

# A Cost Benefit Study of Banning Leaf Burning in Cedar Falls, Iowa

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**ABSTRACT.** This paper looks at the issue of leaf burning in the city of Cedar Falls, Iowa from an economic standpoint. It discusses the costs and benefits associated with leaf burning. A cost-benefit analysis was done over a 10 year period. The analysis suggests that a burning ban would be beneficial for Cedar Falls.

## **I. Introduction**

Air contamination has been a problem associated with most, if not all, large cities in the United States. There are many contributors to the problem such as industry, automobiles, and dry conditions, which causes dust from gravel roads and farms to contaminate the air. One contributor to air pollution that is often over looked is leaf burning. Even though many cities have banned the practice, there are still a few cities that allow open burning within city limits. One city that still allows this practice is Cedar Falls, Iowa. A discussion of leaf burning touches on a variety of other issues such as property rights, personal rights, and freedoms lost or upheld. This paper approaches the issue from a strictly economic perspective, and asks the question “is it better to have open burning or to ban open burning in Cedar Falls?”

The cities of Cedar Falls and Waterloo have been fighting over the issue of burning for quite sometime. Disputes arise partially because people are not aware of the many costs associated with burning leaves; they only see the cost of alternate ways of leaf disposal. To them, burning the leaves is much cheaper than having to bag the leaves and then have the city dispose of them. They see the costs of bags, the time required to bag, and tax money going toward leaf disposal, and conclude that it is cheaper to burn. They acknowledge health concerns, but fail to see all of the costs a city incurs when open burning is allowed. My research will detail the costs of open burning and will claim that it is cost effective to ban burning in the city of Cedar Falls.

## **II. Calculating the Cost of a Burning Ban**

Burning leaves has more costs associated with it than just lighting a match and throwing it on the fire. It has affects on health, property, time, lives, and business. These costs are hard to quantify to some extent due to differences of opinion on the value of each of these effects. What is definite is that all the effects cost money.

The time it takes to gather the leaves, light the match, watch them burn, make sure the fire is out, and to go back into the house is at least as great as the time it takes to rake and bag the leaves. Hence, the time-cost is approximately the same for both methods. The issue of personal rights, i.e. the idea that, "I have the right to burn the leaves on my lawn", versus, "I have the right to breathe clean air," is non-quantifiable, and will be ignored in this analysis. Another assumption is that more leaves are burned during the fall season than at any other time in the city of Cedar Falls, and that not all fall seasons are alike. Some fall seasons produce higher or lower amounts of pollution from leaf burning than an average fall due to differences in weather, or due to poor burning conditions on weekends in the fall. Also, it should be noted that not all air pollution in the fall is due to leaf burning. Some of the other things that influence air quality in the city are dust from the country, industrial pollutants, car pollutants, and pollution from construction.

The city of Cedar Falls has taken some measures in an effort to get residents to switch from burning yard waste to recycling yard waste. The measures include the pick-up of yard waste on Mondays from April until the last Monday in November. These pick-ups must be arranged by phone. Yard wastes may also be dropped off at the transfer station for a fee of \$0.75 per bag. The city will also pick up yard waste during the first two weeks of November free of charge, and during these two weeks one can bring one's leaves to the transfer station free of charge. Biodegradable bags must be used if the city is coming to pick up the leaves and can be purchased at the Public Works Department for \$0.20 each or for \$1.25 each at local retailers. In 2002, according to Brian Heath, close to 20,000 bags were sold at \$0.20 for a total of \$4000.00 spent on bags by the citizens of Cedar Falls [Heath, 2003]. As will be explained below, the number of bags is not expected to rise significantly with a burning ban, so a yearly cost of \$4000.00 will be used.

The city faces other costs with leaf collection. In 2002, \$30,800.00 was spent on leaf collection [Heath, 2003]. It was also estimated that with a burning ban in the city of Cedar Falls, costs would increase by 30%, which would mean a total of \$40,040.00 for leaf collection [Heath, 2003].

The leaf collection costs include labor, truck hours, and maintenance fees [Heath, 2003]. Cedar Falls is also proposing that a new composting facility be built if a burning ban is put into place in Cedar Falls [Heath 2003]. The city and its residents could reuse the leaves as compost for no charge [Heath, 2003]. The projected cost for this new facility is \$100,000.00 dollars: \$70,000.00 for building costs and \$30,000.00 for ground preparation costs [Heath, 2003]. A yearly cost of \$15,000.00 will also be assessed for maintenance of the building after the first year [Heath, 2003]. The initial cost of a burning ban would equal \$144,040.00. For each additional year the cost will be \$59,040.00 (See Equation 1).

### EQUATION 1

#### Total Cost Computations

70,000 Building Cost
30,000 Ground Preparation Cost
40,040 Cost to City with Burn Ban
<u>4,000 Cost in Purchased Bags</u>

\$144,040 Initial Starting Cost for Ban

My study will be a projection for the next ten years, so  $t = 10$ . The discount rate used was  $r = .07$  [Wells Fargo 2003]. This is the interest rate at which \$100,000.00 could be borrowed to build a composting facility. All equations for the costs are shown in the Appendix. The present value of the total projected cost for the next ten years discounted at  $r = .07$  is equal to \$558,712.00.

### III. Calculating the Benefits of a Burning Ban

A burning ban has many benefits. These include health benefits, composting benefits, property damage benefits, plus street damage benefits. The benefits are quantified in this study. That does not mean that there are no other benefits to the city, but these are the main benefits of a leaf-burning ban.

Many studies have proven that leaf smoke is hazardous to our health. Children and the elderly are especially at risk from leaf smoke [Nolte 2001, 20,21]. Leaf smoke can lead to hospitalization for the elderly and

can inhibit the healthy development of children's lungs [Nolte, 2001, 20,21]. This study will consider only the costs of asthma, but that doesn't mean that there are no other health concerns and costs associated with leaf burning.

In Iowa, 7.1% of the population has asthma [Nolte, 2001, 22]. Asthma leads to \$144 million in annual costs in Iowa [Hoffman, 2003].

These annual costs are both direct and indirect. Indirect costs include loss of work, absences from school, and similar effects [Hoffman, 2003]. The direct cost is the cost of medical treatment for the asthmatics [Hoffman, 2003]. Roughly 57% of the costs are direct and roughly 43% of the costs are indirect [Hoffman, 2003]. If there are approximately 200,000 residents in Iowa with asthma and it leads to 144 million dollars in cost then the average cost per person is \$720. The population of Cedar Falls is 36,145. If 7.1% of them are asthmatic, then roughly 2500 people in Cedar Falls have asthma. A cost per person of \$720.00, multiplied by 2500 people, means that a total of \$1.8 million is spent on asthma in Cedar Falls yearly. Since the burning of leaves generally only takes place during two months of the year, October and November, the \$1.8 million must be multiplied by 1/6. Hence, \$300,000.00 dollars are spent on asthma during these two months.

If as few as 20% of asthma problems are due to leaf smoke, then the total cost of burning during these two months is \$60,000.00. There are many studies that say leaf smoke is harmful to asthmatics [Nolte, 2001, 23]. One study even says that asthmatics were "3.1 times more likely to experience an asthma episode after being exposed to leaf smoke" [Nolte, 2001, 23]. Another study about asthmatics said that, "data from 5 hospitals and one physician's office indicated that 64% of the patients had been exposed to leaf burning" [Nolte, 2001, 23]. Asthma attacks may also take days to develop, so the person may not even know that his/her asthma attack was due to leaf smoke [Nolte, 2001, 22]. So attributing only 20% of the cost to leaf smoke is conservative.

Property damage is also a cost that could be avoided by a burning ban. In a study done in 1967 by Robert Kohn, a low-end estimate of \$16.93 in damage was done by burning one ton of leaves [Iowa Department of Environmental Quality, 1982]. According to the CPI, \$16.93 in 1967 is the same as \$93.27 today. According to an interview with Brian Heath, the city of Cedar Falls collected 955 tons of leaves last year. With a burning ban roughly 30% more leaves would be collected [Heath, 2003]. This means that 286 more tons will be collected, and not burned. So right

now the 286 tons of leaves that are burned cost \$26,675.00 in property damage each year in Cedar Falls. Also according to Kohn, in 1967 the burning of leaves cost \$250.00 in damage every year to streets [Kohn, 1967]. According to the CPI, \$250.00 is equal to \$1377.00 today.

The last and major source of money saved by a burning ban is composting. If a composting site were built, the amount of money saved would more than cover the cost of the site. Kohn stated that one ton of leaves composted is worth \$40.00 [Novick, 1971]. This was in 1967. Adjusting the figure by the CPI gives a current value of 1 ton of composted leaves equal to \$220.36<sup>1</sup>. If there are 1200 tons of leaves composted at the composting site and the value per ton is \$220.36, then the total value of the compost is \$264,432.00. Leaves, however, do not retain their original weight when composted; they lose some of it. So if leaves lose half their weight during composting, then the total value of compost would be \$132,216.00. I performed a sensitivity analysis on the percentage of leaves that turn to compost. If leaves retain only 25% of their original weight, then the value of compost would be \$66,108.00. If leaves retain only 10% of their weight, then then compost would be worth \$26,443.20.

The total benefit per year of a burning ban is \$220,268.00 (see Equation 2).

## EQUATION 2

### Benefit Computations

\$144 Million in Asthma Costs  
200,000 Asthmatics in Iowa  
 $144\text{mil}/200,000 = \$720$  per person  
36,145 Residents of Cedar Falls  
7.1% of Iowans Have Asthma  
 $36,145 * 0.071 = 2566$  Residents  
2500 Hundred Residents With Asthma Used  
 $2500 * 720 = 1.8$  Million Spent on  
Asthma Costs in Cedar Falls p/yr  
Burning Season 2 Months  
 $1.8\text{mil} * (1/6) = \$300,000$  in Asthma Costs During These Mos.  
20% Due to Leaf Burning  
 $300,000 * 0.20 = \$60,000$  In Costs Due to Leaf Burning

286 Tons of Leaves Burned in C.F.  
 \$93.27 Damage Per Ton of Leaves  
 $286 * 93.27 = \$26,675$  Property Damage

\$1377 Street Damage Done p/yr

1200 Tons of Leaves Will be Collected With Ban  
 ½ Turned to Compost  
 \$220.36 Is the Value of 1 Ton of Composted Leaves  
 $600 * 220.36 = \$132,216$  Value of Composted Leaves to City

132,216 Value Mulched Leaves  
 60,000 Asthma Costs  
 26,675 Property Damage  
 1,377 Street Damage

**\$220,268 in Benefits Yr 1-10**

The total benefit for the next ten years, discounted at 7%, is equal to \$1,547,070.00 (see Appendix). These figures are based on the assumption that the population will not increase, the wage rate will not increase, and the number of asthmatics in the area will not increase over the next 10 years even though “asthma increases 12% annually in the United States” [Nolte, 2001, 22].

#### **IV. Conclusion**

The present value of benefits minus the present value costs gives the net present value. If the value is positive, than a burning ban should be enacted in the city of Cedar Falls; if the value is negative, than a burning ban shouldn't be enacted unless cheaper methods of leaf disposal are found. The present value of benefits (\$1,547,070.00) minus the present value of costs (\$558,712.00) gives a net present value of +\$988,358.00. Therefore it would be beneficial if the city of Cedar Falls imposed a burning ban on the city, (see Appendix).

The sensitivity analysis uses different percentages of leaf decomposition in the composting benefits. The outcome of the sensitivity analysis concluded that by using 25% of the leaf weight as final compost

weight yielded an outcome of +\$524,043.09 and using 10% of original weight, an outcome of +\$245,454.13. Again, a burning ban would be beneficial for the city of Cedar Falls.

It should be noted that taxes might increase to pay for a burning ban in Cedar Falls and the residents will experience a dead weight loss from the tax. This is probably a small cost and should not affect the outcome of the study. It will also be noted that the number of fires that the fire crew responds to due to leaf burning will also go down and therefore money will be saved. The residents of Cedar Falls will be better off implementing a burning ban.

**Appendix**

**Cost Benefit Study for the City of Cedar Falls, Iowa - 2003  
Leaf Ban Project**

Time	0	1	2	3	4	5	6	7	8	9	10
Undiscounted benefit	0	220268	220268	220268	220268	220268	220268	220268	220268	220268	220268
Undiscounted cost	144040	59040	59040	59040	59040	59040	59040	59040	59040	59040	59040
Present value of benefits	0	205857.94	192390.6	179804.3	168041.4	157048	146773.9	137171.84	128197.98	119811.2	111973.1
Total PVB		1547070.3									
Present value of costs	144040	55177.57	51567.823	48194.23	45041.333	42094.7	39340.84	36767.145	34361.818	32113.85	30012.94
Total PVC		558712.25									

r = .07

Net present value = PVB - PVC = \$988,358

TB/TC 2.7689929 For every dollar spent towards a leaf ban, \$2.76 is made in return  
 Present Value Benefits equals the Sum of Benefits at time (t) divided by (1+r) to the t power  
 Present Value Costs equals the Sum of Costs at time (t) divided by (1+r) to the t power  
 Net Present Value (NPV) equals Present Value Benefits (PVB) - Present Value Costs (PVC)

$$\sum \frac{B(t)}{(1+r)^t} \text{ PVB Equation} \qquad \sum \frac{C(t)}{(1+r)^t} \text{ PVC Equation}$$

**EQUATION 3: Annual Cost of the Burn Ban**

40,040 Cost to City with Burn Ban  
 15,000 Cost of Maintenance for Building  
4,000 Cost in Purchased Bags

\$59,040 Years 1-10 cost

### **Endnotes**

1. Alternately, one could compare the price of composted leaves to the price of peat moss, as was done by Kohn. The price of peat moss at Wal-mart was \$4.97 for a 50-pound bag. There are forty 50-pound bags in a ton, so by this methods, a ton of compost would be worth \$198.80.

### **References**

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