



Biofuels and the Environment: Getting from Here to There

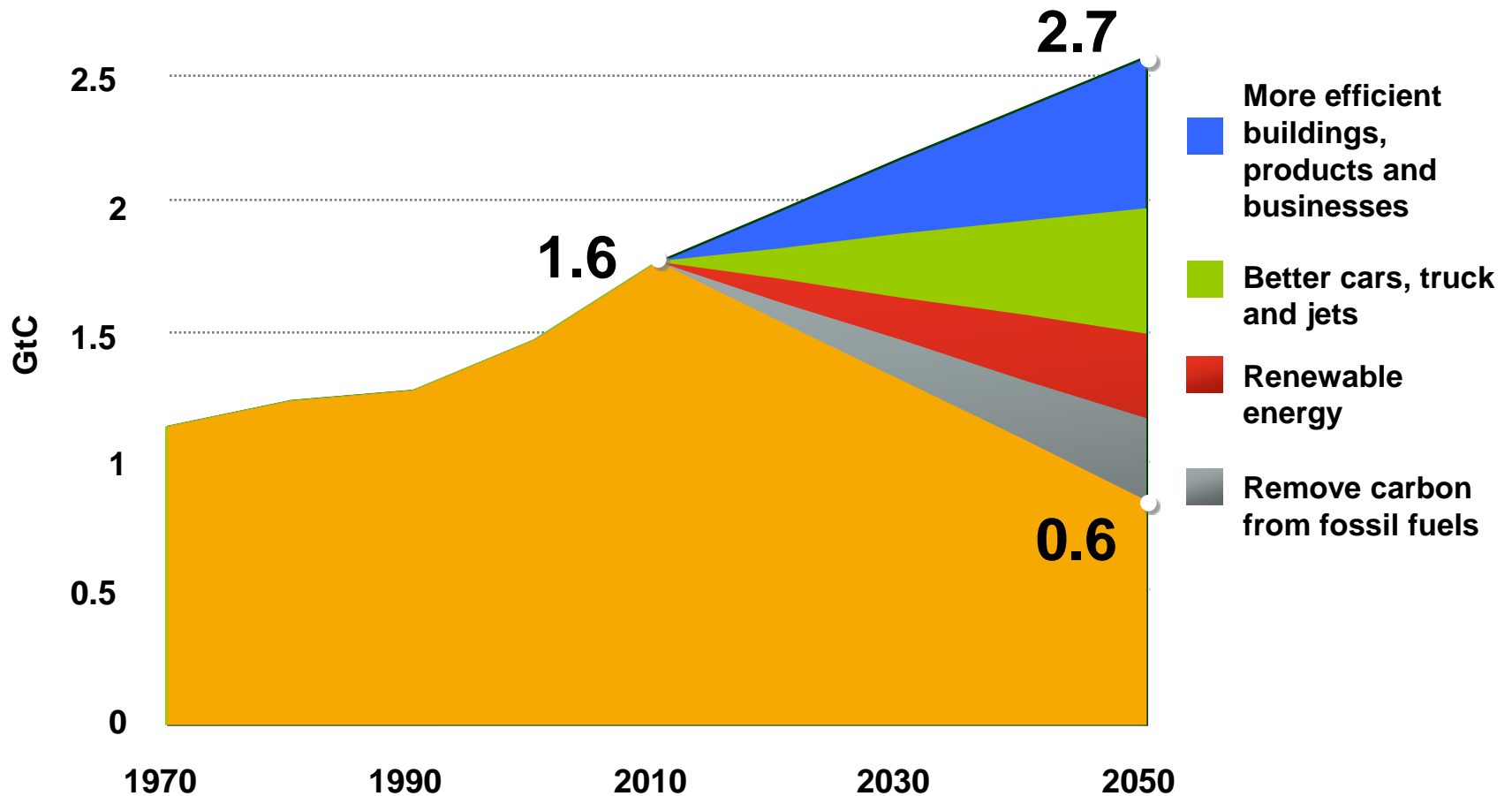
Nathanael Greene

March 28, 2007



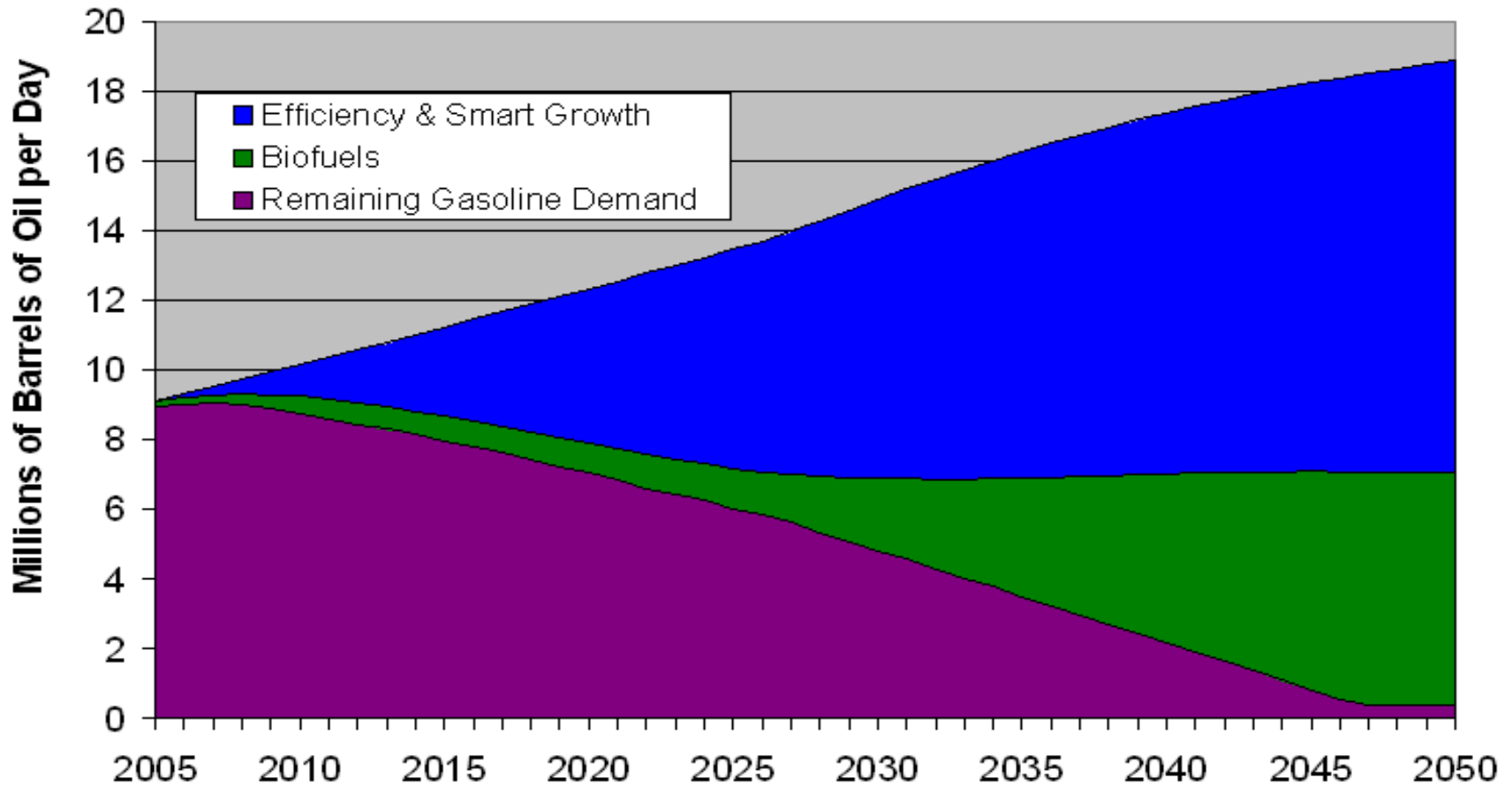
Natural Resources Defense Council

We Need Big Solutions, Fast, and Lots of 'em



- US must contribute a 60-80% reduction in GHG emissions
- Renewables can provide about 1/5 of these reductions
- Biofuels can provide about half of the renewables wedge

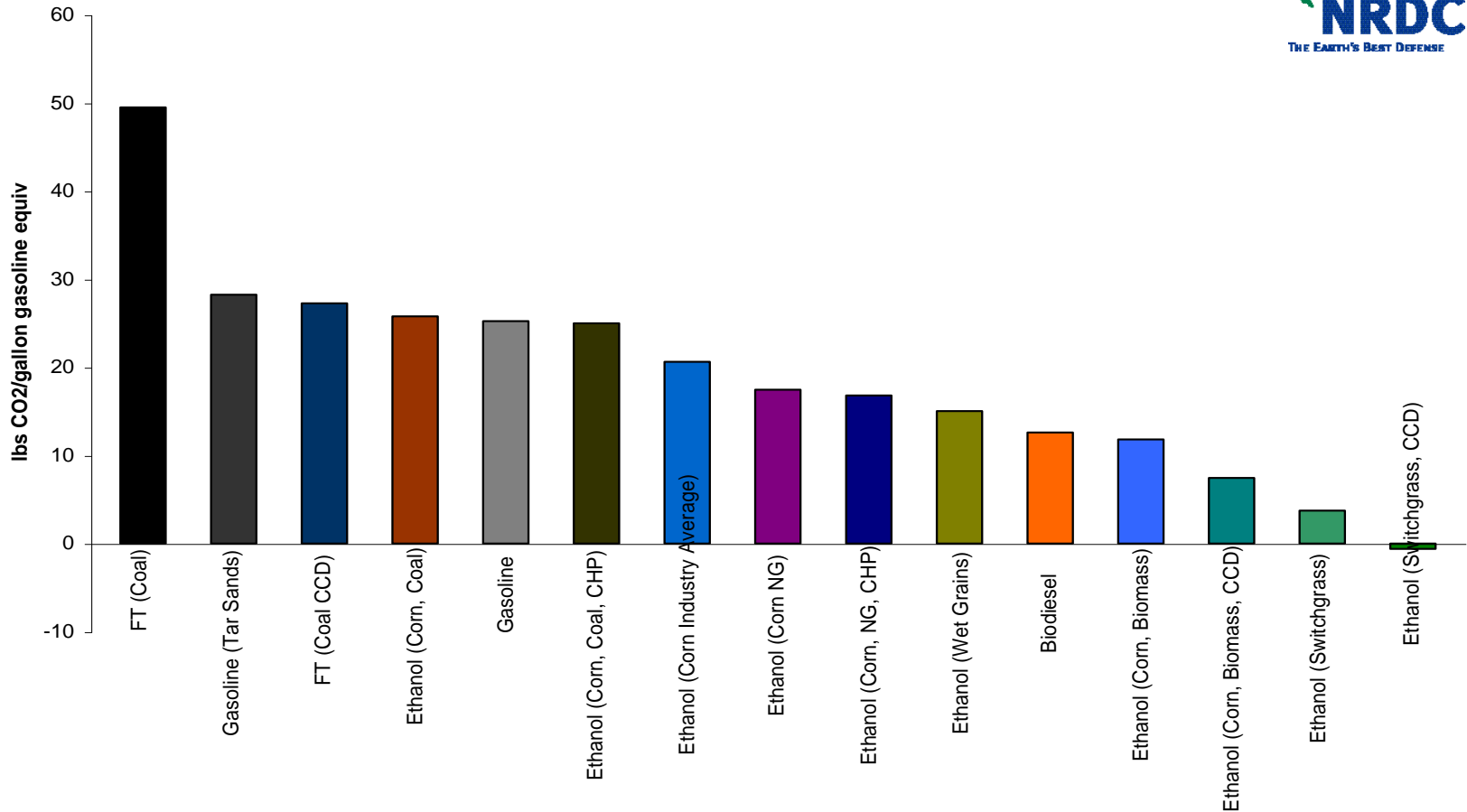
We Can Virtually Eliminate Our Demand for Gasoline by 2050



- To get to very large contributions from biofuels (e.g. ~150 Billion gallons) we need to evolve to diverse lignocellulosic feedstocks

We Can Get Bigger Benefits from Corn Ethanol

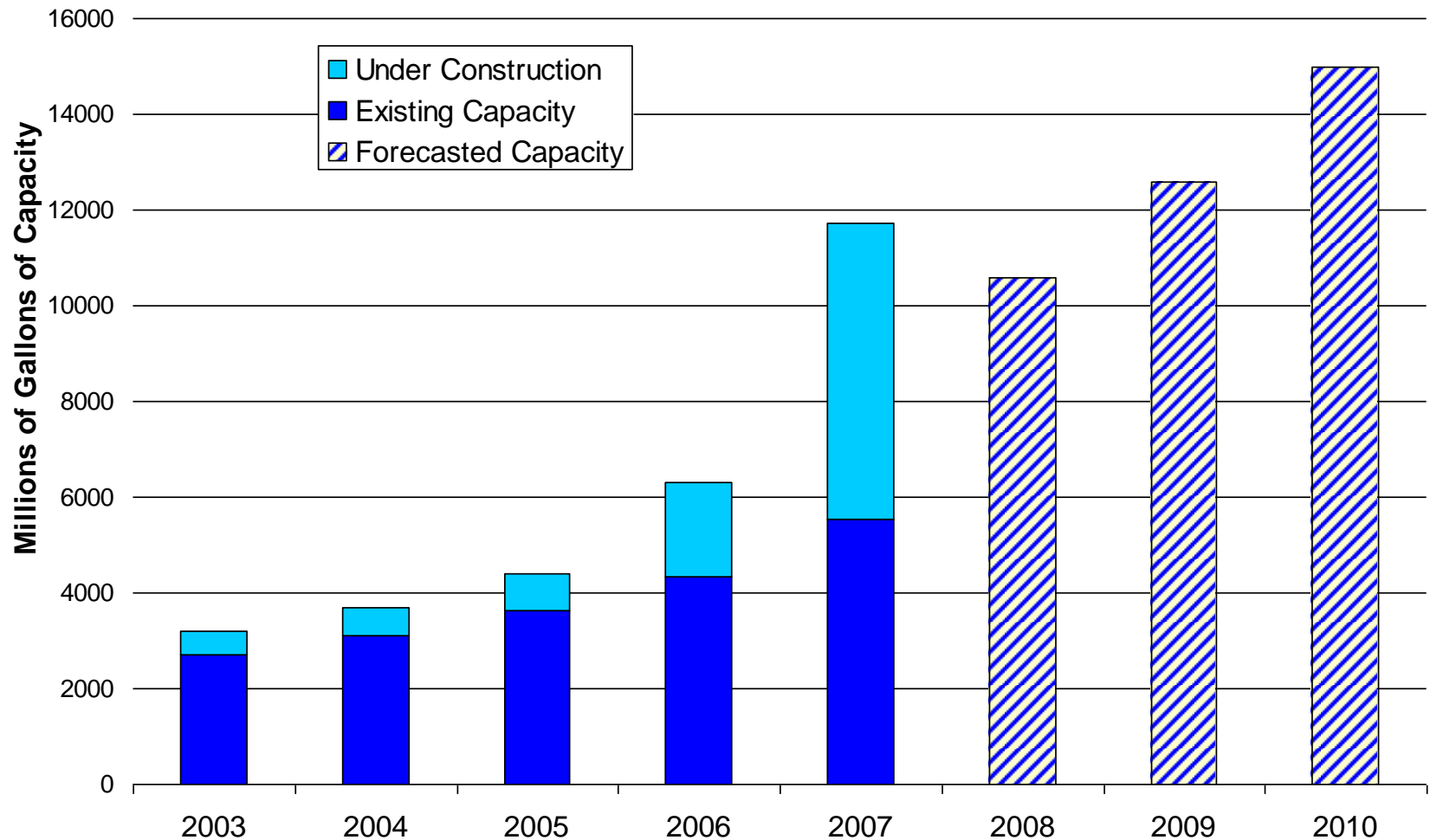
"Well to Wheels" CO2 Emissions from Alternative Fuels



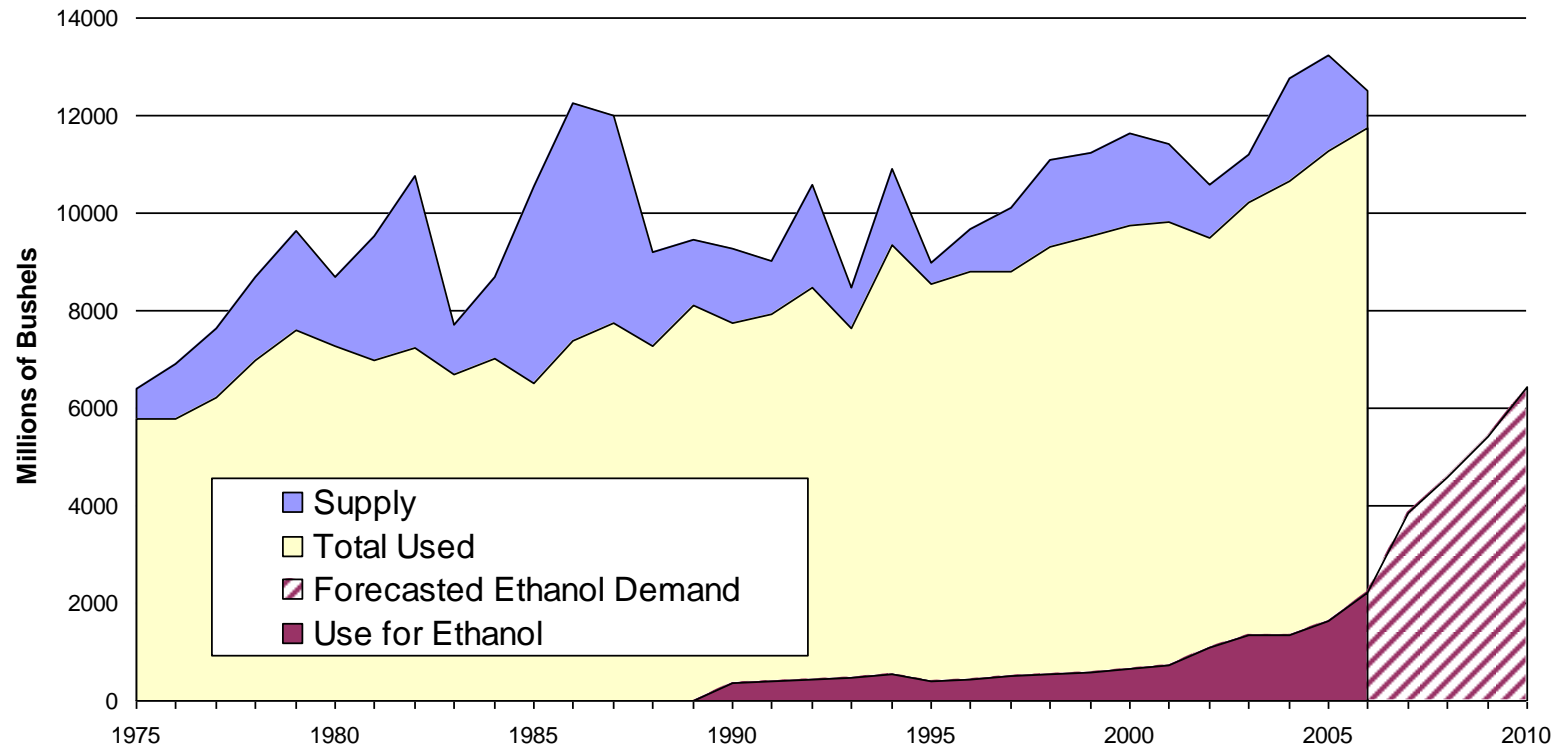
- But corn's role is technically and economically limited
- 15-20 billion gallons of corn ethanol will start to cause significant economic and environmental pressures

The Gold Rush Is on in Corn Ethanol

Explosive Growth in the US Ethanol Industry



Forecast: High Demand, High Prices, Short Supply



- Demand could reach 6.8 million bushels (>50% of total 2006 supply) by 2011
- High demand will cut/eliminate reserves, which will lead to high prices
- Demand for corn is already driving up price of other grains too

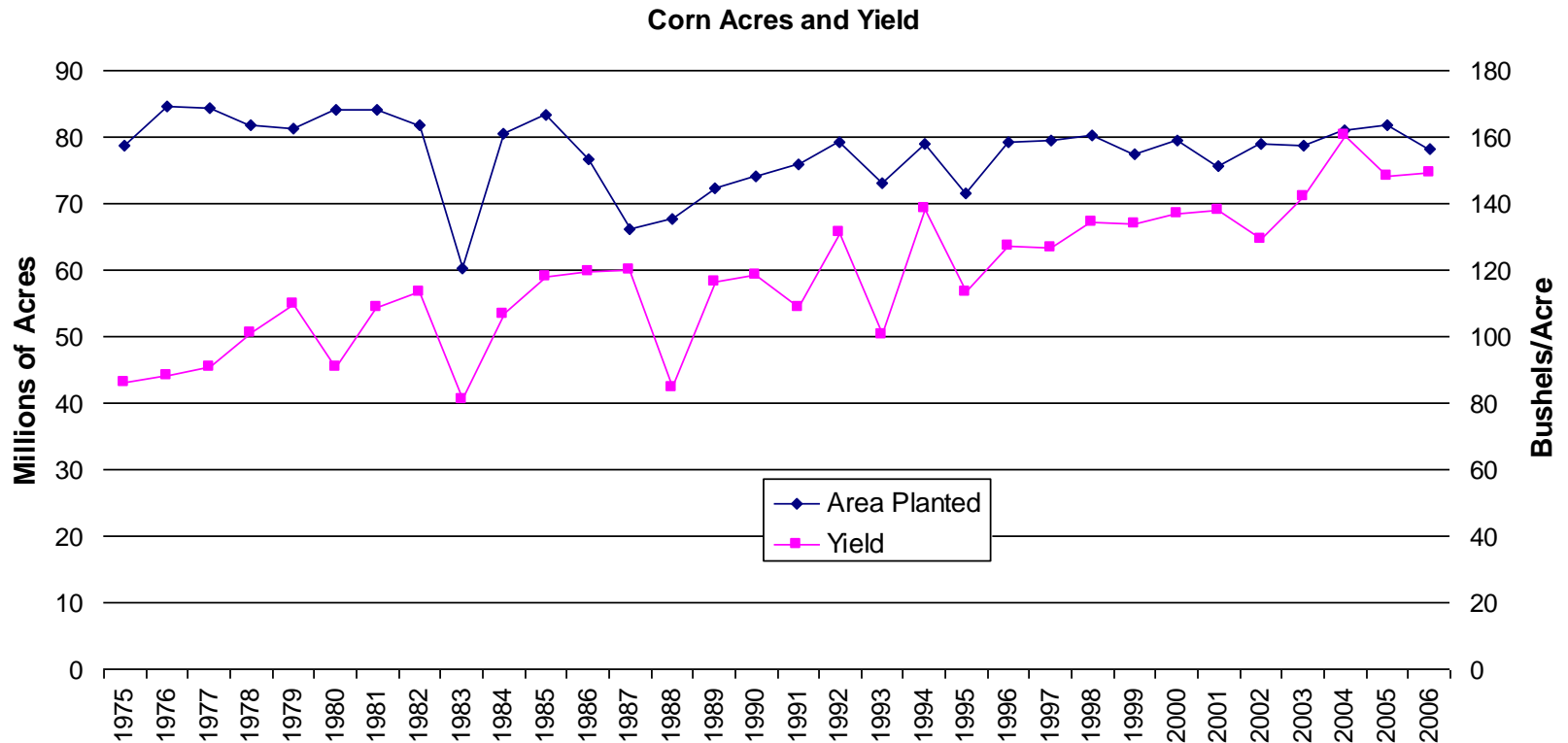
How Can We Meet Rapid Growth in Demand?

- Increase acres
 - Other crops, CRP, new land
- Increase yields
 - GMO, more inputs
- Meet less of other demands

Natural lands, marginal lands, & higher inputs

=

Disproportionate environmental impacts



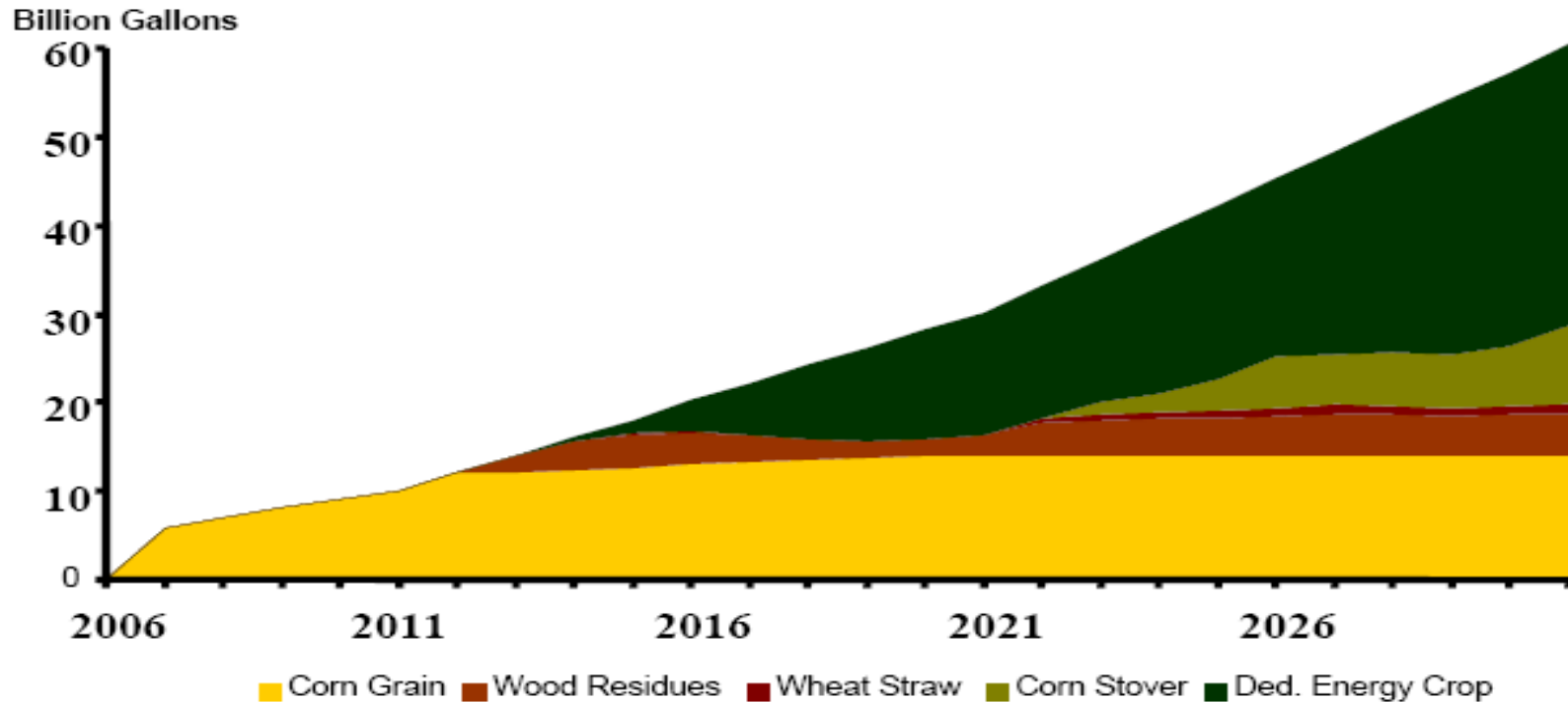
It IS the Speed that Will Kill You

		Baseline	2008 Production Scenarios		
			% Change from Baseline		
Billions of Gallons of Ethanol/Year		6.0	7.5	9.0	11.0
Corn Acreage	Mill. Acres	80.96	4.61%	9.19%	15.15%
Crop Acreage	Mill. Acres	314.26	1.19%	2.36%	3.85%
Acreage in CRP	Mill. Acres	36.68	-3.69%	-7.42%	-12.40%
P Lost to Water	Mill. Tons	0.55	1.52%	3.11%	5.18%
N Lost to Water	Mill. Tons	4.93	1.78%	3.50%	5.67%
Soil Erosion	Mill. Tons	1939.31	1.44%	2.94%	4.83%
Ag. GHG Emissions	MMTCE	92.10	1.77%	3.54%	5.84%

Source: WRI, Feb 2007

- National Corn Growers Association estimate that without disrupting food, feed, and export needs corn could provide between 15 and 20 billion gallons between 2015-2020
 - Reaching these levels sooner will mean bigger impacts
 - Shift to corn-corn from corn-soy rotation biggest single impact
 - Also drive soy production to Brazil (Amazon rainforest)

The Path to Lots of Gallons Is through Energy Crops



- Ugarte et al. December 2006
- Assumes cellulosic conversion technology commercial by 2012
- Assumes corn demand for EtOH never goes down
- No CRP land
- Biggest conversion is from pasture land to hay and dedicated energy crops

Easier to Maintain Habitat with Native Grasses

Habitat Type ^a	Number of Breeding Pairs per 40 ha	Total Number of Breeding Species	Number of Sites Sampled
Dense switchgrass	182	10	8
Poor switchgrass	178	9	8
Reed canary grass ^b	246	9	6
Mixed warm-season grasses	126	13	7
Corn	32	5	16
Beans	22	2	9

a: Habitat types were categorized as follows: reed canary grass sites were not monotypes—they were fields where reed canary grass was the most common grass species (cover values ranged from 15% to 97%); dense switchgrass sites had >40% cover of switchgrass and <4% cover of other warm season grasses; poor switchgrass sites had <40% cover of switchgrass and <9% cover of other warm season grasses; mixed warm season grass sites had >72% cover of native warm season grasses other than switchgrass; bean and corn sites were on commercial bean (spy or snap) or corn fields, respectively.

b: Reed canary grass ranked highest in bird density primarily due to the influence of the large number of red-winged blackbirds (*Agelaius phoeniceus L.*) that nest in it.

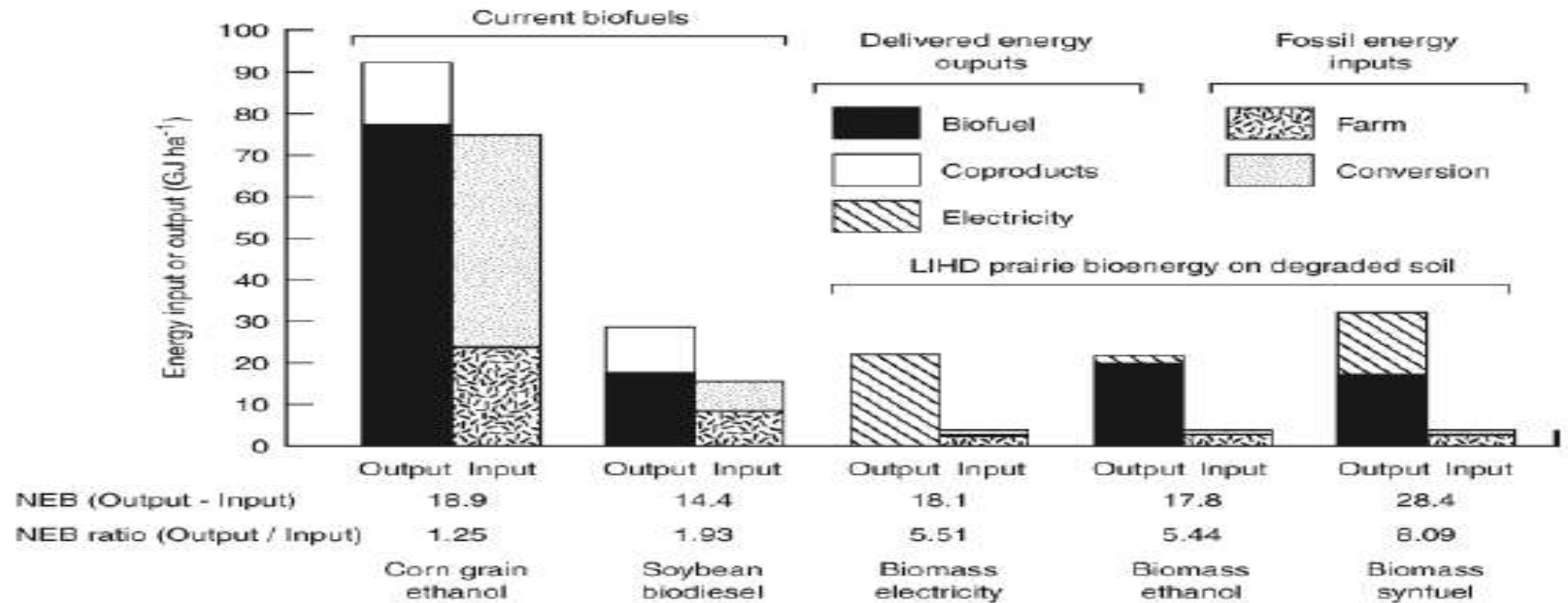
- But benefits can be undermined by
 - Converting natural forests and grasslands
 - Harvesting during the nesting season
 - Growing vast monocultures

Less Fertilizer, Better Uptake, Less Pollution

	Typical Nitrogen application (Kg/hectare/year)	Percent of typical Nitrogen application that ends up in runoff	Nitrogen Runoff (Kg/hectare/year)
Corn	135	58%	78.8
Soybeans	20	81%	16.25
Switchgrass	50	19%	9.7

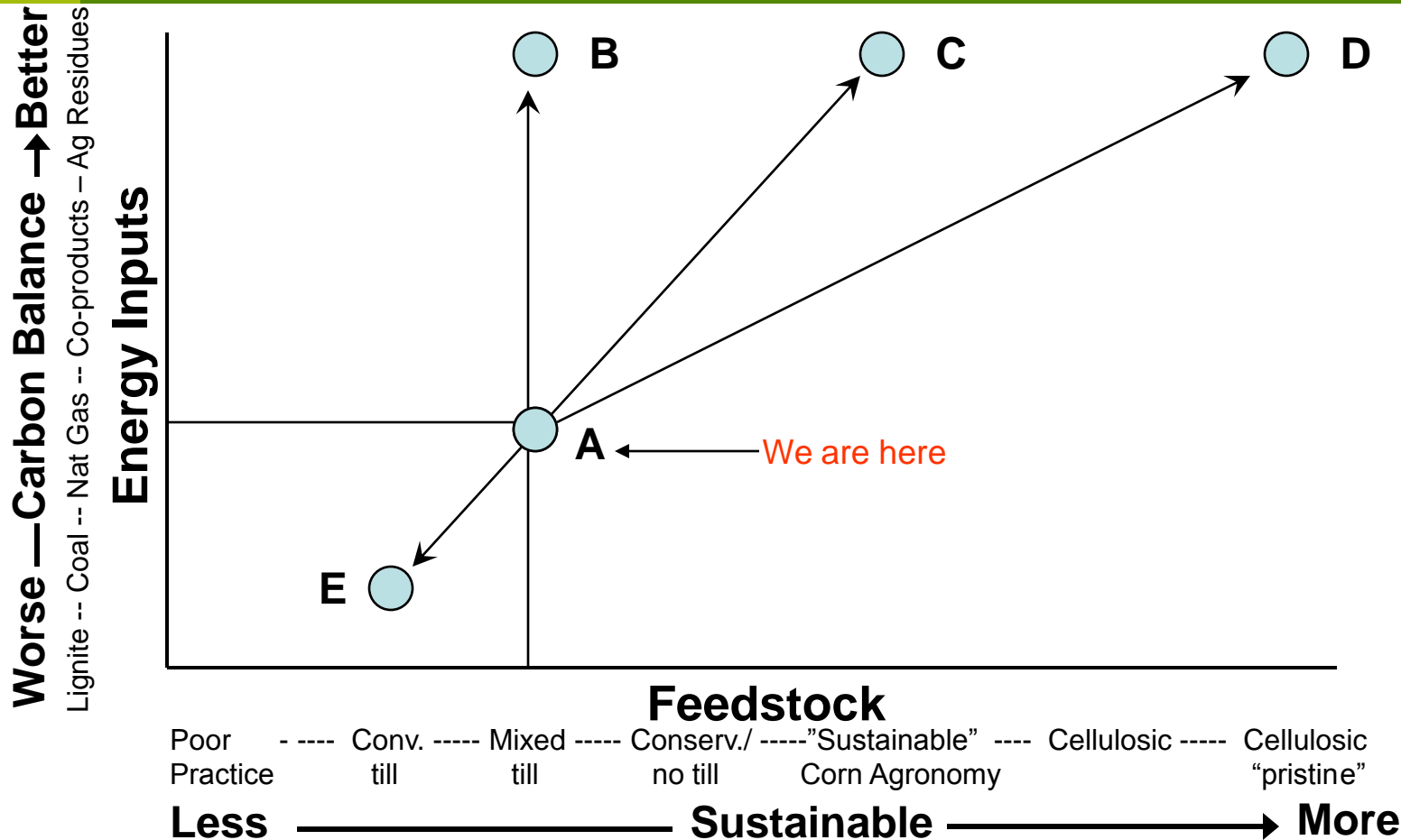
- But pressures to maximize yields may
 - encourage non-native species that become invasive
 - shift root mass to shoot mass
 - encourage aggressive fertilization
 - encourage irrigation in less productive climates

The Promise & Challenge of Low-Input, High-Diversity Perennial Grasses



- Tillman *Science* December 2006
- Same or better Net Energy Balance as corn EtOH from degraded nitrogen-poor sandy soil
- NEB ≠ high EtOH yields and need to be aware that not all forms of energy are created equal
- Shows promise of higher yields (dry tons) on better quality land

We Have to Choose Where Biofuels Will Go



A – Current state of US ethanol industry

B – A biomass powered corn ethanol plant (CVEC, CMEC, Panda, E³)

C – Biomass-powered corn ethanol w/ improved corn agronomy practice

Question: How can grass production complement corn production?

D – Low-carbon cellulosic inputs for feedstock and energy inputs [Max GHG benefit]

E – The wrong direction



The Gold Rush Is Creating a New Urgency

- Need to address the direct impacts of surging corn production
- Need to address the ripple impacts on other commodity crops and natural landscapes
- Need to speed development of next generation technologies
- Need to insert safeguards and performance standards for all biomass harvested for energy

The Farm Bill

- Promoting conservation on working lands
 - Make CSP available nationwide
 - Make CSP & EQIP more efficient
 - Make CSP & EQIP work for residue collection
 - Make CSP & EQIP work for groups of farmers that want to try energy crops (feedstock shed)
- Protecting CRP & sensitive/endangered landscapes (sod-busters & swamp-busters)
 - Maintain # of acres and focus on more sensitive acres
- Promote RD&D of energy crops and technologies
 - Make sure crop practices and logistics come along with conversion

Beyond the Farm Bill

- More biofuels and more efficient vehicles
 - CAFE or some other approach to increasing vehicle fuel economy performance
- RFS or Low-Carbon Fuel Standard
 - Large, long-term commitment
 - Move beyond the blend-wall
 - Force the investment in infrastructure
 - Strong incentive for low-carbon fuels
 - Land-use safeguards
- Incentives for better environmental performance
 - Soil, water, air, wildlife

Not Choosing Is Not an Option

- NRDC is convinced that biofuels can be done right and at a scale to contribute to stopping global warming
- Urgency of global warming means we have to act now
- We need to be honest and open about the potential impacts
- Our chance to set the rules for the market is now
 - Need to make greenness a central part of competition
- Federal, state and local policy is all critical
- We need to work together

