Evolving Agricultural Supply Chains

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By Dr. William W. Wilson
University Distinguished Professor
William.Wilson@ndsu.edu
701 231 7472

Dept of Agribusiness & Applied Economics

North Dakota State University

Fargo, USA

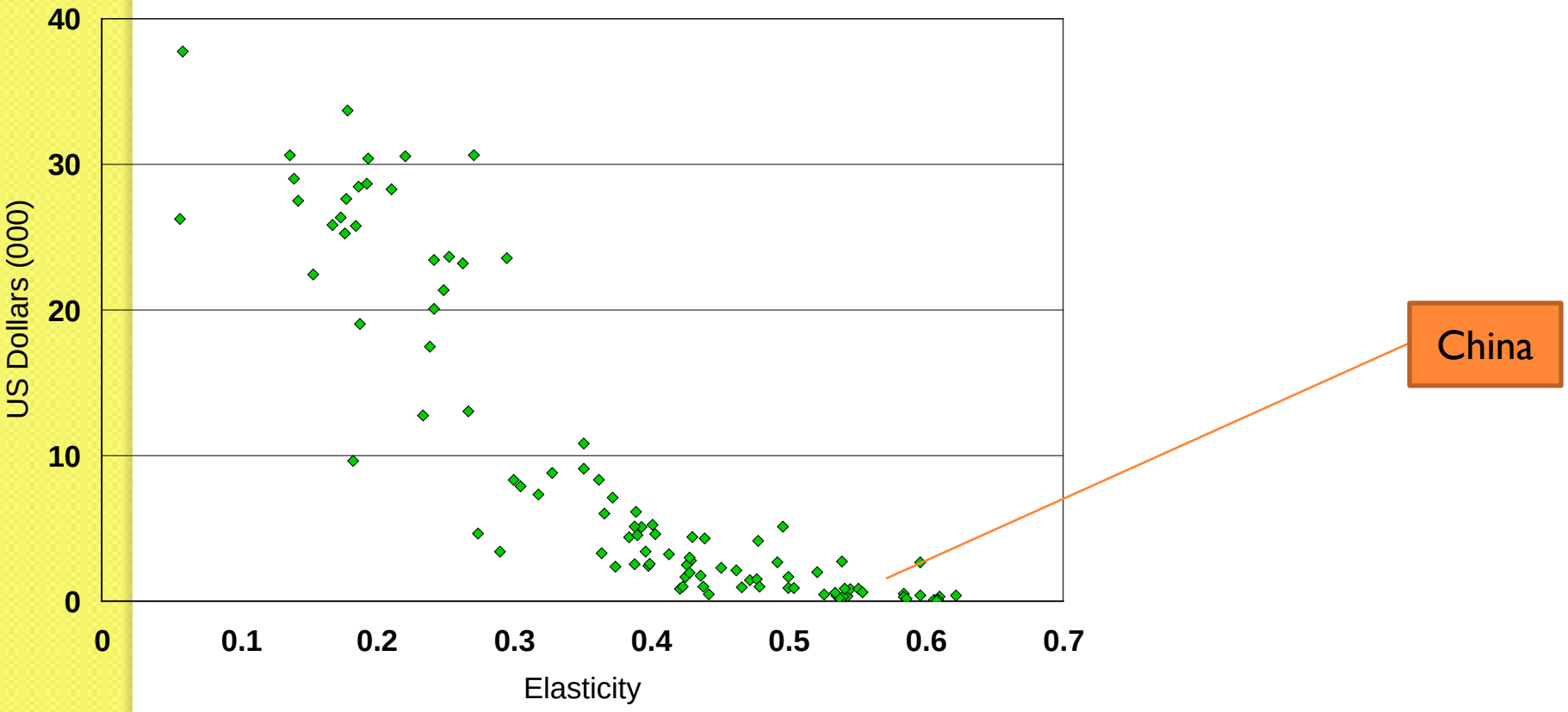
Organization

- Macro drivers to changes in agricultural marketing
  - Implications for global investments
- Supply Chain Management in Agriculture:
  - Principals and implications for market participants
- Facilitating Mechanisms of Efficiency Gains in Supply-Chain Management
  - Examples of mechanisms to improve efficiency of supply chains
- Implication for Investment and Strategy
  - Infrastructure and management

Macro drivers to changes in agricultural marketing

- Global supply and demand
  - Demand growth exceeds productivity growth
  - China
  - Brazil
  - FSU
- Biotechnology—change in trend, geography, future traits, wheat, US vs. ROW
- Change in geography of production and trade
  - Partly in response to biotechnology
  - More cropping alternatives
- Biofuels—35% of corn area in US is now supporting ethanol
- Volatility---more risky—examples of losses/gains
- Sophistication of industry, particularly buyers

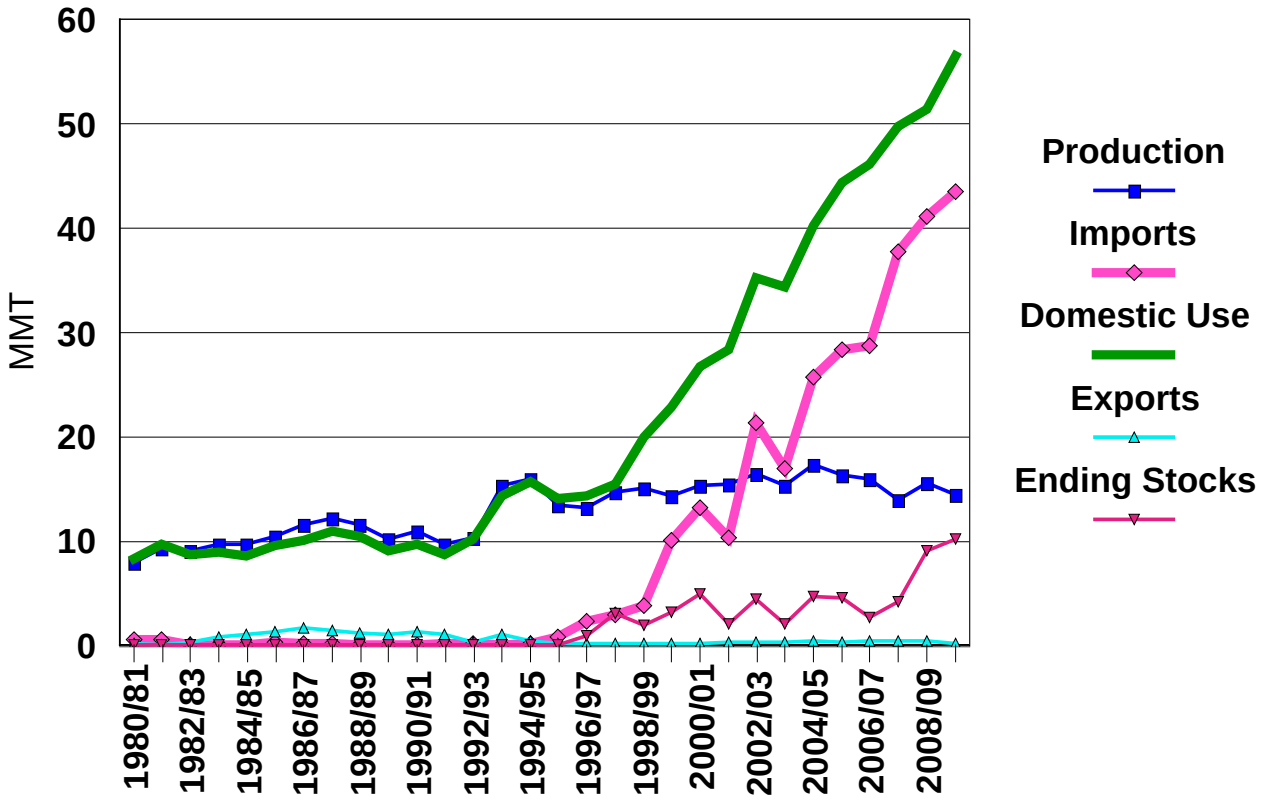
Where does the growth come from?



- Urbanization and population demographics
  - Result in irreversible changes in diets
- Income growth and impacts of large income elasticities (% ΔD/% ΔI)
  - China: .47 vs. US <.15
  - NAfrica, SE Asia, S Africa also have relatively large income elastiticies of demand for soybeans

China Soybean Supply Demand

- Near nil growth in production
- Rapid growth in consumption driven by increase in income, urbanization and changes in diets
- Imports now at 42 mmt
- Recent changes in imports is exhausting most world soybean production in recent years
- *Projections have this increasing to 52 mmt by 2010/11*

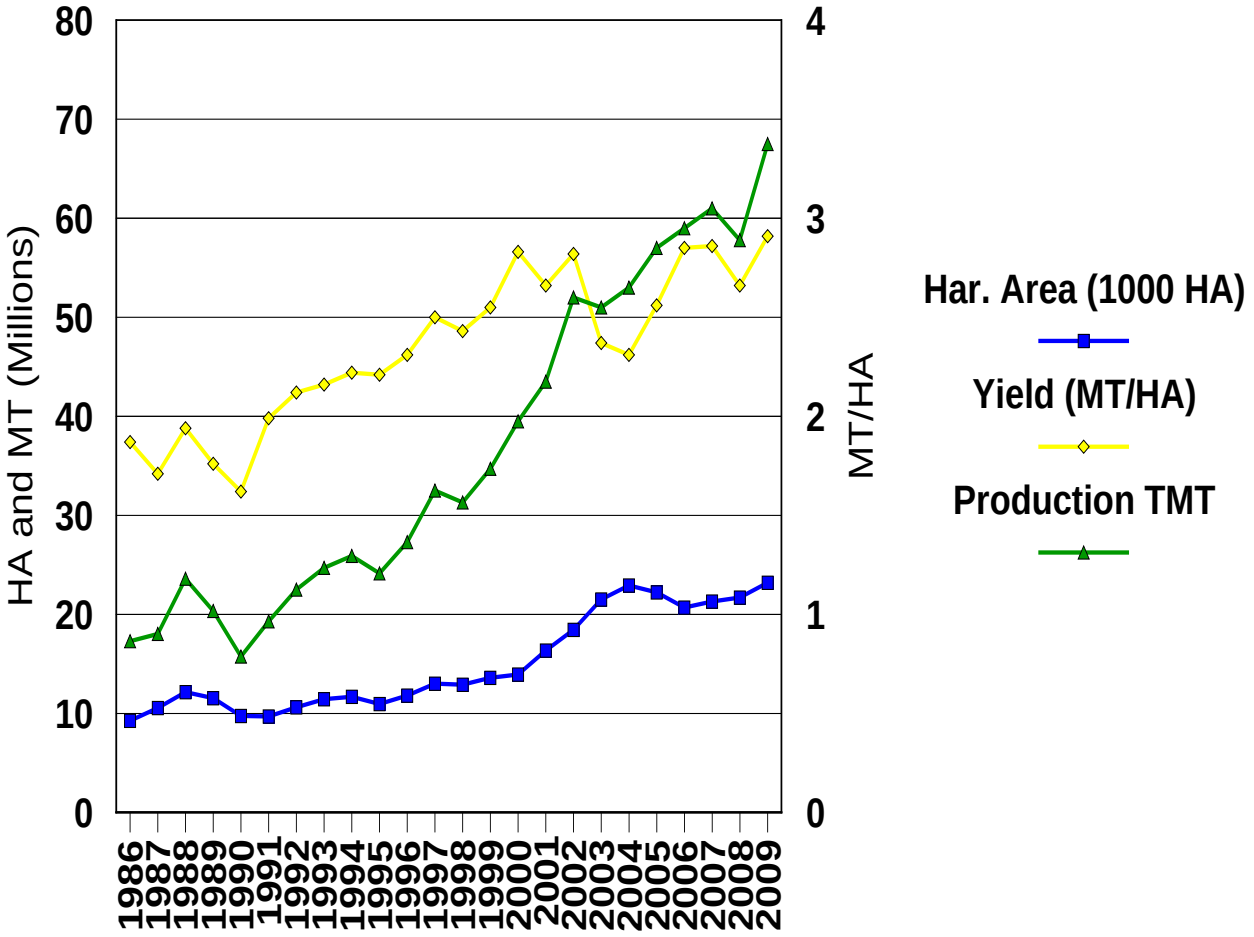


Supplies: Selected Changes--

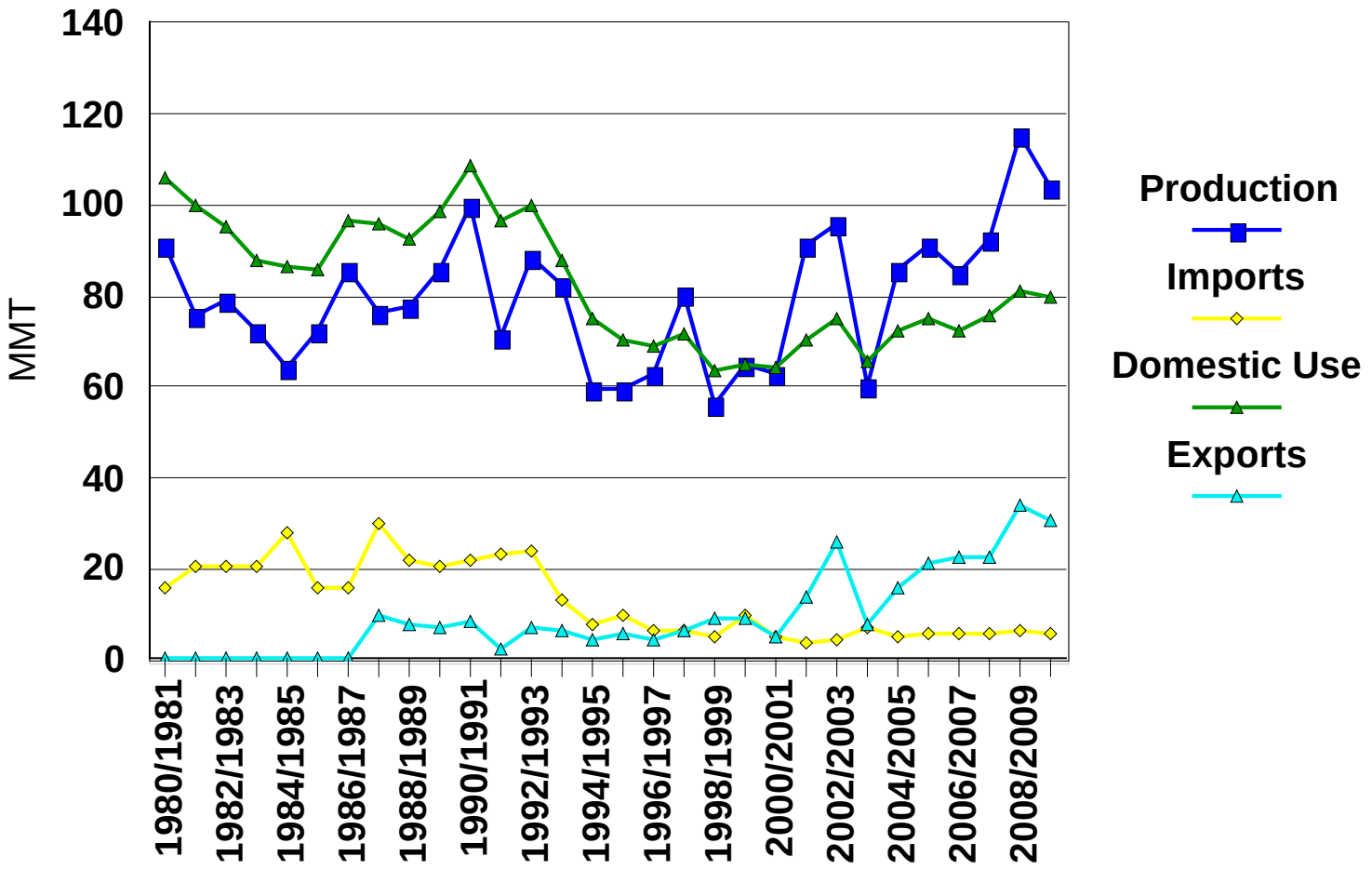
- Changes in geography

Brazil Soybean Supply and Demand

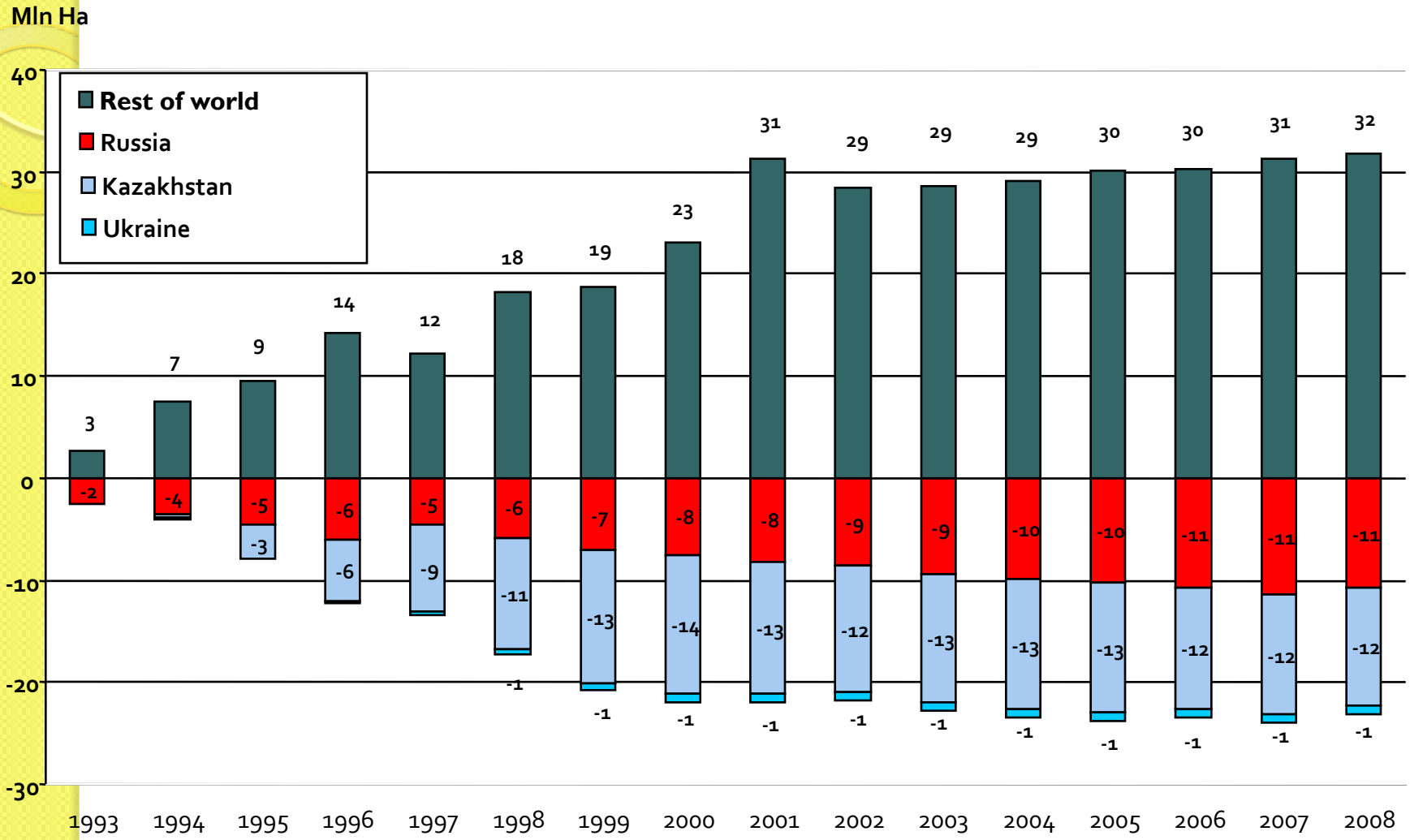
- Rapid growth in production
- Yields growth accelerated after 2004
- GM tech adopted legally in 2004; and followed by legislation to allow research on GM crops.
- Future limits related to logistics: cost, availability and congestion



FSU Wheat Supply Demand

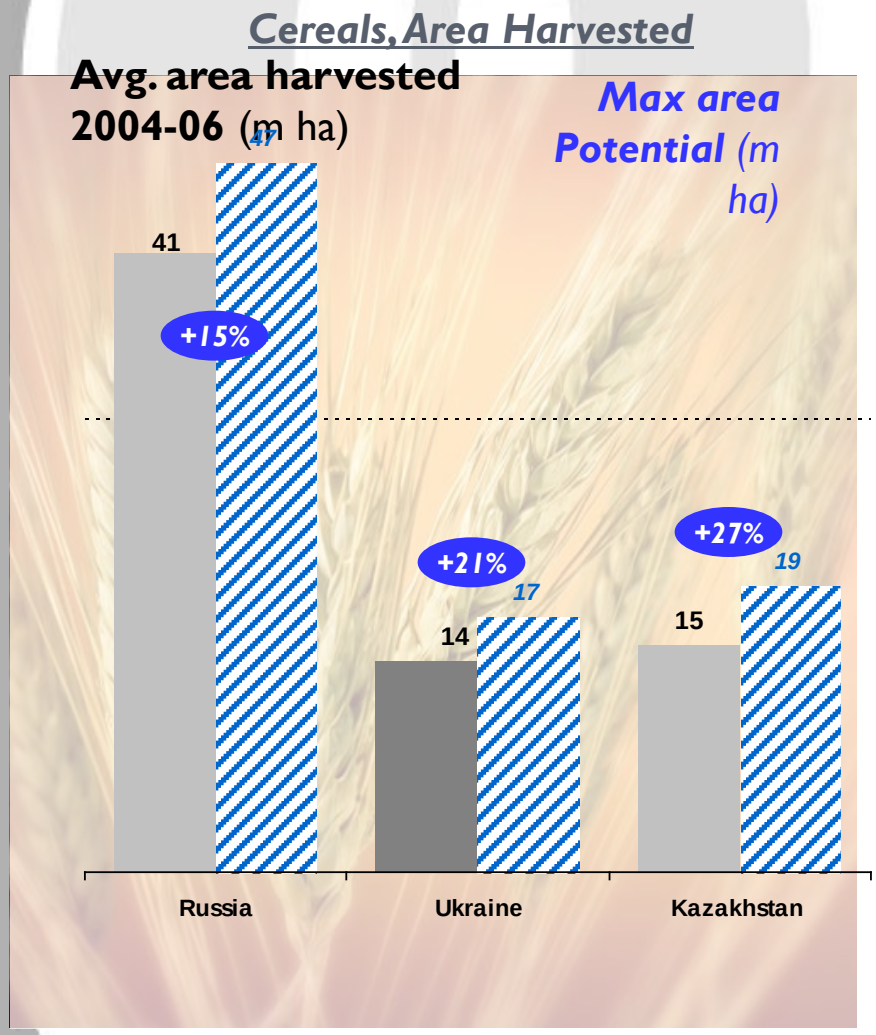


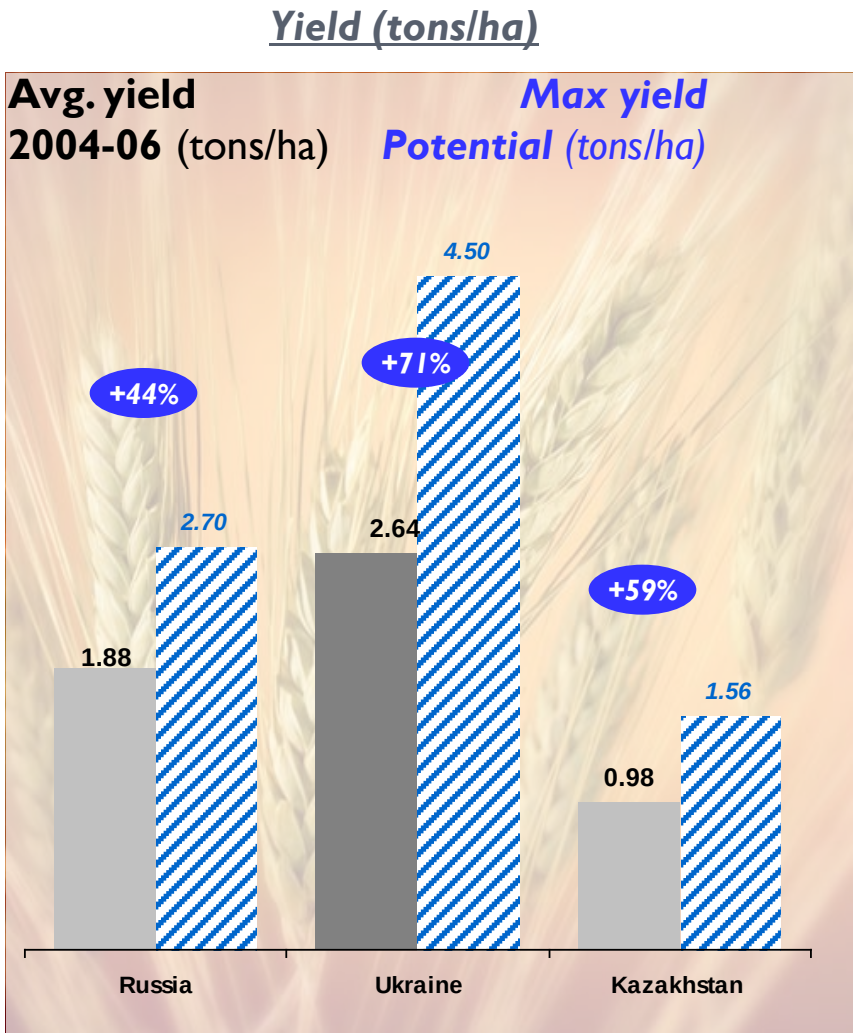
World' gain and FSU Black Sea' loss of arable land, 1992=100%



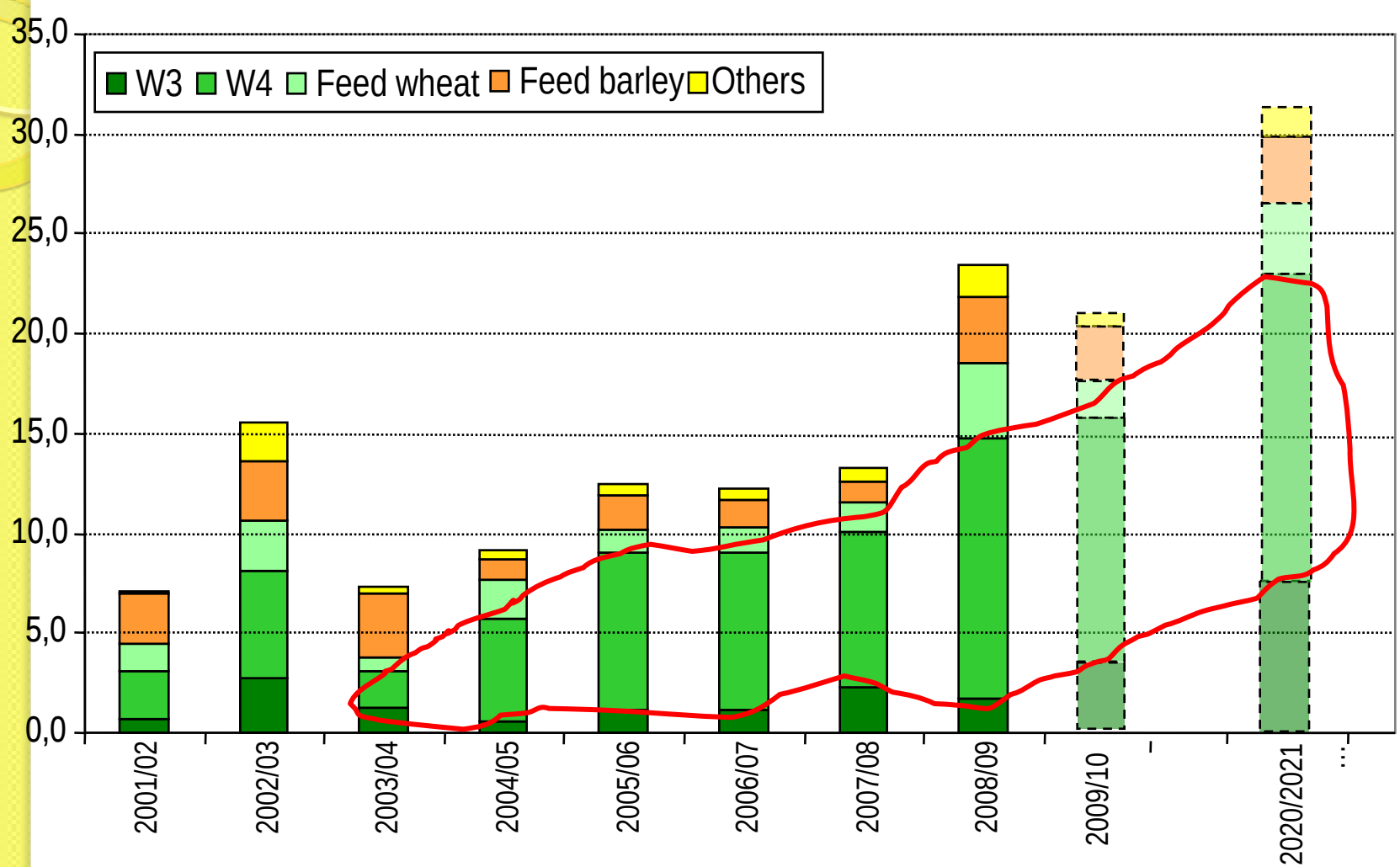
Over last two decades the dramatic arable land shrinkage has taken place in three FSU Black Sea countries…

Black Sea region has a substantial agricultural production potential





Type/Quality break-downs of Russian grain exports



Key specialization: feeding developing countries of Middle East and North Africa with world's cheapest 11.5-12.5% protein milling wheat

Holdings Operations
Argentine bags - Canadian Temporary Bins - grain dryer
isn't it amazing

Newest port terminal:
Tuapse on the Russian Coast of Black Sea
Capacity: 100 th tons; 2.5 MMT annual export capacity

The Rapid Change in Russia/FSU Grain Handling

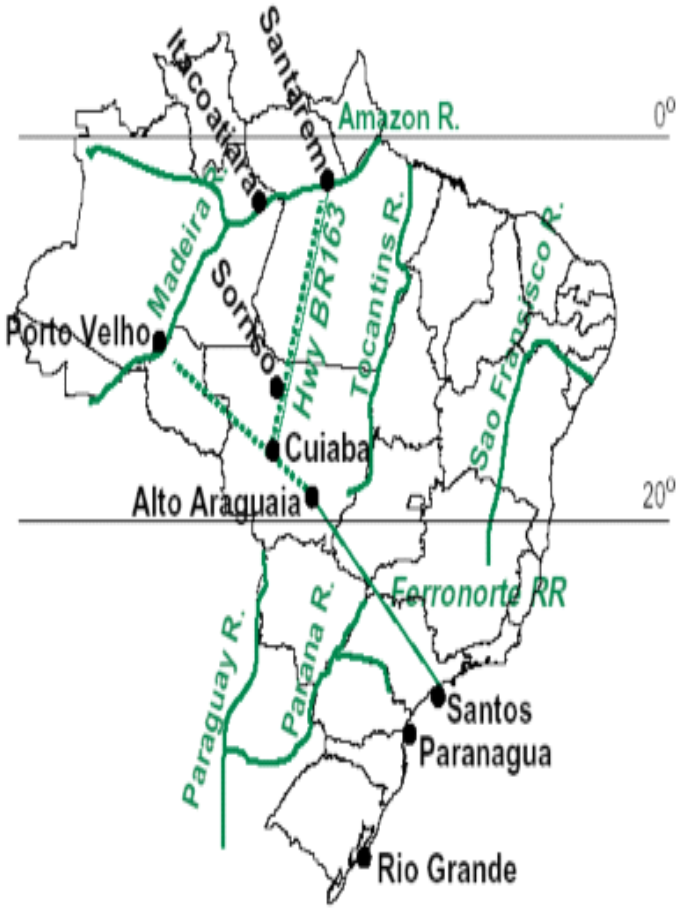
Summary: Global Demands for Logistics

- Russia
  - Interior infrastructure (new elevators), railways, wagons
  - on-farm storage facilities.
  - for infrastructure and production Russia roughly needs $20-25 billion
    - ~6-10 billion for on farm
    - $350 million for port infrastructure, railway stations reconstruction, wagons, inland country elevators, etc.
- Ukraine
  - See *Financial Times* June 2 "Investment Climate will Determine Yield"
  - $20-25 billion investment in production and infrastructure
  - ….even though majors have already invested, "the market is still wide open for smaller companies…"

BRAZIL SOYBEAN DEVELOPMENT AREA AND TRANSPORT PROJECTS (DATED FIGURE)

Problem: rapidly changing agriculture, no traditional institutional investment in logistics infrastructure, changing geography of agriculture, excessive logistical delays and demurrage

- **Evolution** of demands/needs ($7billion 7 years ago)
- President allocated funds, and new president will have to execute
- **Growing Accelerating Program** where large investment in infrastructure will be carried under it.
  - Ports USD 2,5 billion till 2014
  - waterways(including dredging) USD 1,7 billion in the next 4 years
  - farm roads USD 1 billion.



Source: Economic Research Service, USDA.

Source: Adapted from USDA-ERS WRS 01-3, Schnepf, Dohlman, and Bolling.

Brazil Logistics Investment

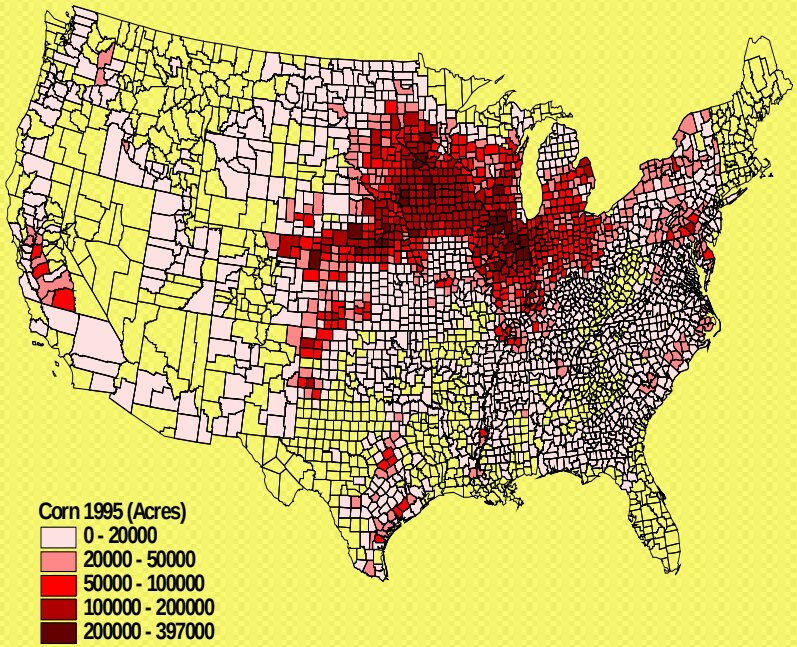
- **Currently ongoing projects**:
  - including North-South Railway; Tucurui Lock, Paving of the BR-163: Expansion of ALL railway from Mato Grosso to Santos Port:
- **Most important investment needs going forward:**
  - Ports: Investments will be required to expand the port capacities at Itaqui, Santarem and Vila do Conde (mainly).
  - Inland terminals: railway and waterway terminals will also demand private investments
  - Transport means: Barges and rail convoys will also be required.
- **Summary:**
  - As a result, Mato Grosso (mostly) will gain strong logistic advantages, helping to develop the region (adding more storage capacity, enhancing second cropping, etc.)
  - **Reality**: there will be difficulties due to regulations, environmental issues/permits and bureaucracy which may delay or even halt those funds. By the end of this year election for a new president will be placed which will re-assess these priorities.
  - **Summary:** "*Brazil development may not be sustained because we are on the eve of a logistical burnout, simple most of the paved roads, harbors and terminals were made in early seventies.*"

AgBiotech—a huge and far reaching revolution

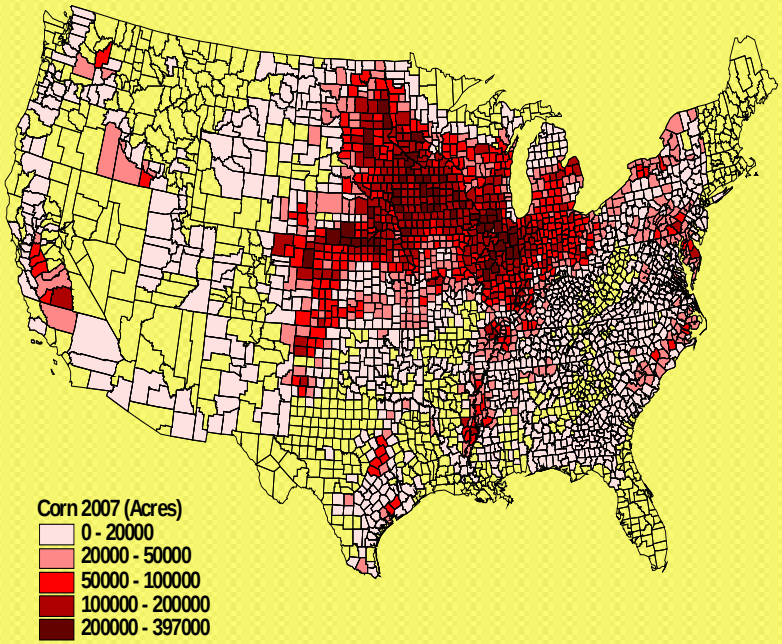
Crop Competitiveness: Longer-term impacts of GM in competing crops on supplies

- Concerns on decreasing wheat competitiveness
- Impacts of GM in competing crops
  - Changing geography on production and displacing other crops, notably small grains
  - Changing technology growth rates
  - Improved technology in competing crops (RR2 Soybeans, DR corn), raises the opportunity cost of planting wheat (or other small grains)!

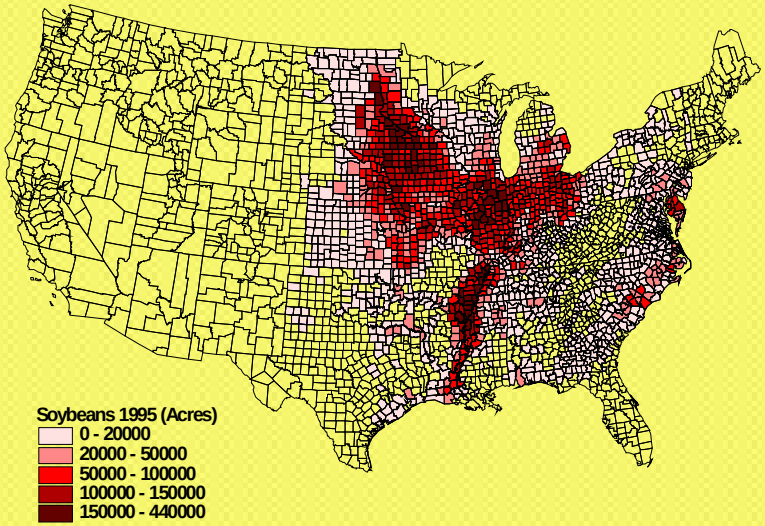
Corn Planted 1995



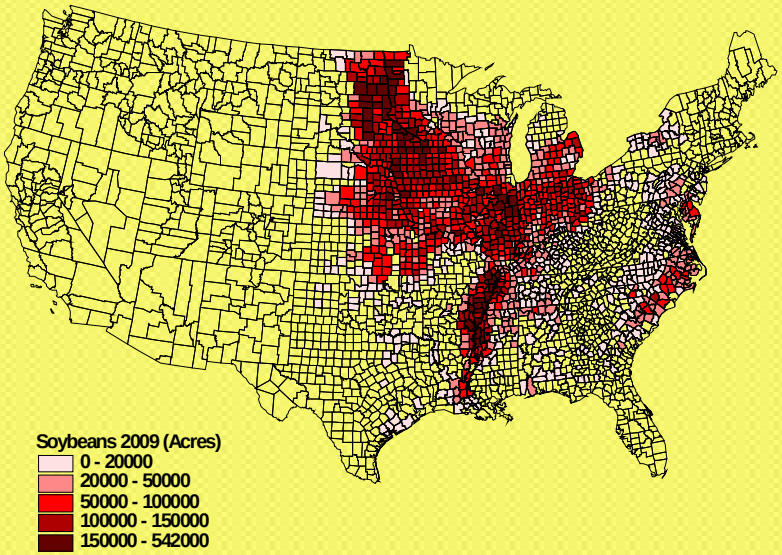
Corn Planted 2007



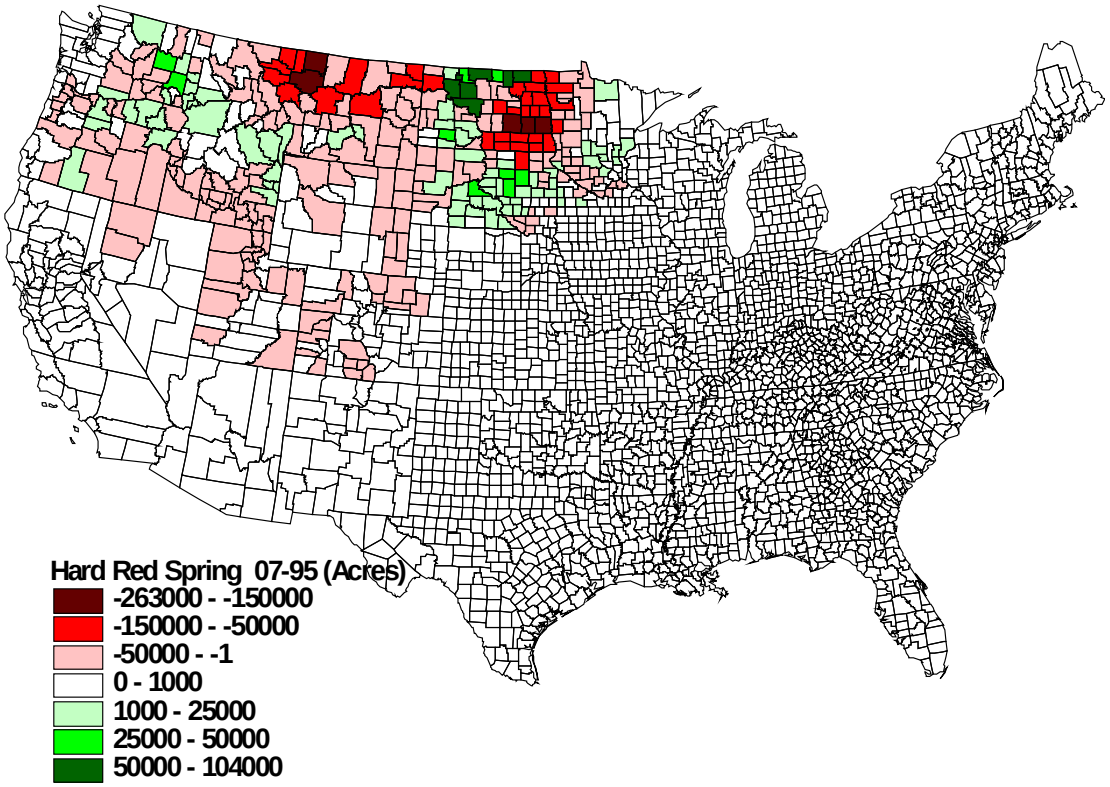
Soybean Planted Area 1995



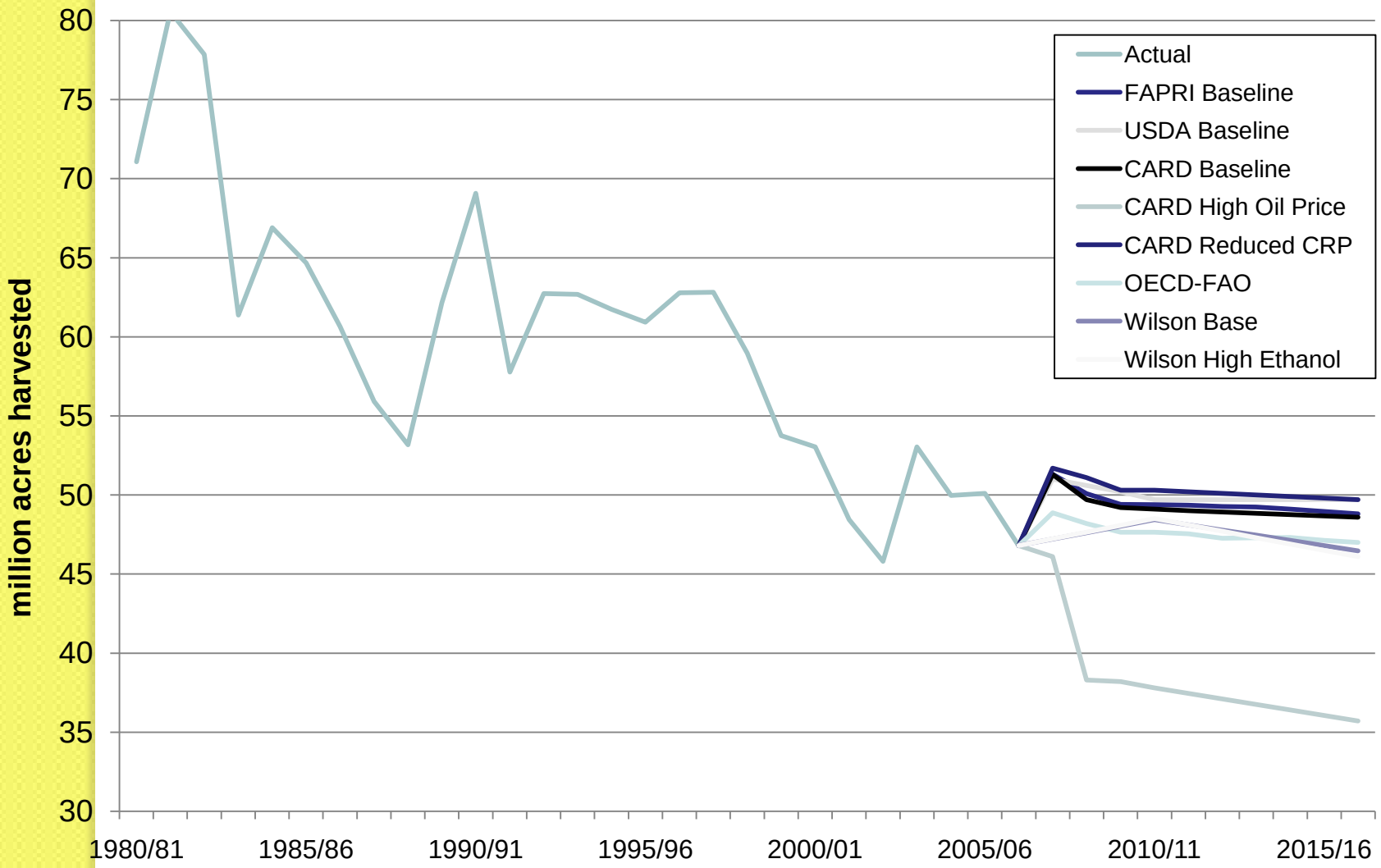
Soybean Planted Area 2009



Change in HRS Planted Areas 1995-2007



U.S. Harvested Wheat Acres, 1980-2006, and Projections for 2007-2016



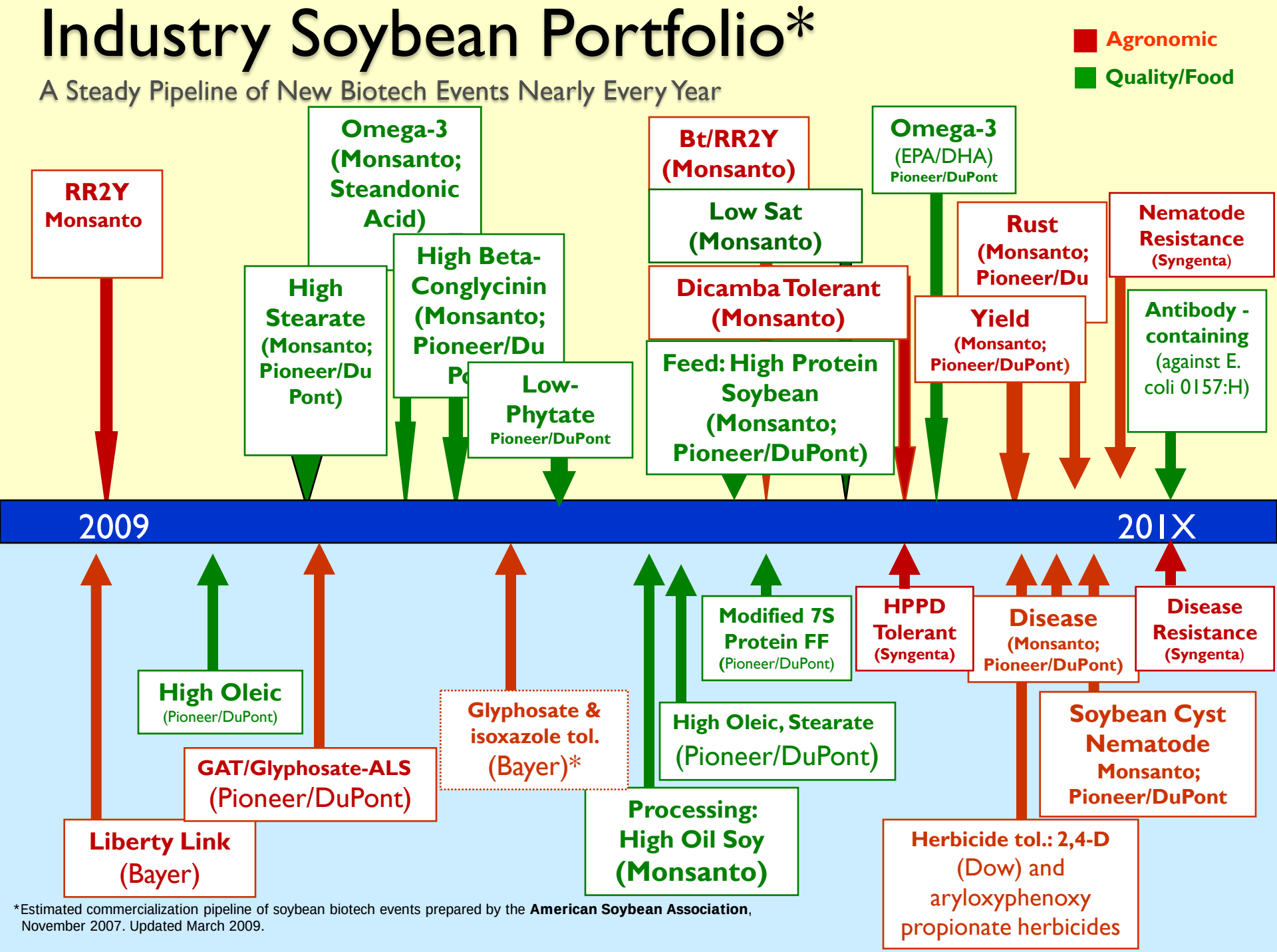
Dept of Agribusiness & Applied Economics,
NDSU, Fargo - 58102

New GM Traits and Competition

- Results of these expenditures in research is for
  - Emergence of new GM traits
  - An escalation in yield growth rates

Industry Soybean Portfolio*

A Steady Pipeline of New Biotech Events Nearly Every Year



*Estimated commercialization pipeline of soybean biotech events prepared by the **American Soybean Association**, November 2007. Updated March 2009.

Multi-Generational Drought-Tolerant Corn Creates Value Across Multiple Market Segments

HIT PROJECT

Drought-Tolerant Corn

KEY MARKET ACRES	U.S.	BRAZIL	ARGENTINA
AVAILABLE MARKET	80M	30M	6M
PERCENT PENETRATED	0%	0%	0%

❻ R&D Pipeline

Drought-Tolerant Corn

PROJECT CONCEPT:

First-generation drought tolerance is targeted to minimize uncertainty in farming by buffering against the effects of water limitation, primarily in areas of annual water stress

2006 PERFORMANCE UPDATE:

2006 STATUS: **Phase 2**

- Yield enhancement demonstrated again in 2006 under water-stress conditions in U.S.
- Lead gene chosen
- 2007 trials expected to demonstrate yield enhancement in multiple hybrids under dryland conditions

VALUE CATEGORIES:

TOTAL RETAIL VALUE/ACRE: $10 - $30/acre

SEGMENTED VALUE OPPORTUNITY ACROSS MARKETS: U.S. EXAMPLE

Source: Spatial Climate Analysis Service, Oregon State University

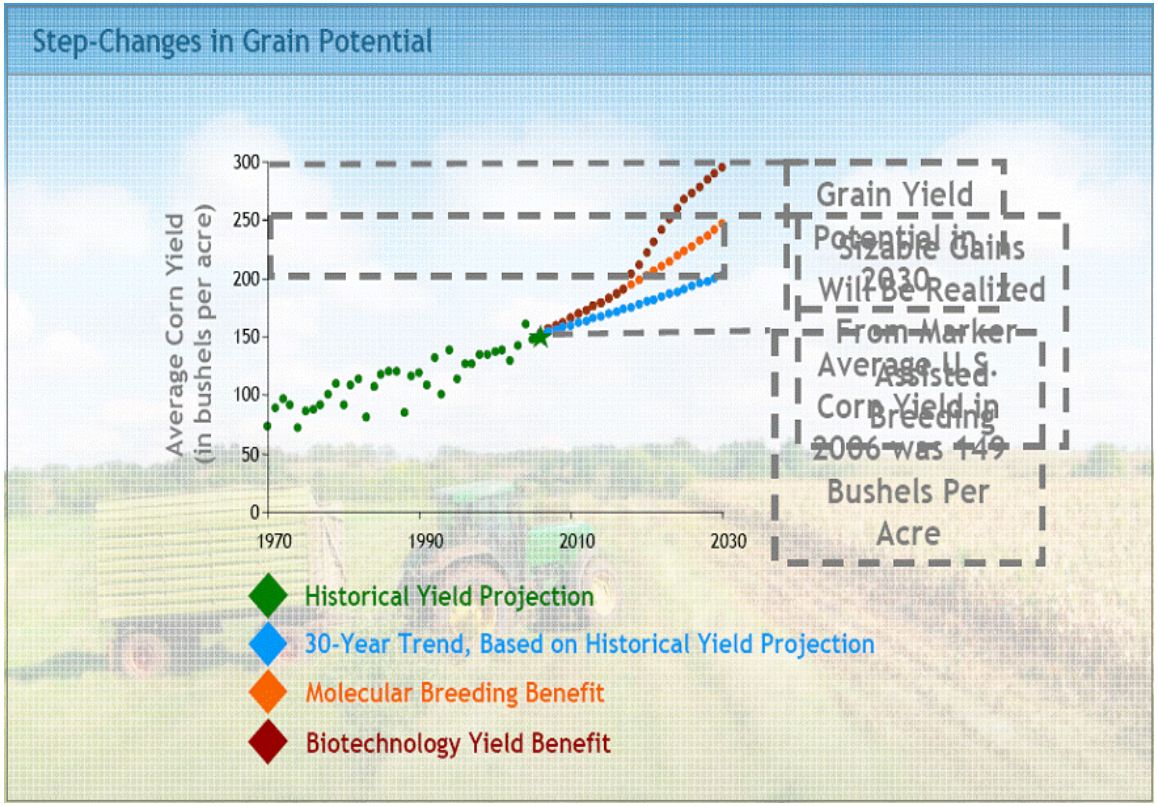
IRRIGATED	WESTERN DRYLAND	STABILITY
8-12M acres	10-12M acres	50-60M acres
14-18" typical precipitation in growing season	14-18" typical precipitation in growing season	17-19" typical precipitation in growing season
Irrigated	Non-irrigated	Non-irrigated
Value is in replacing irrigation, reducing the variable costs of irrigation	Value is in improved yields annually, by improving water-use efficiency	Value is in improved yields when moisture is less than optimal

Drought Resistant GM Trait in Wheat

- Australia GM lines *had yield 20 percent higher than conventional wheat varieties under conditions of drought stress*.
- Drought Tolerance in Corn: *GM trait can save 25 percent of losses caused due to drought* Edmeades (2008)

Projected Yields: Double by 2030

- Monsanto released the following figure to illustrate the change in prospective growth rates.
- *These translate to growth rates in the area of 3.2 to 3.4% per year*.
- Other companies have released similar goals



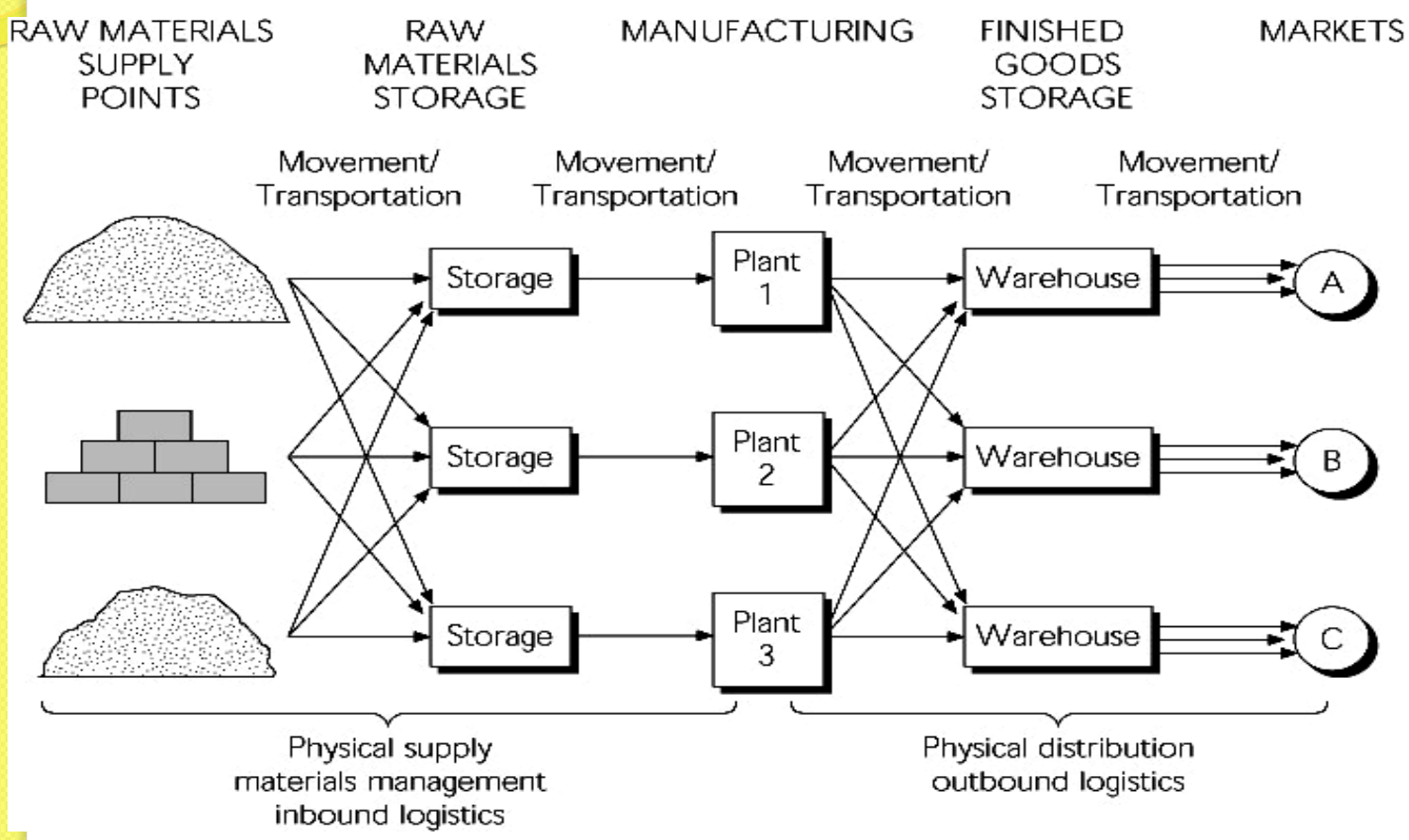
Supply Chain Management in Agriculture: Principals

- Purpose of SCM and logistics: get right product to the right place at the right time at lowest possible cost
  - Involves management of resources, in a way to use logistical resources more efficiently, vs., spending more money on infrastructure

Management Response to Risk and SCM: *Diversify—Longer Term!*

- Responses to risk in commodity markets
  - Hedge (cross-hedge)
    - Transfer a portion of risks to 3rd party
  - Contracts (above)
    - Increase in contracting for a portion of purchases
  - Geographic diversification:
    - Increase the geographic scope of purchases
  - Buffer stocks (temporal diversification)
    - For non-hedgable commodities, this is an appropriate strategy
    - Accumulate stocks when prices are low; draw down stocks when prices are high
    - Costs are important; but in many cases would be less than the cost associated with market volatility
- Strategic Risk Management:
  - Requires assessment and use of each of above for portions of purchases
  - Strategic questions
    - How much should be allocated to each strategy
    - How should these change over time

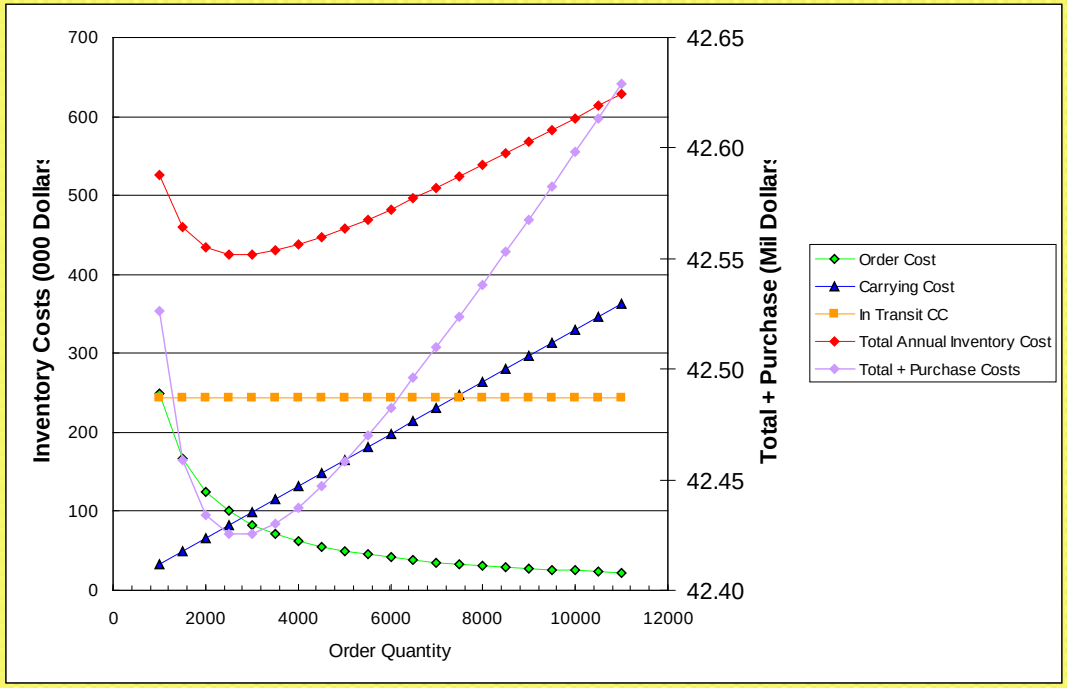
AgBusiness Logistics and Supply-Chain Mgmt



CONVENTIONAL SCM MODELS:

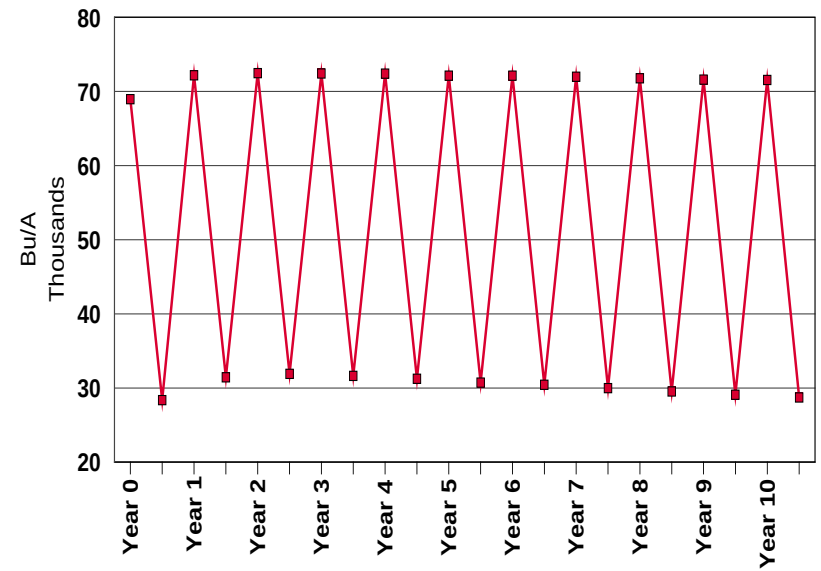
Effect of Order Quantity on Inventory and Total Procurement Costs

- **Goal is**
  - to balance different costs in supply-chain decisions
  - Minimize total costs and that determines purchases, timing of purchases, and inventories
- **Results:** Frequently has recommendation of near-nil inventories
- **Problem is compounded by** several points important in agriculture
  - Price changes—anticipated
  - Price Risk: if not hedgable
  - Quantity risk:
  - Quality risk:
- All of these result in solutions requiring more elaborate strategies regarding purchases, relations with suppliers, diversification and buffer-stocks

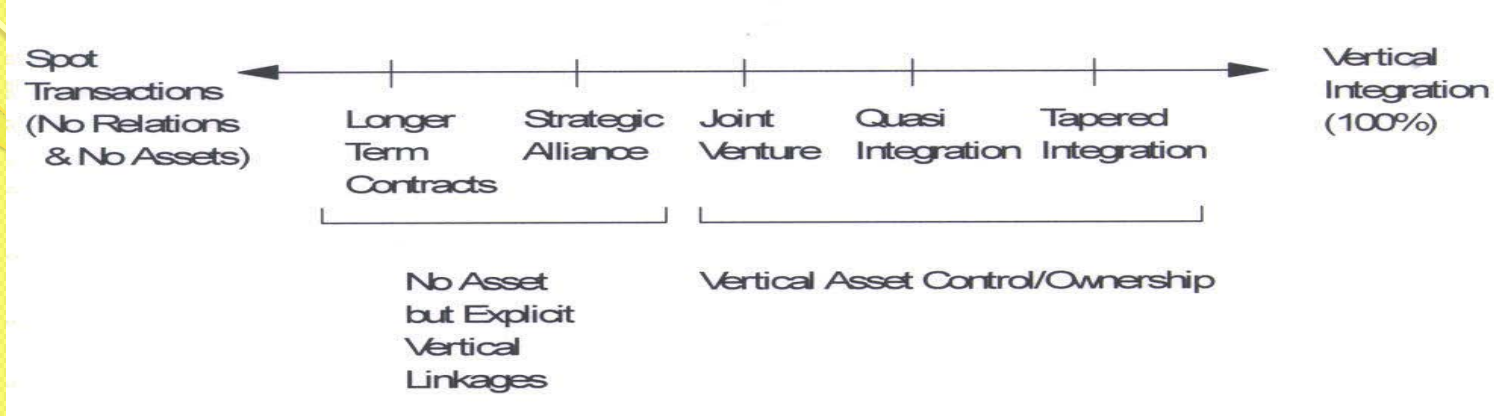


Buffer Stocks

- Temporal diversification—intercrop year
- Common in many industries and provides partial risk protection against—just the opposite of JIT
  - Price and spread risk
  - Quantity and quality risks
- Concept
  - Accumulate stocks when prices are low
  - Draw down stocks when prices are high
  - Accrue costs of storage



Vertical Coordination: A Spectrum of Alternatives for SCM



- How to conduct production at lower cost through VI, vs., non-VI strategies?
- Where are there efficiencies that allow VI companies to operate at lower cost?

AB- *Premier Example of Optimal Vertical Strategy*

- Market
  - Growth in market share: 37 to 53%
  - Premium product and Profitable
  - High opportunity cost of capital hence, making investment in ag, come at a high cost
- AB—extreme vertical control (SCM)
  - Always: made with *best available ingredients*, and, fresh/dated
    - Tight specifications on ag ingredients, and facilities
    - Variety specific ,Vomitoxin, Chemical use, Storage
    - Consistent blend of ingredients across breweries by variety composition, and year of production
  - Vertical integration (ownership)
    - Owns: breeding, varieties, elevators, malt houses, and leases rail cars
    - Tapered Vertical Integration in most functions (30/35/35)
      - Ratios Varies by function and through time (as structure of market changes)
  - Contracts with growers
    - pre-planting for 100% of requirements, with named varieties and targeted locations; has BARI growers
    - Contract formulae and subsequently adopted by competing crops
    - Insurance (prospective) for insuring against crop quality deviations
  - Highly diversified: US (as well as intra US—MW, West, and Intermountain) and Canada; geographically
  - Contract with Maltsters for requirements: PDS and toll malting
  - Inventories: Temporal diversification
    - Carries inventories…for about 12 months requirements
    - Varies through time with volatility, cost and with price (low price---accumulate stocks; high prices—decumulate stocks)

--the great VI experiment
AB- Inbev, Pepsi, Coke and others

- Inbev acquisition of AB
  - Paid a premium for AB
  - In part, since AB is a premium product,, i.e. commands a premium in the market
  - In part, this is due to a multitude of vertical controls and marketing
- Radically different approaches to vertical management
- InBev—
  - Outsources as much as possible, uses incentive contracts to provide incentives
  - Mgmt bonuses (very substantial by industry standards) based on cost savings;
  - Will adjust product quality if/as necessary if crop quality problems
  - If prices go up, it will be easy to raise prices as competitors will have to as well
- Outlook: a big experiment
- Other major changes in supply chain strategies are pursuing Vert. integration
  - Pepsi and Coke----are re-establishing Vertical Integration as a strategy by acquiring bottlers/distributors
  - WSJ Nov 2009 for more on re-verticalization (Oracle, and others
    - Attributes the change to verticalization to volatile commodity prices, financial pressures at suppliers …
    - *"The historical view of vertical integration was that you had complete control of the supply chain and that you could manage it the best," Today's approach is more nuanced. Companies are buying key parts of their supply chains, but most don't want end-to-end control. …..."If you're buying fully from a market, you are relying on that market's supply chain,"*

Recent communication from major international milling firm

- *The milling industry in _____has become of lately a fierce competitive environment. Price is the ONLY tool to get the volumes of flour. In consequence, margins have had a really big decline. We are very concerned about this squeeze and we cant do anything on the" supply" side of the equation to alleviate this. The only way today to better our margins, I think is on the acquisition side and supply-chain-management…... I know of the problems and complications around this, but it is not business as usual anymore.*

- *Given this is one of your areas of expertise, I would like to meet personally and discuss the issue further...*

- *My very best personal regards,*

Facilitating Mechanisms of Efficiency Gains in Supply-Chain Management

- Sophisticated shipping mechanisms emerging in the United States (and seeking to be replicated elsewhere)
  - Mechanisms to improvise efficiency in shipping/logistics which allows greater throughput with existing infrastructure
- Implications: These are key elements to facilitate more efficient SCM, as opposed to spending more on infrastructure (as will be occurring in FSU and Brazil)

Major Changes in US Grain Rail Logistics

- Box-car to covered hopper cars; to jumbo CH cars
- Multi-car shipments: 1, 26, 52, etc
- COTS: Development of forward guaranteed shipments by rail: tradable, penalties for non-performance, or late; forward, etc.
- Demurrage: Increase in demurrage charges and scope to encourage better utilization of equipment
- Shuttle trains: 110+ cars with incentives

Economics and Adoption of Shuttle Trains

Evolution from Single Car Shipments			
Configuration	Introduced	Volume per transaction	
		bushels	mt
Single cars	1900s	3,307	90
26 cars	Late 1980s	85,796	2335
52	Early 1990s	171,591	4670
100/110-Shuttles	Mid-1990s early 2000s	362,987	9879

Elements of Shuttle Mechanisms

		Rebate/savings		
Shuttle Element	***Details***	***$/Car***	***$/mt***	***c/b***
Shuttle definition	110 car train of dedicated capacity equipment, locomotive and crew; origins and destinations must be approve and conform to engineering requirements;			
Tariff Rate Differential	Selected by route; some only allow shuttles			
Loading Incentive	Load 110 cars in 10/15/21 hours; 1 origin elevator	150/100/50	1.50/1.00/.50	4/3/1
Unload Incentive	Unload 110 cars in 15 hours at 1 destination elevat0r	100	1.00	3
Shuttle allowance	2 year/ 1year/3 month committment	150/100/0	1.50/1.00/0	4/3/0
Total potential incentives		400/300/150	4/3/1.50	11/9/4
Guarantees	BNSF guarantees a minimum of 2.5 trips/month. If 5 trips per conecutive 61-day period cannot be met, shipper can cancel the remaining trips without a penalty, or request additional shuttle trips to make up for the difference			
Pricing	All Shuttles allocated by auction mechanisms; different durations			

Alton ND

Kalama

Shuttle Technology

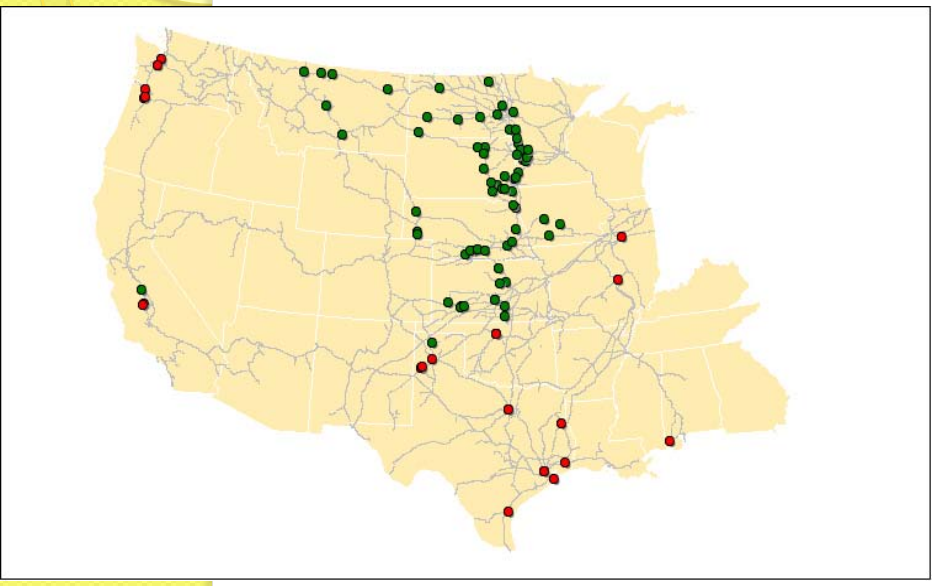
Shuttle Use is Now Dominant

- For one of major grain hauling railroads
  - 50-60% of volume is in shuttles (and DET's.)
  - Varies between domestic and export
  - Currently using 95 shuttles (nearly 1 mmt) and expected to increase to 105-108 in future
- Exports and Shuttles
  - PNW is nearly exclusively Shuttles
  - Gulf: 85% shuttles (and due in part to parts of Texas not having adequate shuttle infrastructure)
  - Mexico: 95% Shuttles with a few 27 car units
- Shuttle competitiveness
  - Rail costs are reduced and savings shared with shippers
  - This has provided immence advantage to rail vs barge

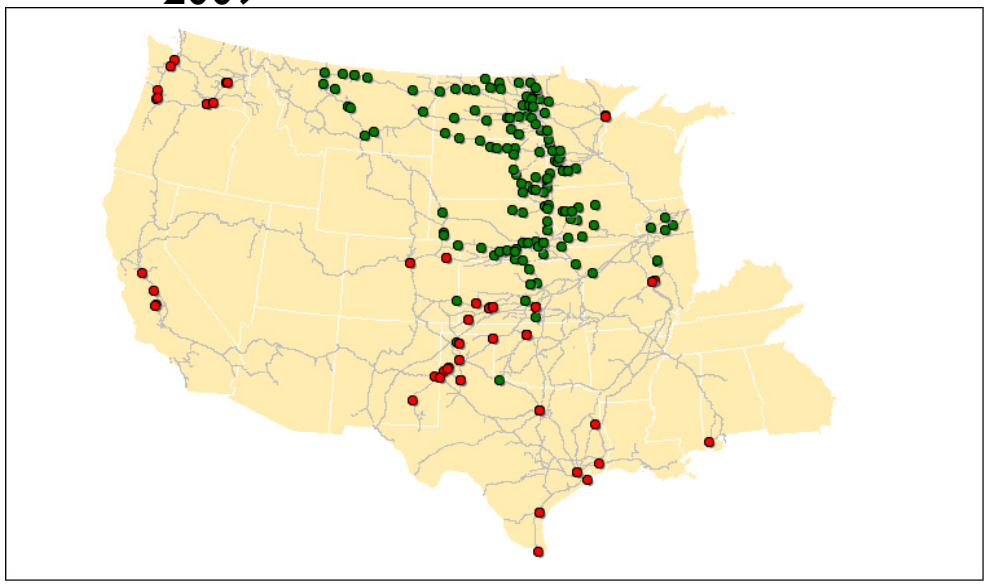
Shuttle Franchise

BNSF Shuttle Franchise

2000



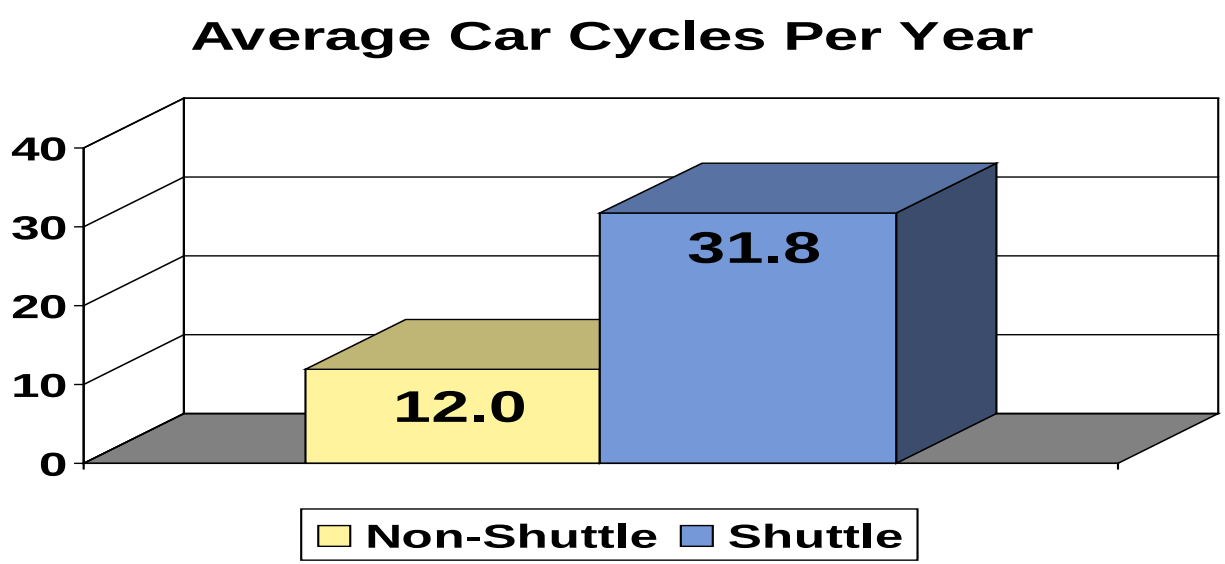
2009



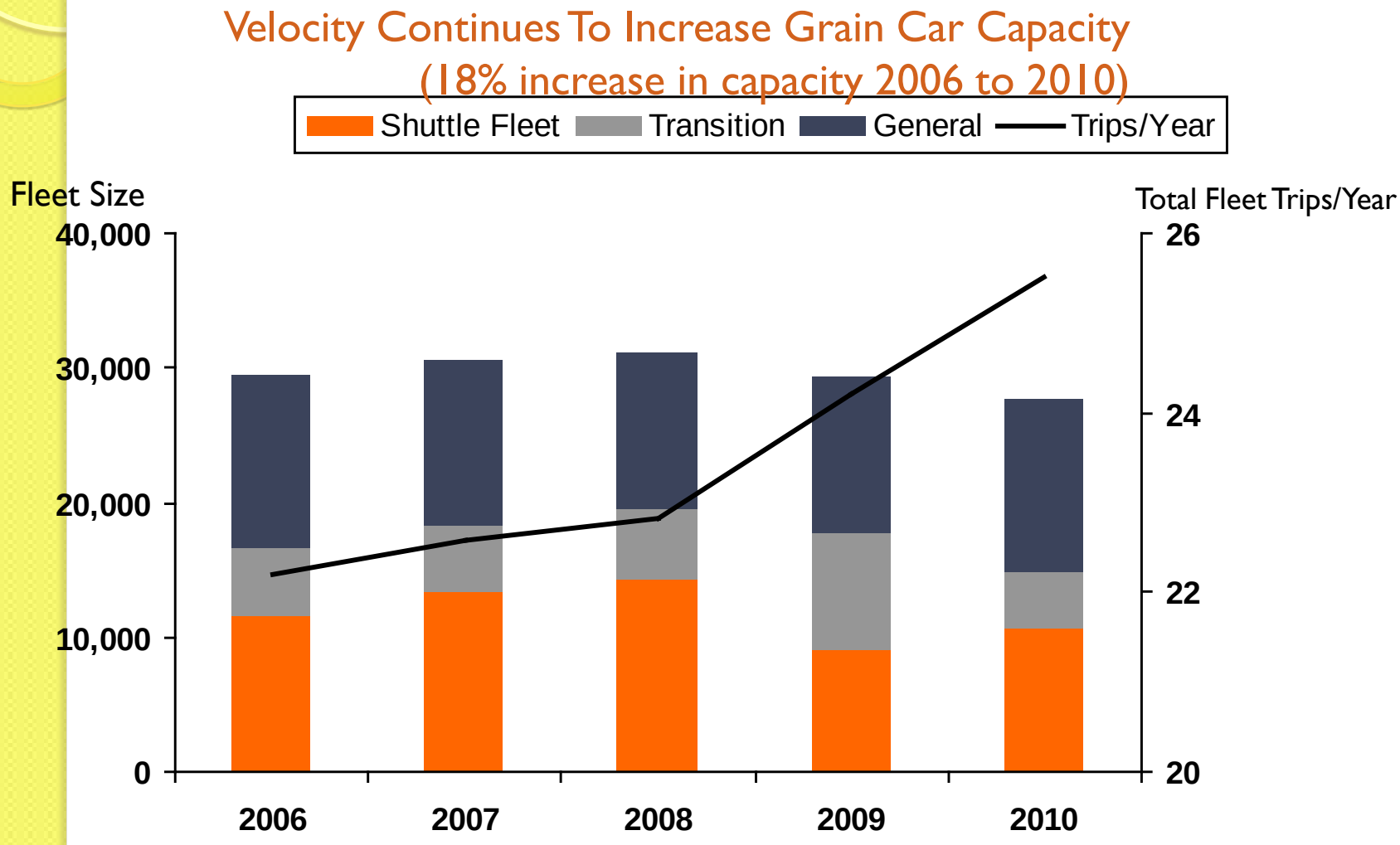
	2000	2009	Change
• Origins	77	163	+112%
• US Destinations	33	71	+115%
Minnesota Origins	15	25	+ 67%
Minnesota Destinations	0	1	
Mexican Shuttle Destinations	8	29	+262%
Total Shuttle Stations	118	263	+123%

Average Car Cycles Per Year

- Bottom line:
  - Shuttles are nearly 3 times as efficient at non-shuttles
  - Shuttle efficiency approaching that of competing rail products (e.g. coal, etc)
  - Efficiency improves ROI and encourages investment in grain shipping
  - Barges and other modes have not achieve comparable efficiency gains



Rail Transportation Capacity



Recent Shuttle Technology

	Early Shuttle Elevators	Most Recent Shuttle Loaders	
		Gavilon	Harrold Grain
Storage	1.0 million bushels	1.8 mill bushels	2.2 mill bushels
Loadout	25,000 bph (8 cars/hour	70,000 bph (20 cars/hour)	100,000 bph (29 cars/hour
Loadout time:	110 cars in 15 hours	120 cars in 10 hours	
Unload time per truck	7 minutes	1 minute	
Unload legs	2 X 7,000bph	3X 20,000 bph	2X25000 bph
Comment	***This is a man killer***! [as you begin loading when car is spotted to meet ODE requirements		Circle track to allow continuous loading. "Farmers have keyed in and are just producing a lot more bushels per acre,"… "A lot of CRP and grass has been broken in the past five years. They say the cows are leaving and the plows are coming back."

Most Recent: Gavilon at New Rockford ND

Harrold Grain, S.D. Building a new elevator that can handle 140-car shuttle trains—circle track

Implications for Grain Supply Chain Management

- Shuttle use requires
  - Investment in capacity and infrastructure ($10-13 million and track space)
- Turn-over 10 to 12+ times per year
- Information transparency (See railroad www pages)
  - Primary market results are available on www
  - Secondary markets/transactions in shuttle commitments
- Trading
  - Railroad has evolved toward "scheduled" shipments
  - Less car capacity available for non-forward type transactions
  - Coverage in shuttles is critical for shippers, handlers or exporters
    - Shippers without shuttle coverage will/may be precluded from competing in future transactions
  - Increased emphasis on planning, up to 3-24 months forward

Summary Points: Implications
Exciting times for ag and investment opportunities in Ag

- *Demand:*
  - Growth is exceeding productivity growth (1-4%/year
  - Driven by population growth, income, urbanization and changing diets; and, new uses including biofuels
  - Regions with stronger growth: China, N. Africa,
- *Supply*
  - Conventional technology: productivity growth is .8 to1.4%;
  - New technology (biotech) will result in growth 3-3.4%/year
  - Most of the increase production (to meet demands) will come from productivity growth, and shifts in the geography of production
- *Geographical Shifts*:
  - US increase soybeans, corn and shift from small grains
  - S. America increase soybeans, and corn
  - FSU—more domineering in small grains and non-biotech crops
- *Biotechnology*: Game changer and induce changes in productivity growth rates, and spatial geography of production

Implications for Global Supply Chains

- *Investment needs in Infrastructure:* FSU, Brazil and Others (China import capacity)
- *US*—advantage is due to existence of infrastructure and, more efficient management/use of infrastructure through innovative pricing mechanisms
  - Expansion of capacity, notably by rail (New export facility at Longview)
  - Innovative management mechanisms to induce efficiency---having the impact of greater throughput with existing capacity
- *Implications for the Ag Industry: Inputs, Shippers, etc.*
  - Greater competitive pressures from non-US origins
  - Transactions more forward looking including greater detail on shipping
  - Requires mechanisms to reduce/manage risks for buyers and sellers for longer periods than previously
- *Future:*
  - Investment lags/games (in all countries) to accommodate changing geography of spatial trade in agriculture
  - Greater emphasis on managerial control of supply-chains
  - Greater needs to create mechanisms to improve efficiency of supply-chains and to achieve increased volume with existing capacity
  - Challenges with escalation of emerging highly differentiated GM traits (i.e. in soybeans and corn), and wheat (10 years)

Questions

- Discuss evolution of agricultural supply chains due to changes in profitability and structure of agriculture
- Focus on how structural changes in ag enterprise affect the structure and business strategies of agricultural service industries
- Implications for farm input suppliers, wholesalers, distributors and retailers
- What types of new investments are needed in the global supply chain
- Globally, where will these new investments be made
- Will the types of agricultural investments vary across the globe
- How will ownership structure of these investments change over time
- How will globalization of ag change in the future