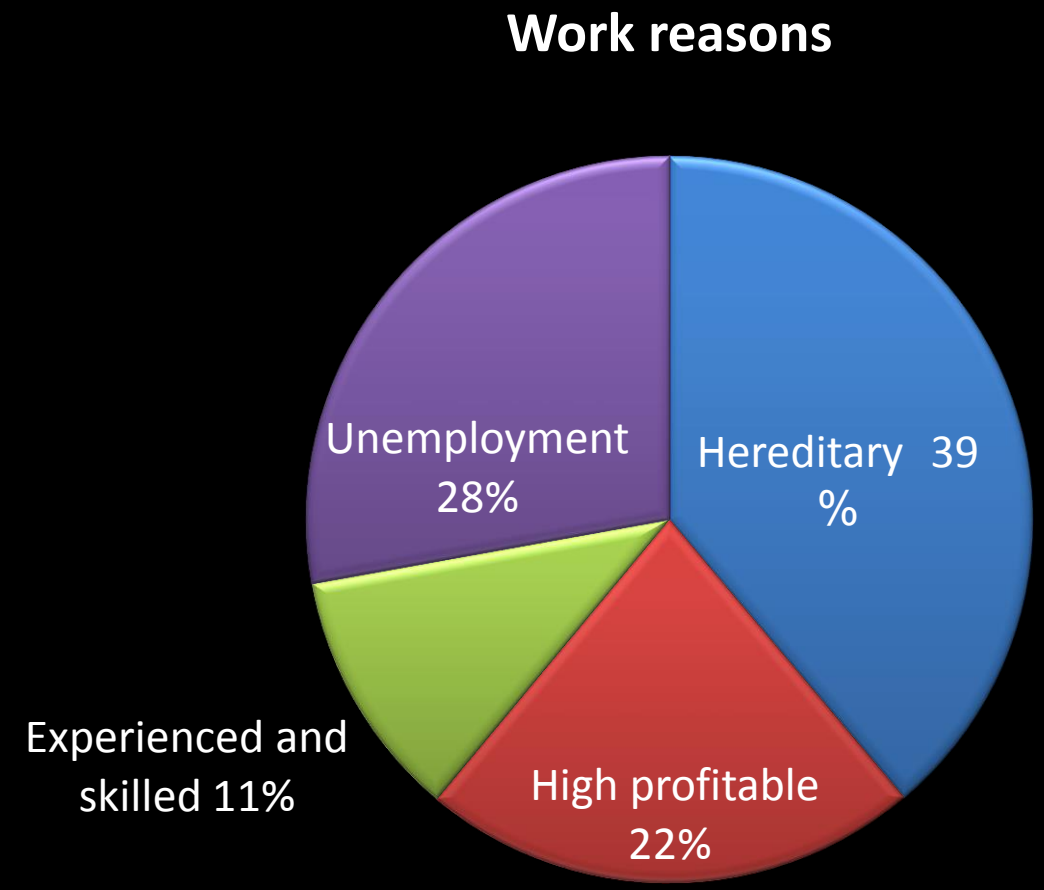
Emissions through the seasons



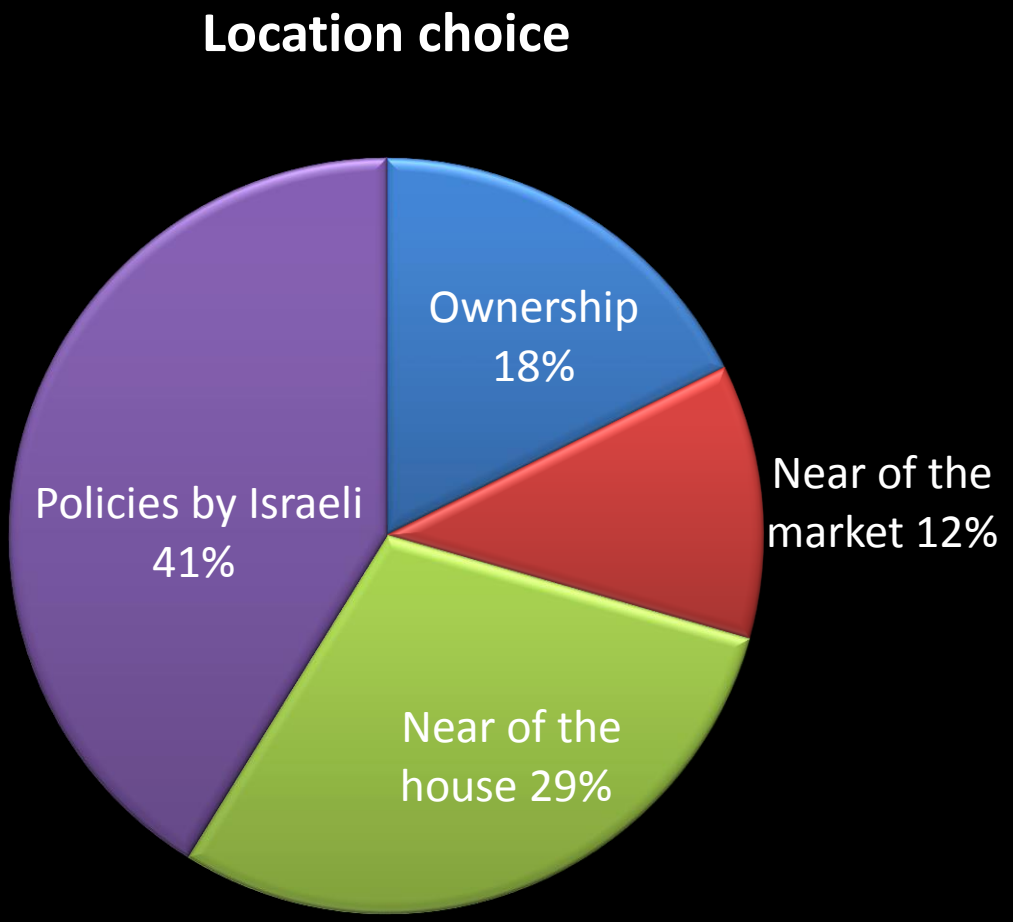
Worker age



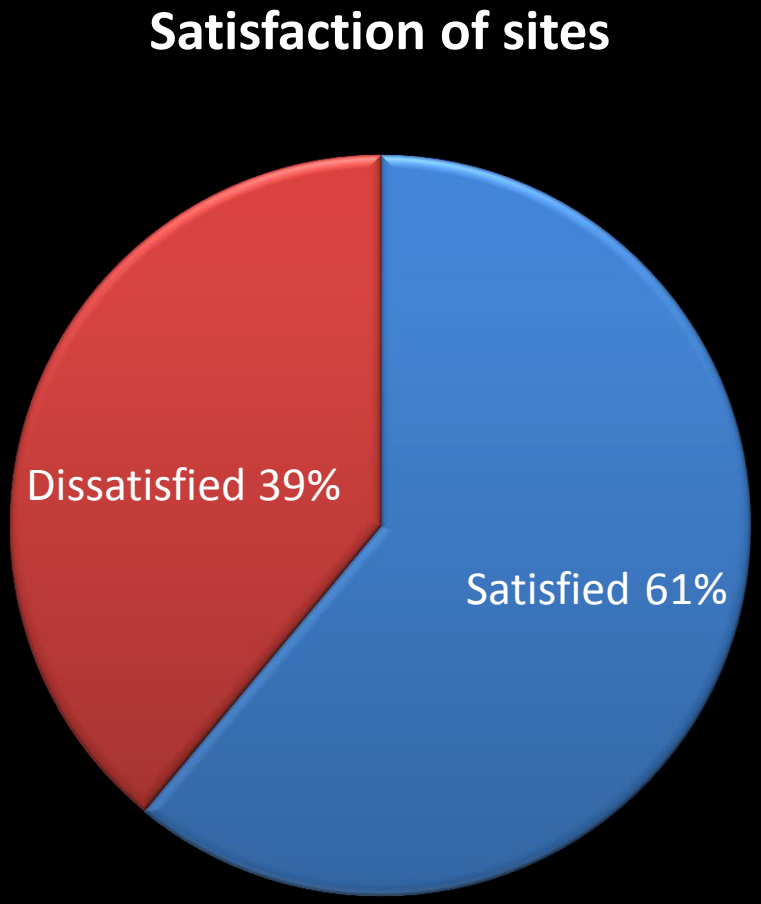
Work reasons



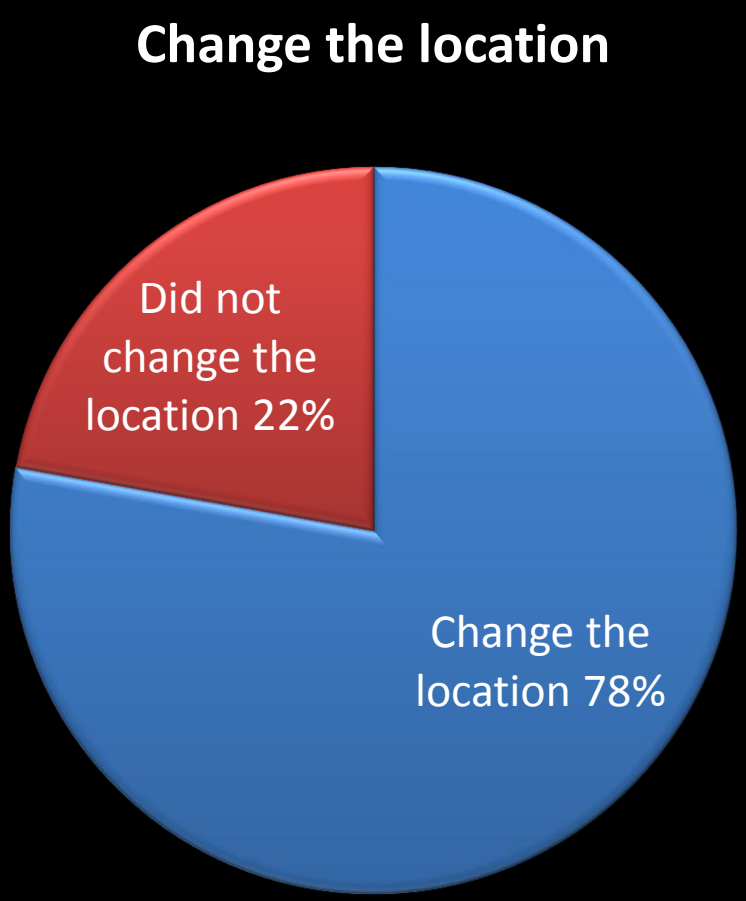
Location choice

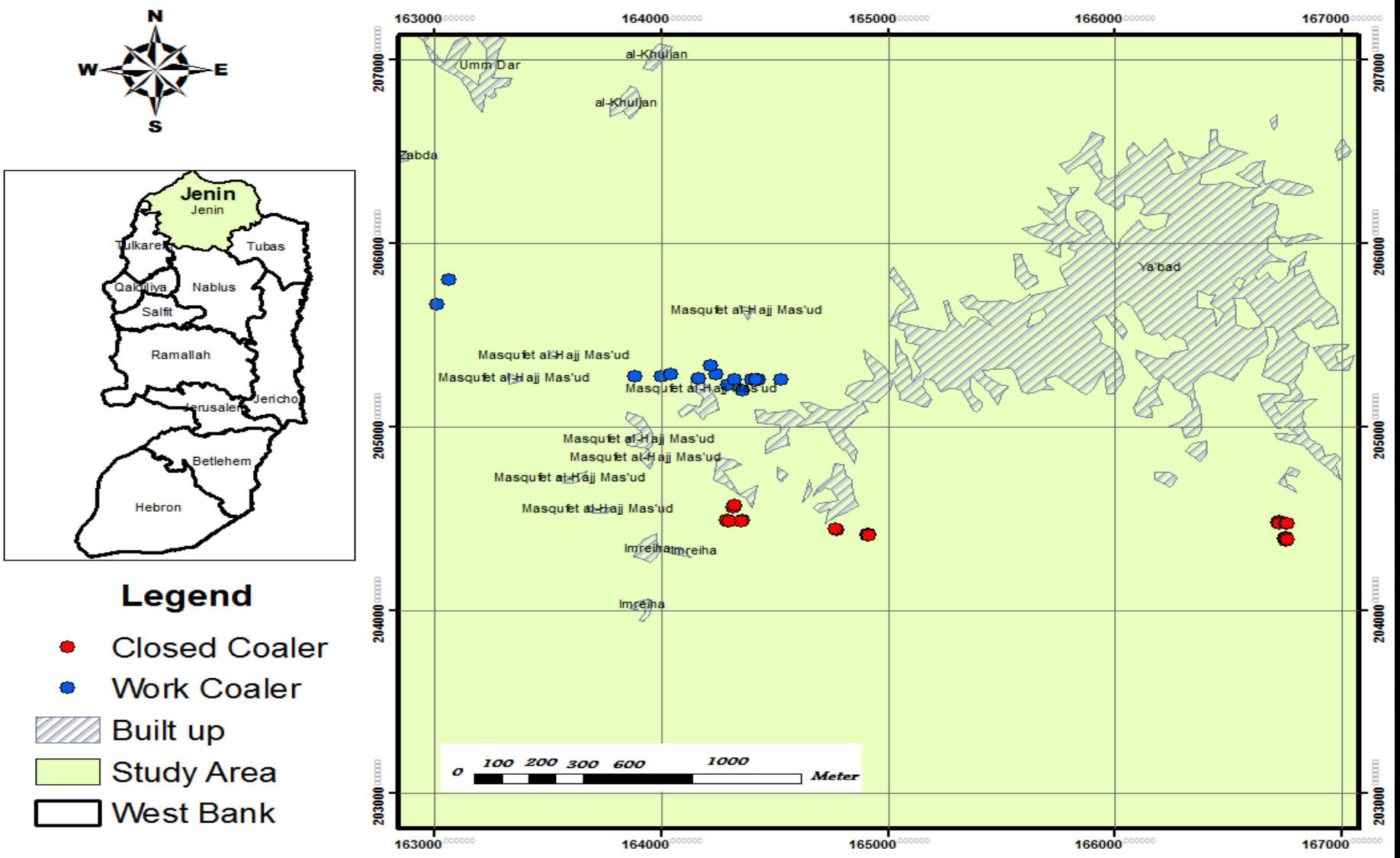


Satisfaction of sites



Change the location




N
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E
S
Jenin
Jenin
Tulkarem
Tubas
Qalqilya
Nablus
Salfit
Ramallah
Jerusalem
Jericho
Betlehem
Hebron
Legend
Closed Coaler
Work Coaler
Built up
Study Area
West Bank
163000
164000
165000
166000
167000
207000
206000
205000
204000
203000
Umm Dar
al-Khuljan
al-Khuljan
Zabda
Ya'bad
Masqufet al-Hajj Mas'ud
Masqufet al-Hajj Mas'ud
Masqufet al-Hajj Mas'ud
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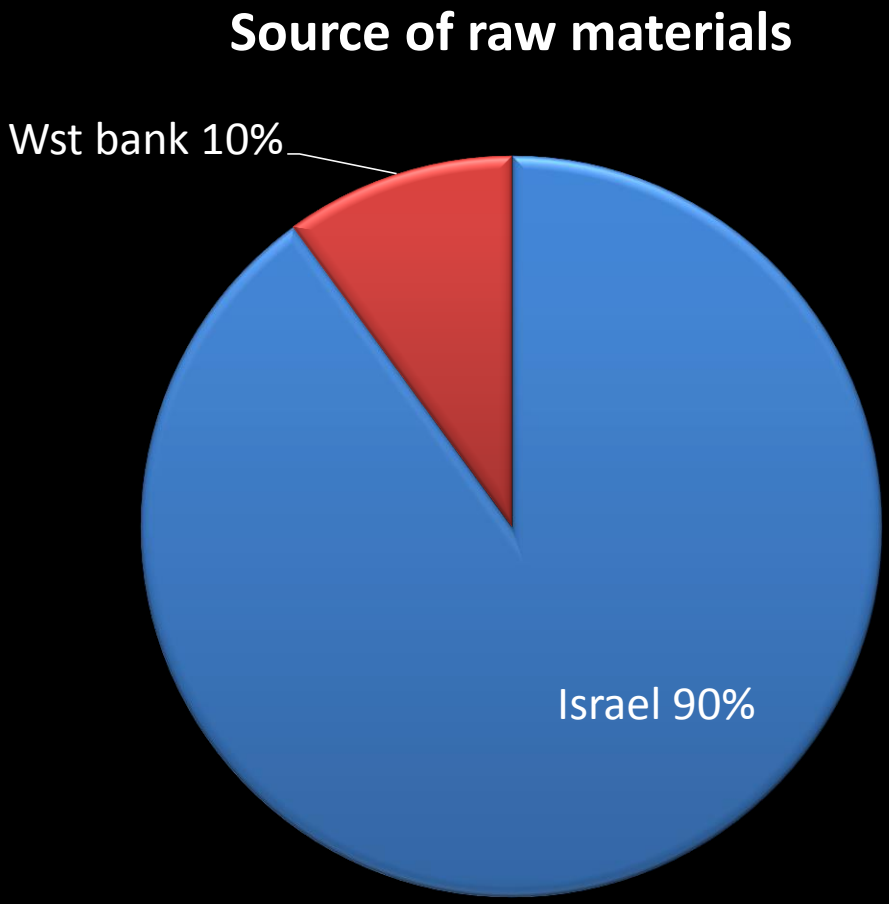
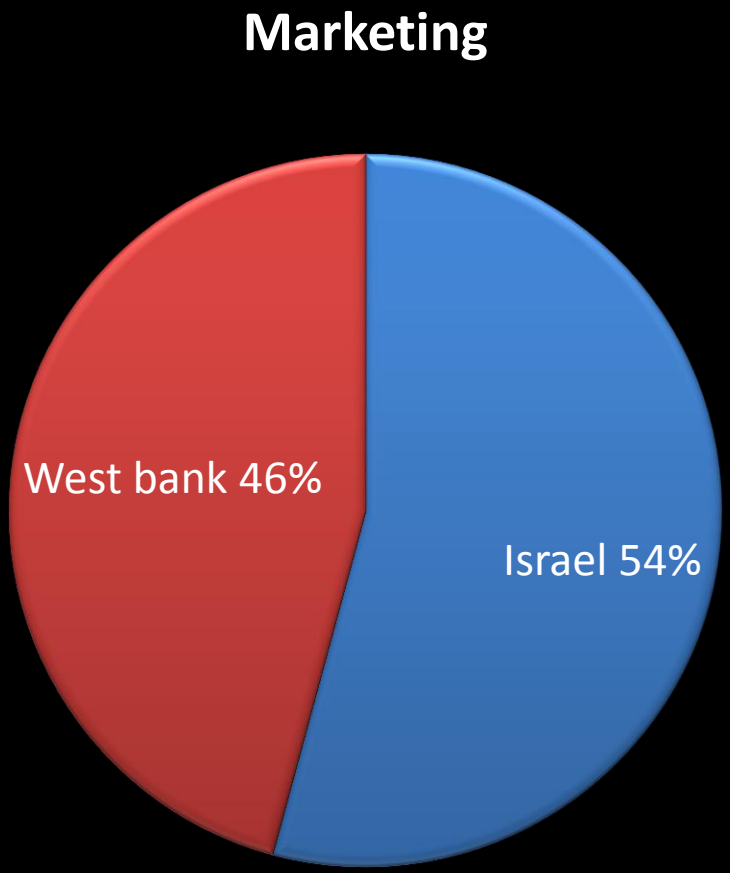
1000
Meter

Source of raw materials

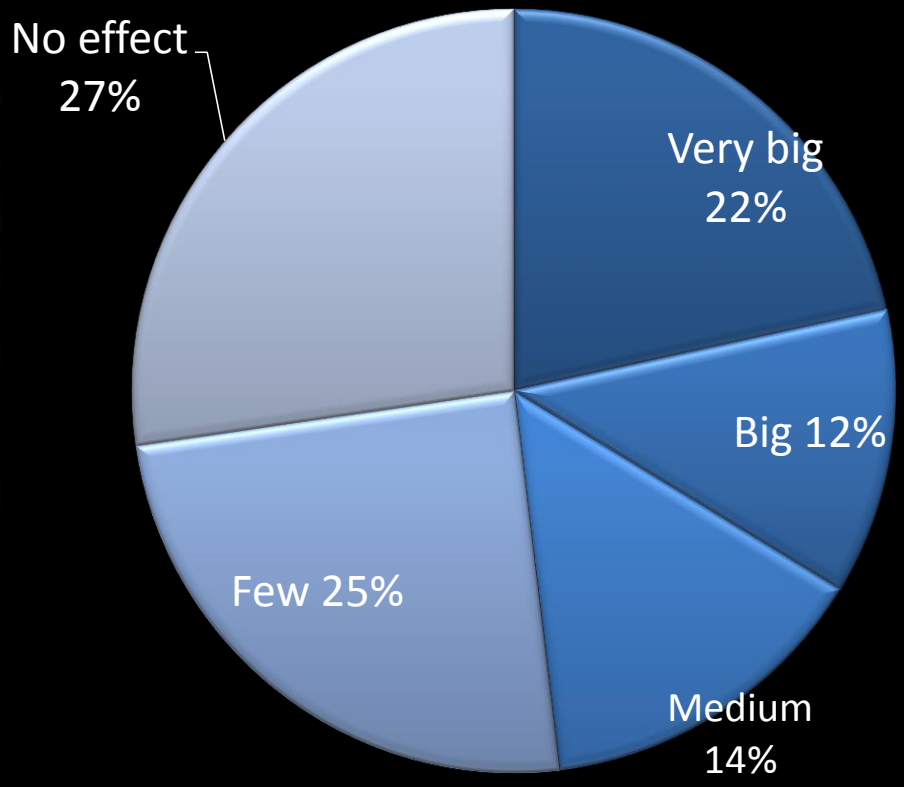


Marketing

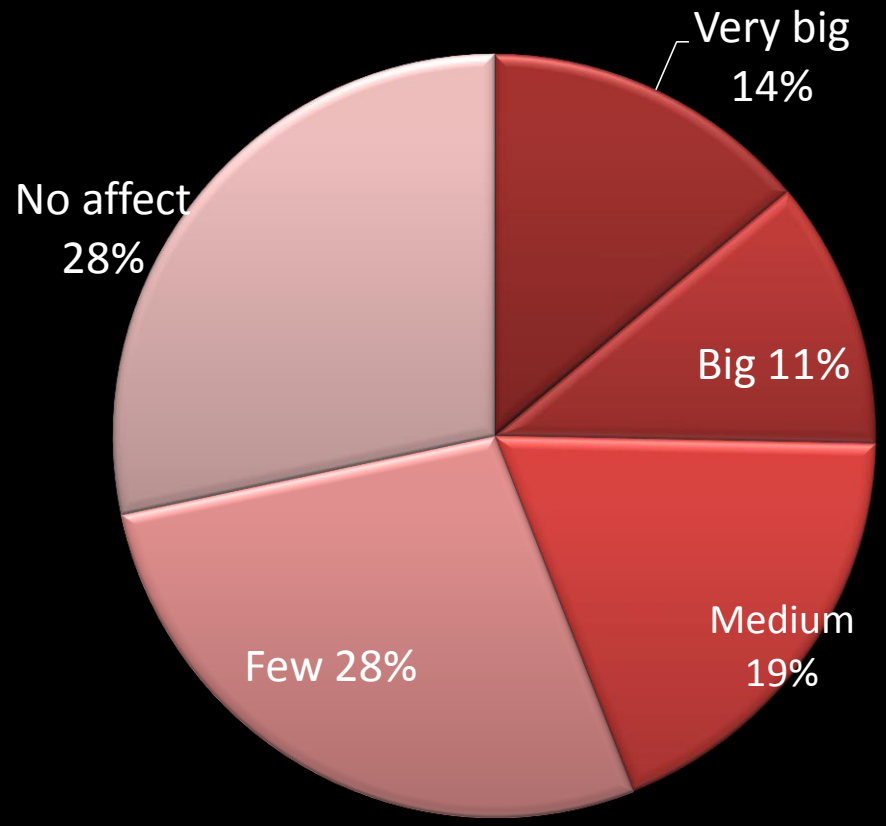


The charcoal impact on the property of the people

Outer walls Staining by the deposition of carbon

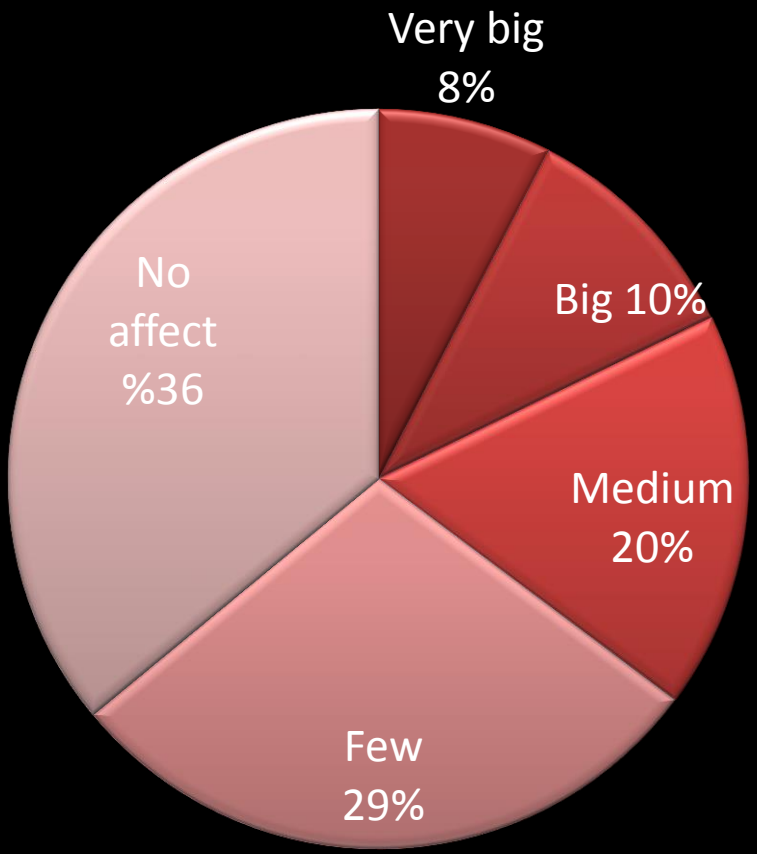


Impact on the house cleanliness

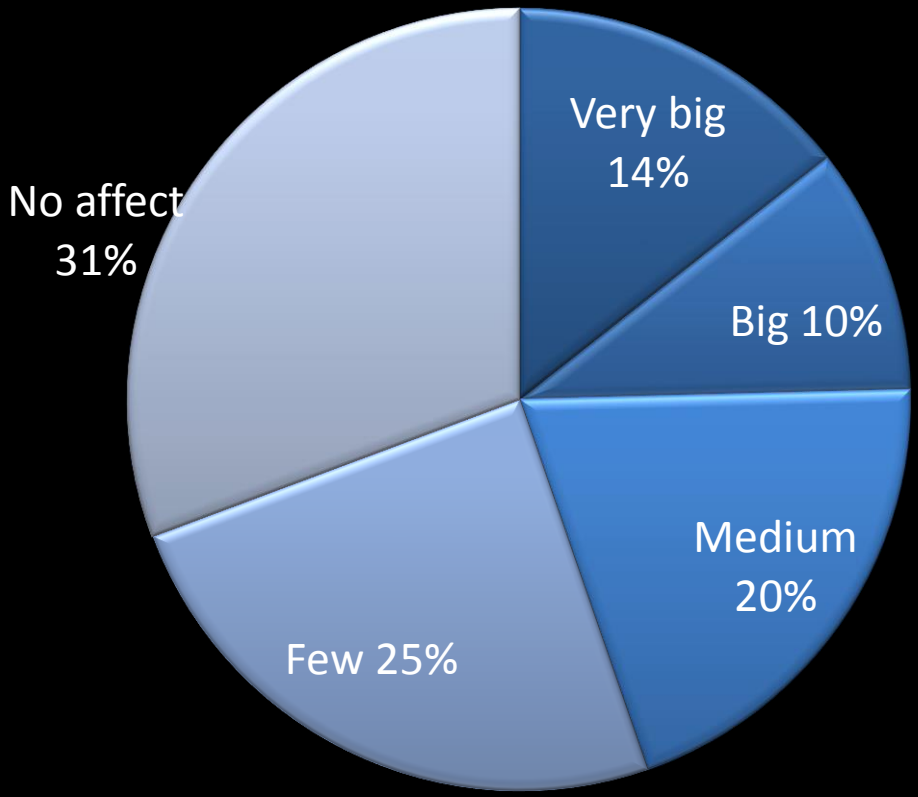


The charcoal impact on the property of the people

Impact on window

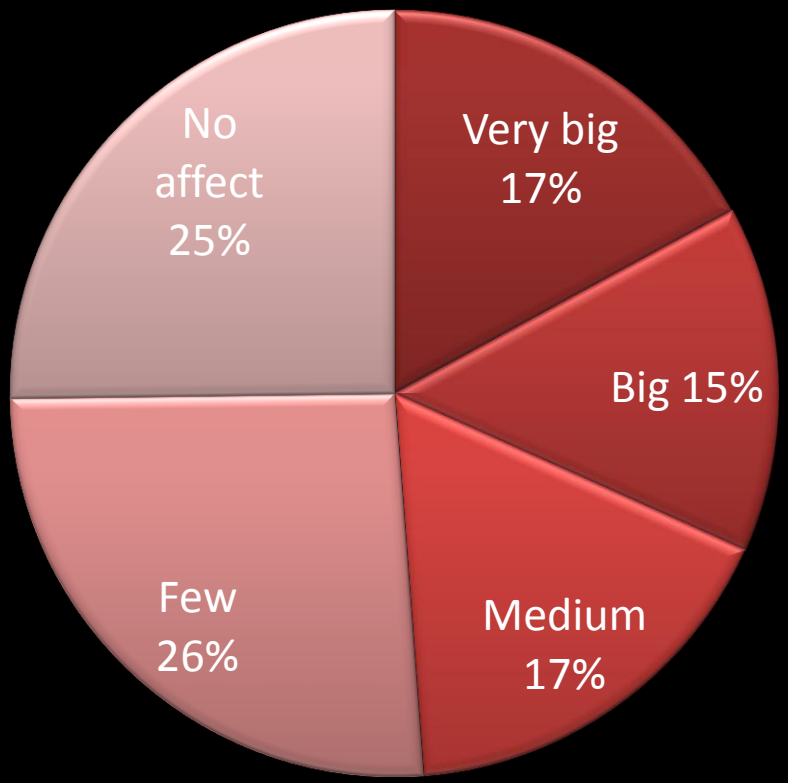


Damage to windows and cut sieve

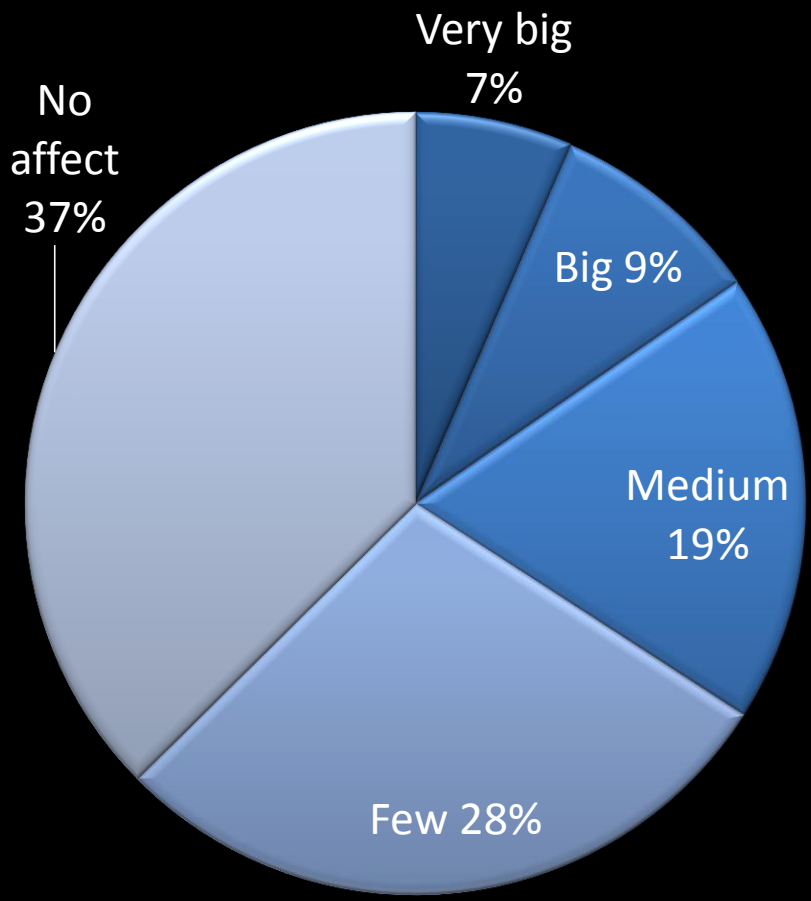


The charcoal impact on the cars

Staining the car

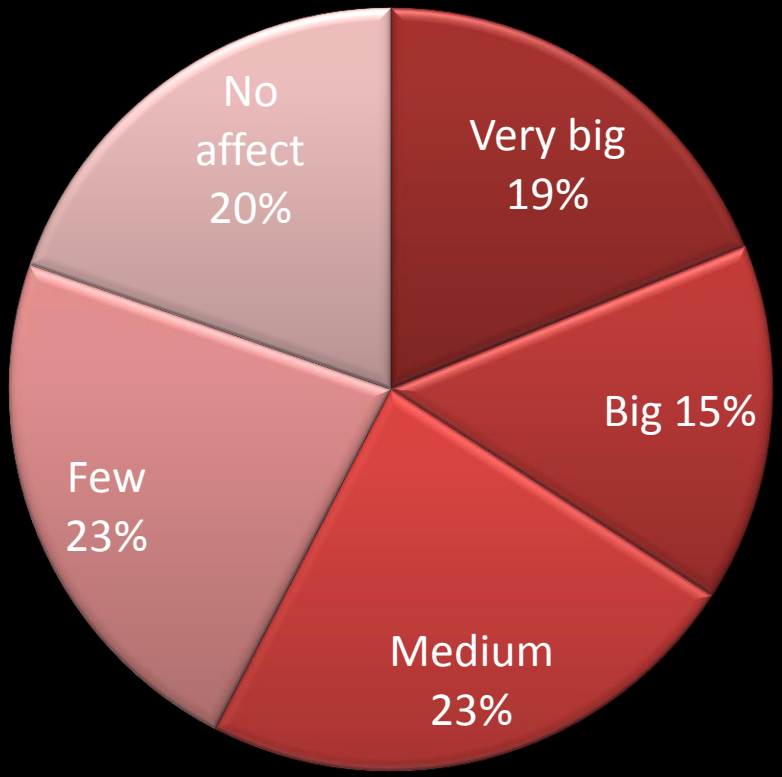


Distortion of car paint

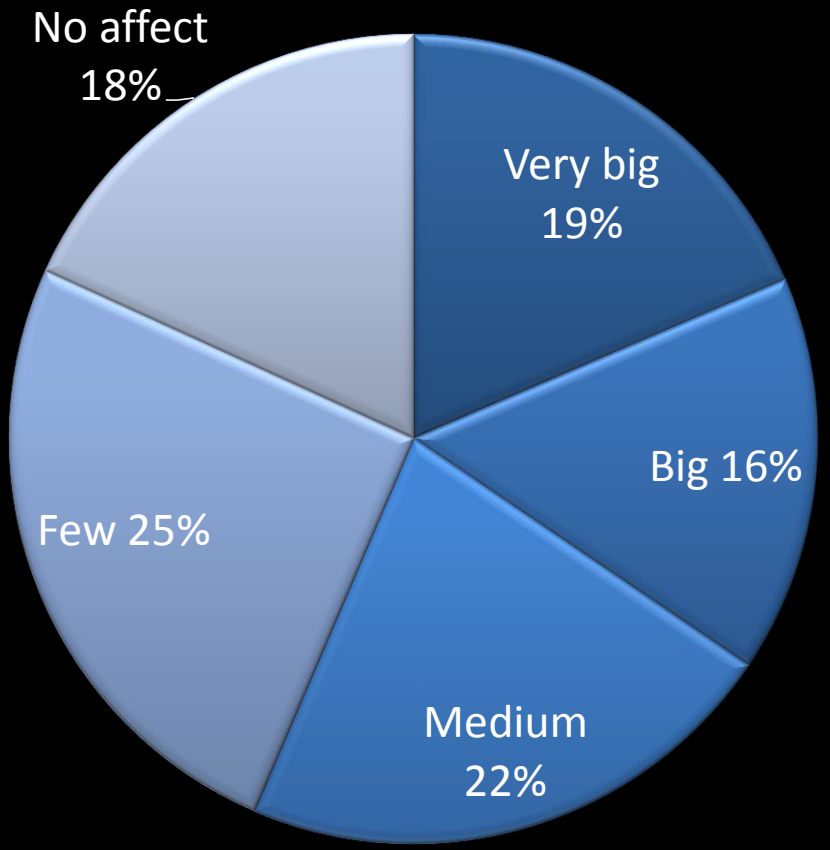


The charcoal impact on houseplants

Plants wilting

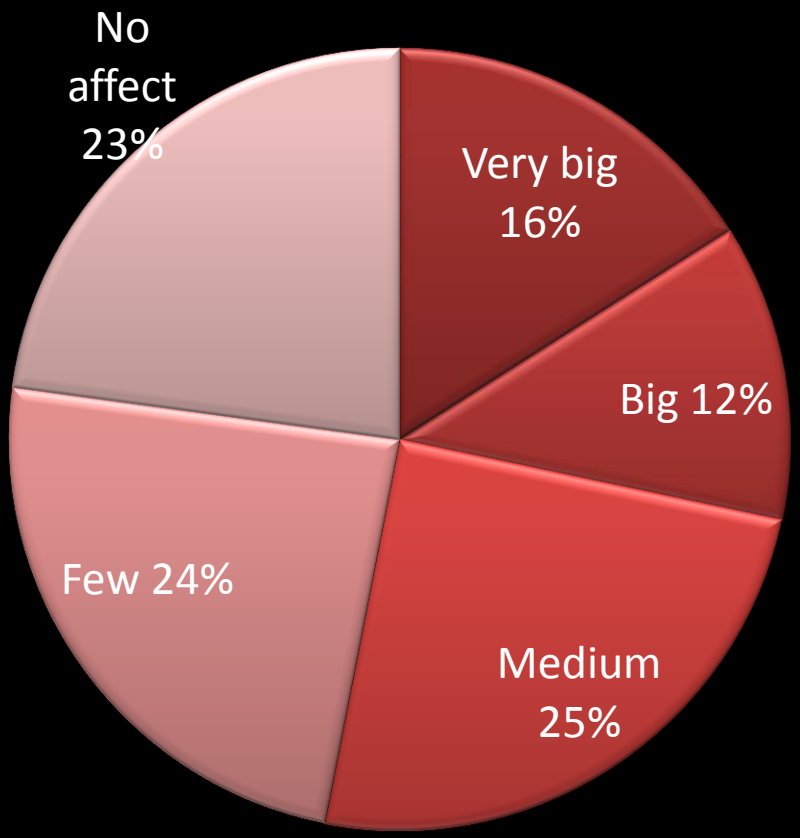


Change leaves color

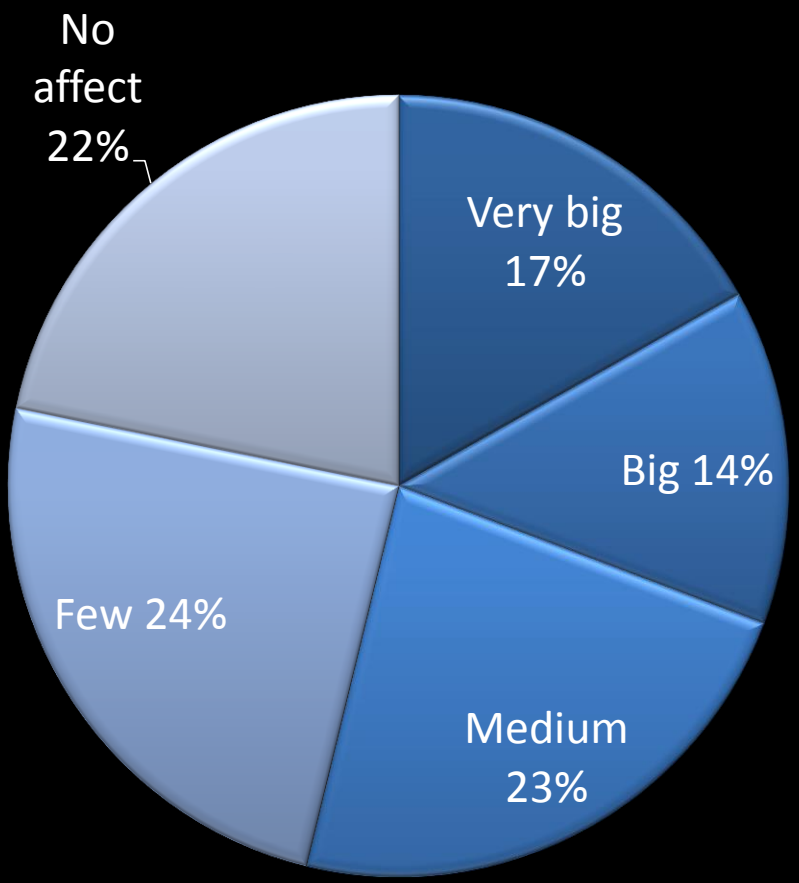


The charcoal impact on houseplants

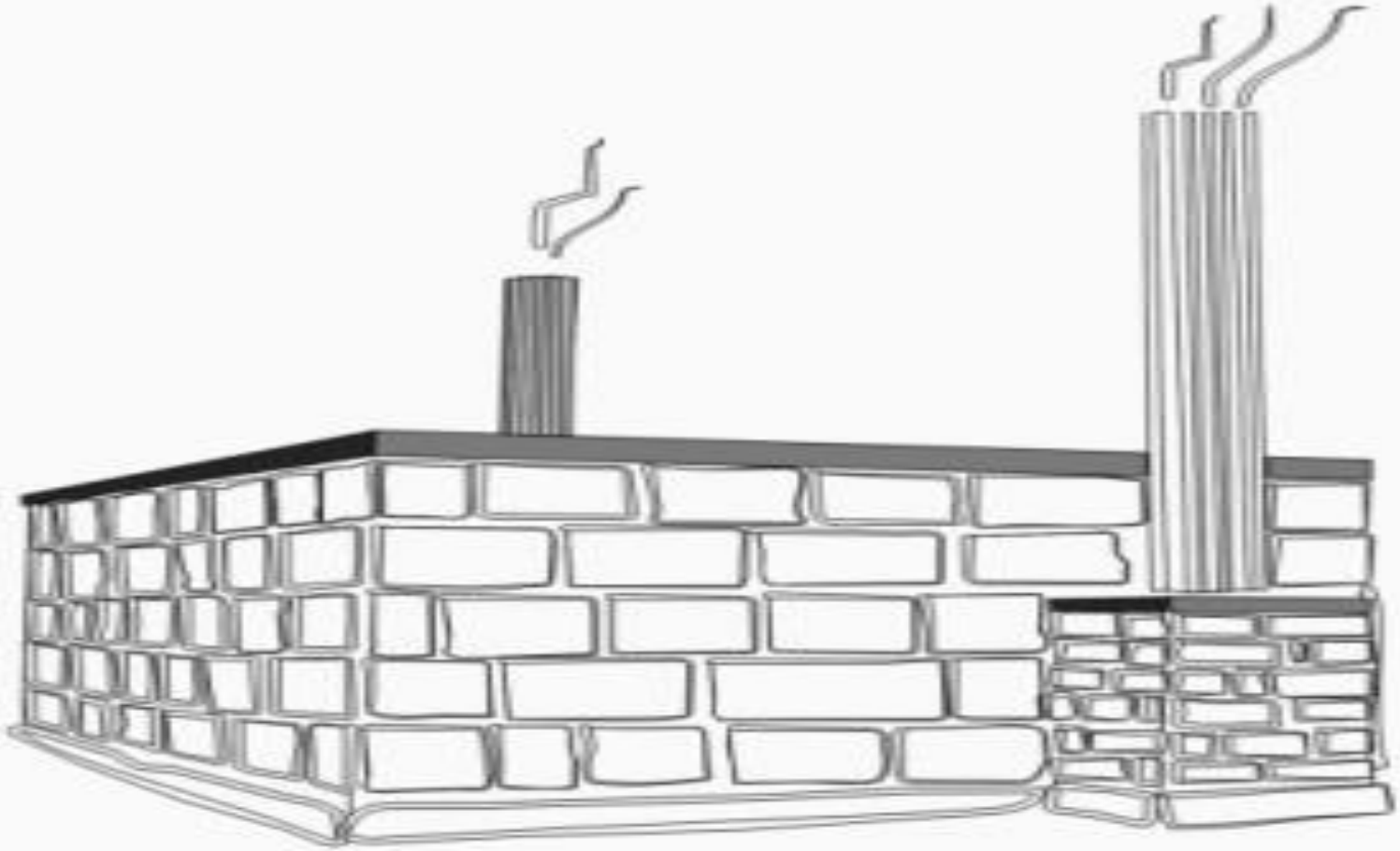
Slow of the plant growth



Damage to plants flowers



Adam-retort



Adam-retort in Yabad

Adam-retort in Yabad

Coal Worker

Coal Worker

Coal Worker

Coal Worker

Coal Worker

Coal Worker

Coal Worker

Coal Worker

Coal Worker