

Vanderbilt University Humanities 161

Individual Behavior, the Tragedy of the Commons, and Environmental Sustainability

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The Tragedy of the Commons

- ❑ **Garrett Hardin, 168 Sci. 1243 (1968)**
- ❑ **Ten Rational Herders (RHs A -- J)**
- ❑ **One Common Grazing Area**
- ❑ **Congested Resource**
- ❑ **RH A's benefit = +1**
- ❑ **RH A's cost = -1/10**

The Tragedy of the Commons

- ❑ **RH A's Payoff is $1 - 1/10 = 9/10$**
- ❑ **Response of A**
- ❑ **Responses of B - J**
- ❑ **Individually Rational**
- ❑ **Collectively Deficient**

The Tragedy of the Commons

- ❑ **Collective Action Problems**
- ❑ **Exceedence of Carrying Capacity**
- ❑ **The Actual v. Hypothetical Commons**
- ❑ **Societal Options**

Potential Sources

- ❑ **Large Industrial Sources**
- ❑ **Small Businesses**
- ❑ **Agriculture**
- ❑ **Individual Behavior**

Traditional Regulatory Focus

- ❑ **Large Industrial Facilities**
- ❑ **Wastewater Treatment Plants**
- ❑ **Toxic Chemicals**
- ❑ **Automobile Tailpipe Emissions**

Individual Behavior as a Source Category

- **Defining Individual Behavior**
 - § **Sole Individual Control**
 - § **Sole Product Manufacturer Control**
 - § **Mixed Individual and Product Manufacturer Control**

The Challenge of Individual Behavior: Leading Sources of Dioxin 1987 ^[1]

1987 (gTEQ/y)		
1.	Municipal solid waste incineration, air	8,877
2.	Medical waste incineration, air	2,590
3.	Secondary copper smelting, air	983
4.	Backyard barrel burning, air	604
5.	Bleached pulp and paper mills, water	356
	All others	<u>585</u>
Total		13,995

^[1] Data from NAS Dioxin Study Table A-28 (2003) (source totals have been rounded to the nearest whole number).

The Challenge of Individual Behavior: Leading Sources of Dioxin 1995 ^[1]

1995	
Municipal solid waste incineration, air	1,250
Backyard barrel burning, air	628
Medical waste incineration, air	488
Secondary copper smelting, air	271
Cement kilns	156
All others	<u>459</u>
Total	3,252

^[1] Data from NAS Dioxin Study Table A-28 (2003) (source totals have been rounded to the nearest whole number).

The Challenge of Individual Behavior: Leading Sources of Dioxin 2002/2004^[1]

2002/2004	
Backyard barrel burning	628
Sewage sludge	77
Residential wood burning	63
Coal-fired utilities	60
Diesel trucks, air	36
All others	<u>243</u>
Total	1,106

[1] Data from NAS Dioxin Study Table A-28 (2003) (source totals have been rounded to the nearest whole number).

The Challenge of Individual Behavior: Leading Sources of Dioxin 1987-2004^[1]

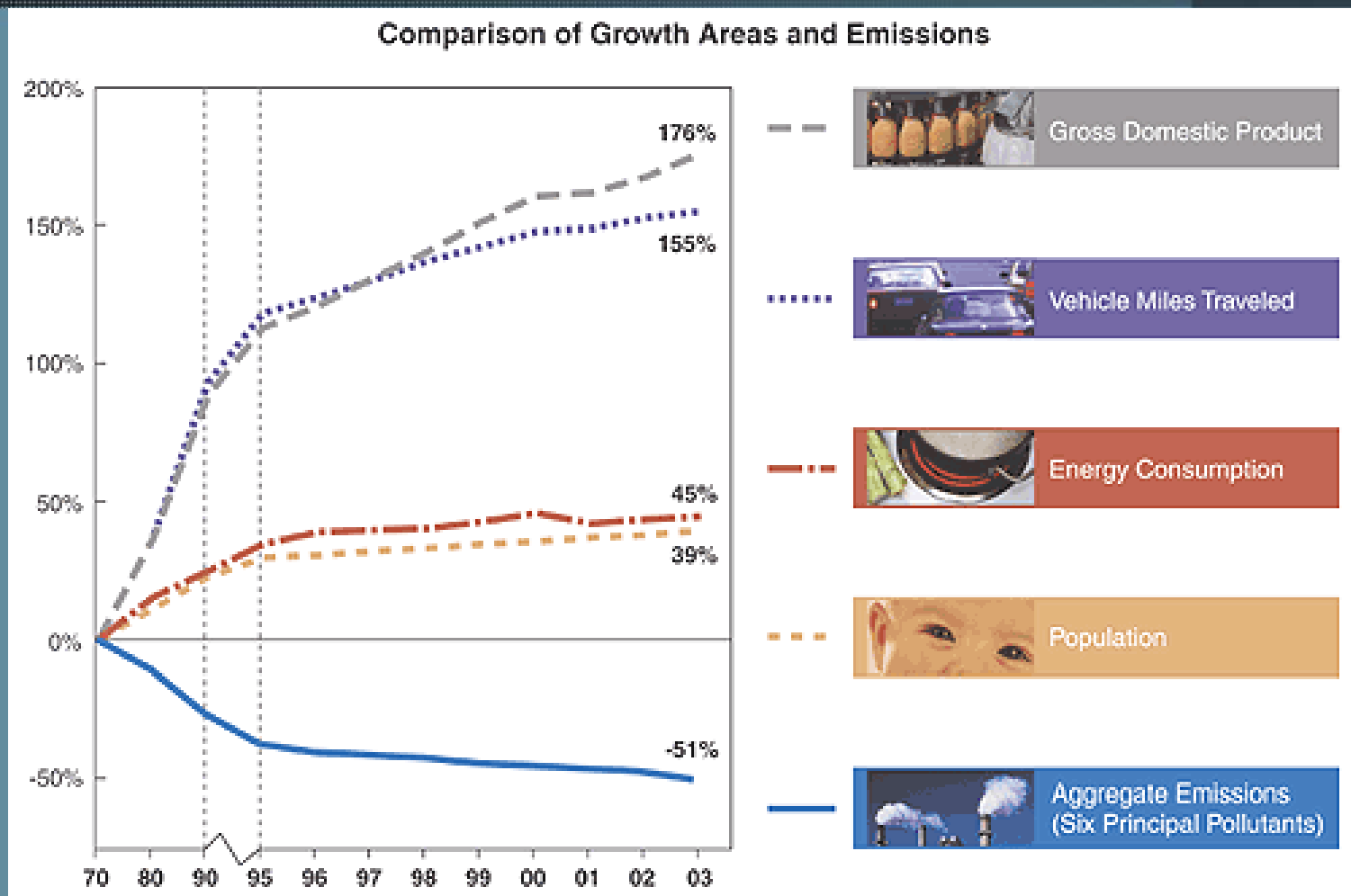
1987 (gTEQ/y)			1995		2002/2004	
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Total		13,995	Total	3,252	Total	1,106

[1] Data from NAS Dioxin Study Table A-28 (2003) (source totals have been rounded to the nearest whole number).

Sources of Other Air Toxics (in tons)

Emissions	Individual	Large	Individual	
Type	Amount	Industries	Combined	Percentage
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
		Amount	Total	Of Total
Acetaldehyde	20,598	6,410	27,008	76.3%
Benzene	203,751	4,092	207,843	98.0%
Formaldehyde	<u>54,489</u>	<u>5,765</u>	<u>60,254</u>	<u>90.4%</u>
Total	278,838	16,267	295,105	94.5%

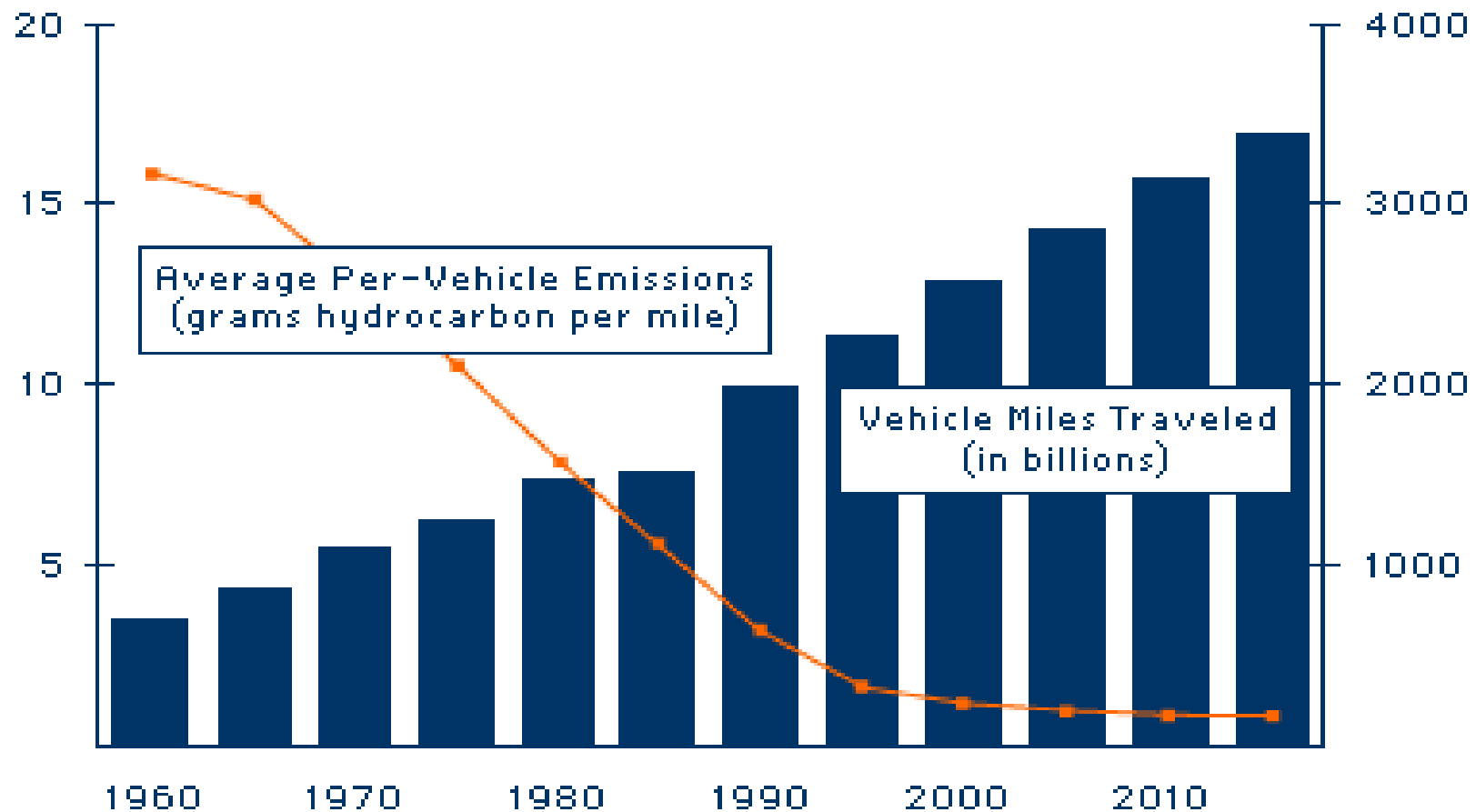
EPA Air Trends



Source: *Air Emissions Trends - Continued Progress Through 2003*
<http://www.epa.gov/airtrends/econ-emissions.html>

The Challenge of Individual Behavior

Cars Are Getting Cleaner, but People Are Driving More



Estimated Ozone Precursor Emissions from Individuals

- Almost 13 million tons/year nationally, or 30.6% of total emissions. Individual sources include:
 - On-road motor vehicles (private cars and light trucks)
 - Non-road motor vehicles (atvs, recreational marine, lawn & garden)
 - Residential electric use (35.7%)
 - Consumer product use
 - Backyard burning

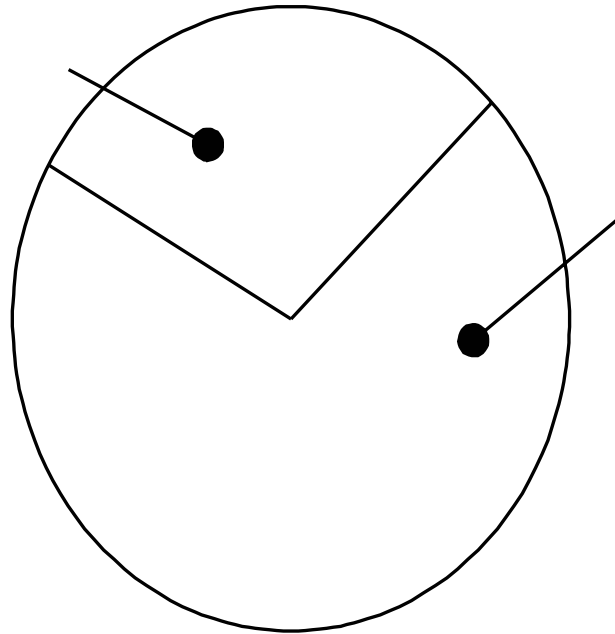
Individual Behavior as a Source Category

Source	Individual Amount	Share of Individual Amount	Individual Share of Total
<i>On-Road Vehicles</i>			
Cars		33.1%	10.7%
Light Duty Trucks		25.0%	7.6%
Subtotal	7,539,600	58.1%	17.7%
<i>Non-Road Vehicles</i>			
Marine Recreation		5.1%	1.6%
Lawn/Garden		8.0%	2.4%
Other Recreational		1.9%	0.6%
Subtotal	1,945,400	15.0%	4.6%
<i>Fuel Combustion/Electrical Utilities</i>			
Residential		16.6%	5.1%
Subtotal	2,155,200	16.6%	5.1%
<i>Consumer Product Use</i>			
Consumer Solvents		8.5%	2.6%
Pesticide Application		0.2%	0.1%
Architectural Coatings		1.6%	0.5%
Subtotal	1,339,700	10.3%	3.2%
Grand Total	1,297,700	100%	30.6%

Low-Level Ozone or Smog

Los Angeles Area

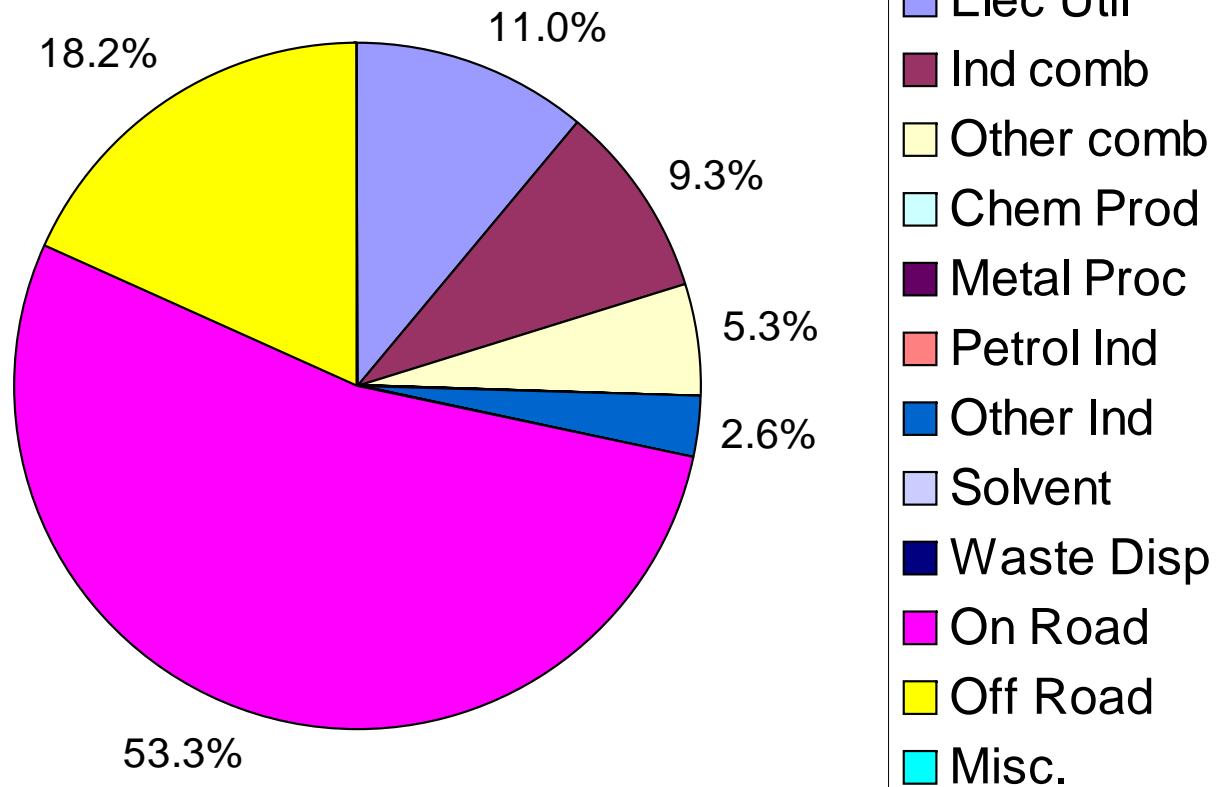
**Stationary
Sources
20%**



**Mobile
Sources &
Consumer
Products
80%**

1999 NO_x Emissions in Nashville EAC (352 tpd)

1999 NO_x Emissions in Nashville EAC (352 tpd)



Middle Tennessee Survey Results:

Activities respondents identified as having changed in response to poor air quality

	PERCENT MENTIONED
None or No Action	77.2
Go outdoors less	11.6
Other (not on list)	4.9
Walk	3.9
Carpool	1.5
Combine trips	1.1
Bike	1.0
Don't grill outside	0.8
Postpone lawn care	0.8
Reduce energy use	0.7

Implications, Part I

- **Interest Groups**
 - **Industry**
 - **Environmental Groups**
 - **The General Public**
- **Policymakers**
 - **Population and Economic Growth**
 - **Regulatory Standards**
 - **Zero-Sum Game**

Implications, Part II

□ Research

- What is the contribution of individual behavior?
- What influences individual behavior?
- What is the role of government?
- What are the roles of other source categories?
- What are the roles of interest, civic, religious and other groups?

Implications, Part III

□ Government

- Focus on all source types
- Focus on norm change
- Focus on measuring changes in behavior
- Add procedural protections
- Create incentives for cross-source initiatives