Pesticide Spraying

An insect pest has attacked about 20 percent of the trees in a pure stand of white pine. In an effort to reduce his economic loss, the owner has his forest crop sprayed each spring with a relatively new pesticide. The species which he is trying to eliminate is normally preyed upon by other insects, a parasite, and song birds from nearby woods. To the south of his property is a bird sanctuary for rare species of waterfowl and the carnivorous osprey. He has been assured that natural barriers and the wind direction will keep the pesticide out of the wildlife area. The three areas shown on the diagram (Figure 1) were carefully studied over a five-year period by researchers from a nearby university. Insect populations were estimated, fish and bird populations studied, soil samples collected, and pesticide concentrations measured in an effort to determine the overall environmental influence of this new pesticide. The results are recorded in Table 1.

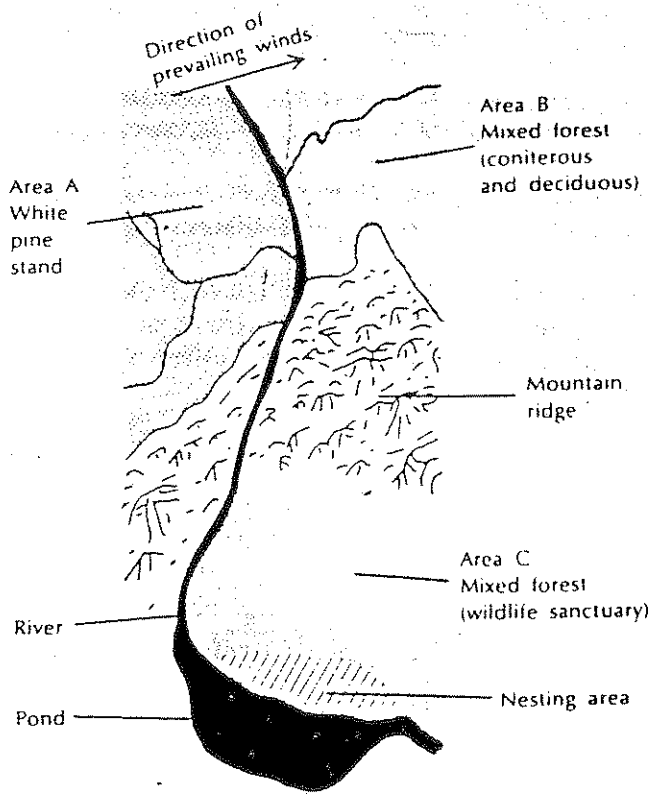

Figure 1 A Problem in Pest Control

Table 1 Statistics of the Five-Year Study

Year	Area	Insect population	Species of insect predators	% of pests with parasites	% fish mortality (adults)	Pesticide concentration in fish (ppm)	Carnivorous birds		No. of soil species
							% nesting success	Insecticide in eggs (ppm)	
1975	A	200,000	4	50	10	50			42
	B	50,000	7	30	10	50			60
	C	50,000	8	30	8	30	80	70	74
1976	A	4,000	2	10	10	150			30
	B	2,000	3	20	10	120			55
	C	40,000	8	30	8	100	25	170	70
1977	A	200	0	4	50	250			24
	B	1,000	1	10	40	200			50
	C	40,000	8	25	10	150	10	240	68
1978	A	800,000	0	2	80	400			20
	B	80,000	1	5	70	350			46
	C	50,000	7	25	50	250	4	300	60
1979	A	1,400,000	0	0	90	500			7
	B	100,000	0	3	90	450			25
	C	50,000	7	30	70	300	2	400	56

Name _____ Class _____ Date _____

Weather and Nesting Success in Whooping Cranes

The whooping crane has long been in danger of becoming an extinct species. Its population has been carefully studied by the Canadian Wildlife Service since its breeding grounds in Wood Buffalo National Park were discovered in 1954. The whooping crane migrates north from the Aransas Refuge in Texas. It builds its nest in marshy areas of Wood Buffalo National Park and feeds in numerous nearby shallow potholes. The weather in the summer breeding areas has a substantial effect on the nesting and feeding habits of these birds. Heavy rainfall may flood nests and cause a high mortality in young birds. Temperature extremes or heavy snowfall early in the season may also disturb the nesting success.

Data are presented which show the bird population of the northerly migrating whooping cranes over 15 years. Nest sites were carefully examined without disturbing the birds and the number of hatching eggs counted. Measurements of snowfall and rainfall during the summer period were recorded. Not all of the birds which migrated north from the winter area in Texas were in the same breeding area. The results of the study are summarized in Table 1.

Table 1 Statistics of the Fifteen-year Study

Year	Migrating adults	No. of nests	Eggs laid	Hatched eggs	Rainfall (inches)	Snowfall (inches)
1955	21	6	6	4	3.5	1.4
1956	20	3	2	0	5.9	0.2
1957	20	4	4	3	4.6	0.8
1958	22	5	5	4	2.4	1.1
1959	23	4	6	2	2.5	5.6
1960	23	8	8	4	3.2	1.8
1961	30	6	6	5	2.9	0.03
1962	32	0	0	0	7.6	3.0
1963	28	4	6	2	5.9	0.5
1964	26	10	10	7	3.2	0.8
1965	32	10	10	6	2.9	1.0
1966	36	2	2	0	5.4	2.9
1967	30	4	4	3	3.5	0.4
1968	32	3	4	3	2.8	0.7
1969	33	3	3	1	5.8	2.4
1970	32	5	5	4	2.1	0.6

Questions

1. Plot a graph to show how the crane population has changed over the past 15 years.

2. When was the population highest? When did it reach its lowest level?

Name _____ Class 187 Date _____

Temperature Variation

Many factors play a part in determining the temperature at any given point on the earth's surface. Elevation, latitude, and nearness to bodies of water are three that any geography student will be quick to mention. This study deals with two factors, each having specific importance to soil temperatures.

The Shade Factor

Temperatures were obtained in November in a fairly arid area of Nevada. At two different sites, temperature readings were taken at a number of heights above and below the soil surface. One site was shaded by juniper, while the other was not. The results are summarized in Table 1.

Table 1 Temperature Readings in an Arid Region of Nevada in November

Condition	Height in cm from soil surface	Temperature in C°	
		Beneath forest cover	Unshaded field
Air	150	18	20
Air	90	18	21
Air	60	18	20
Air	30	18	21
Soil surface	0	16	33
Humus	−6	12	19
Mineral	−15	9	15
Mineral	−30	7	12

Questions

1. Construct a graph with height on the vertical (y) axis and temperature on the horizontal (x) axis. Plot the data and join the points with straight lines. Use different colors for the two sets of data.

2. At what time of day do you think the data were collected? What major difference would you expect 12 hours later?

3. From your own experience, which surfaces feel coolest and which hottest to the feet on a sunny day? Why?

4. The temperature data alone should indicate to you that there will be many differences in both the living and non-living features of the two sites. Predict what differences might be found if you were in the position to analyze the sites further. Give your reasons for each prediction.

The Seasonal Factor

Air is very changeable stuff. Its temperature fluctuates markedly on daily and yearly cycles. The surface soil layers show similar, but somewhat less extreme, changes in temperature. Soil inhabitants are fortunate that this is so, as you will gather from an analysis of the data in Table 2.

Emissions of Air Pollutants in the United States

Table 1 summarizes the estimated nationwide (U.S.A.) emissions of air pollutants for 1972.

Table 1 Estimated Nationwide Emissions, 1972 (Millions of metric tons per year)

Source	Carbon monoxide	Particulates	Sulfur oxides	Hydrocarbons	Nitrogen oxides
Transportation	57.8	1.1	0.7	15.0	7.3
Fuel combustion in stationary sources	1.7	8.1	22.1	0.6	9.1
Industrial processes	8.7	6.8	6.6	4.2	0.1
Solid waste disposal	7.1	1.0	0.1	1.4	0.5
Miscellaneous	15.3	8.7	0.5	7.7	1.5
Total	90.7	25.6	30.1	29.0	18.7

Questions

1. (a) Calculate the total amount of air pollutants produced in 1972.
   (b) Of this total, what percentage was contributed by vehicles?
   (c) For each of the five categories of pollutants, calculate the percentage that is contributed by vehicles.
   (d) Opponents of expressway construction and of vehicular traffic in downtown areas quote the figure that you determined in (b) as evidence that the automobile is the main culprit in air pollution. Automobile manufacturers point out that the use of the total percentage figure is not realistic because some pollutants are more harmful than others. What do you think? Why?

2. (a) 22.1 million metric tons of sulfur oxides were produced by the burning of fuels in stationary sources. What percentage of the total is this?
   (b) Coal combustion accounted for 18.2 million metric tons of sulfur oxides and fuel oil combustion for another 3.9 million metric tons. Stated differently, power plants produced 15.2 million metric tons, industrial plants 4.6 million metric tons, and space heating of homes and businesses, 2.2 million metric tons. Suggest steps that could be taken to lessen the amount of sulfur dioxide released into the air. Discuss the feasibility of your suggestions.

3. (a) What percentage of the total carbon monoxide emission was produced by transportation vehicles?
   (b) Supporters of expressway construction in cities often state that automobiles produce more carbon monoxide when they are driven slowly. Therefore, they argue, carbon monoxide pollution can be reduced by building expressways to keep the traffic moving faster. Research appears to back up their opinions. In the United States vehicular traffic is almost evenly divided between rural and urban areas. Yet, 70% of the carbon monoxide produced by vehicles is found in urban areas where driving speeds are slower. Do you agree with those who support the construction of more expressways? Why?

4. (a) Nitrogen oxide emissions for 1974 totalled 20.8 million metric tons. What do you think were the main reasons for the increase over the 1972 value?
   (b) There are over 940 power plants in the United States that burn fossil fuels. They produced 15.2 million metric tons of sulfur oxides and 3.6 million metric tons of nitrogen oxides. These large quantities of dangerous pollutants would be eliminated if the power plants were replaced by nuclear power plants. Discuss the feasibility of doing so.