

Overview of the CARD/FAPRI Modeling System

Bruce A. Babcock

Center for Agricultural and Rural Development

Iowa State University

Data

- USDA/ERS – PS&D View commodity data
 - Livestock (April/November releases)
 - All Other Commodities (October/December releases)
- USDA Foreign Agriculture Service Attaché Reports
 - Biofuels
- International Financial Statistics
 - Historical macro data (October/December issues)
- Global Insight
 - Global projection macro data
- FAO
- Official government websites/statistics
- International Data Base U.S. Bureau of census
 - <http://www.census.gov/ipc/www/idbnew.html>
 - Downloadable in spreadsheet format

U.S. and International Models Commodity Coverage

Grains	Oilseeds	Cash Crops	Livestock	Dairy	Biofuels
Wheat	Soybeans	Sugar	Beef	Milk	Ethanol
Rice	Rapeseed		Pork	Butter	Biodiesel
Corn	Sunflower Seed		Mutton	Cheese	
Barley	Ground Nuts		Poultry	Non-fat Dry Milk	
Sorghum	Palm		Eggs	Whole-fat Dry Milk	

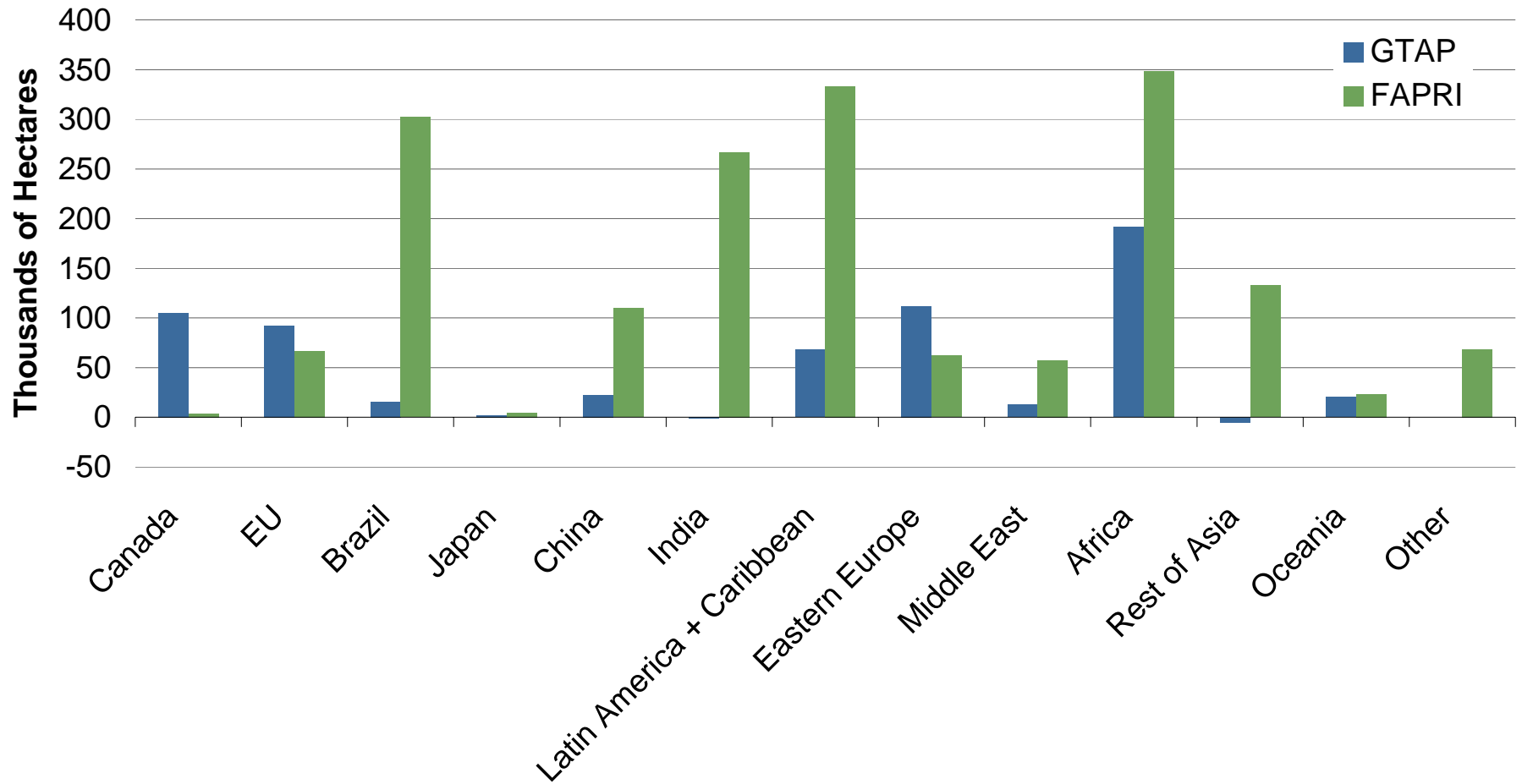
What is the CARD/FAPRI Modeling System?

- A large system of annual agricultural supply and demand curves that are updated each year.
- System is solved to find world and some country-specific market-clearing prices on an annual basis for major crops, beef, swine, dairy, and poultry.
- Projections made 10 or 15 years ahead
- Annual basis important because ag policy and trade agreements and biofuel mandates are typically phased in.

Questions

- What are the premises underpinning different approaches for assessing land use changes?

Change in International Crop Acres from 2.6 Billion More Gallons of Corn Ethanol



Why the Difference?

- Product Differentiation
 - GTAP assumes that corn from the U.S. is more like corn from Canada than corn from Argentina. FAPRI assumes that corn is corn.
- Yield response to price
 - GTAP assumes that both yields and acres will respond to price. FAPRI assumed that only acreage responds to price.
- Which model is correct?
 - No way to refute model predictions

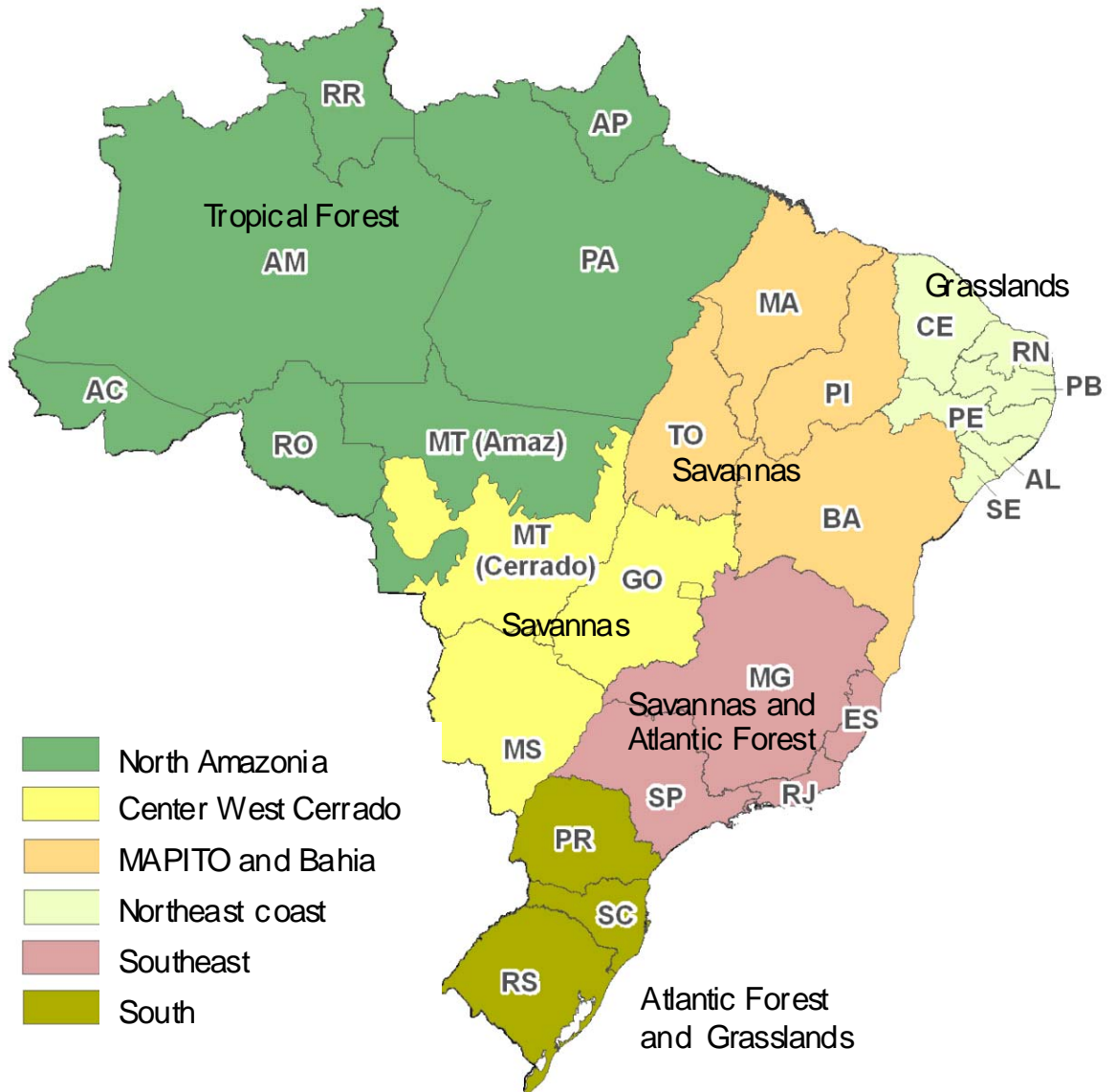
Other differences

- GTAP moves from one equilibrium to another
- CARD/FAPRI has an annual time step where markets clear each year and long-run equilibrium conditions can be imposed
- GTAP is run by many (including us)
- CARD/FAPRI can only be run by us

Questions

- What are the premises underpinning approaches for assessing land use changes?
- What are most important data for improving land use estimates?

Macro-Regions Used in the Brazilian Land Use Model



Key Brazilian Questions

- Higher crop prices (than they otherwise would be) from biofuels leads to expanded crop production in the U.S. and overseas
- Expanded crop production comes about in part by expanding cropland
- Expanded cropland decreases pasture
- Will pasture then increase?
 - If it expands, where? In the frontier or in the region where crops expand?
 - If not, why? Will cattle herd shrink? Will cattle go on feed? Will pasture productivity increase?

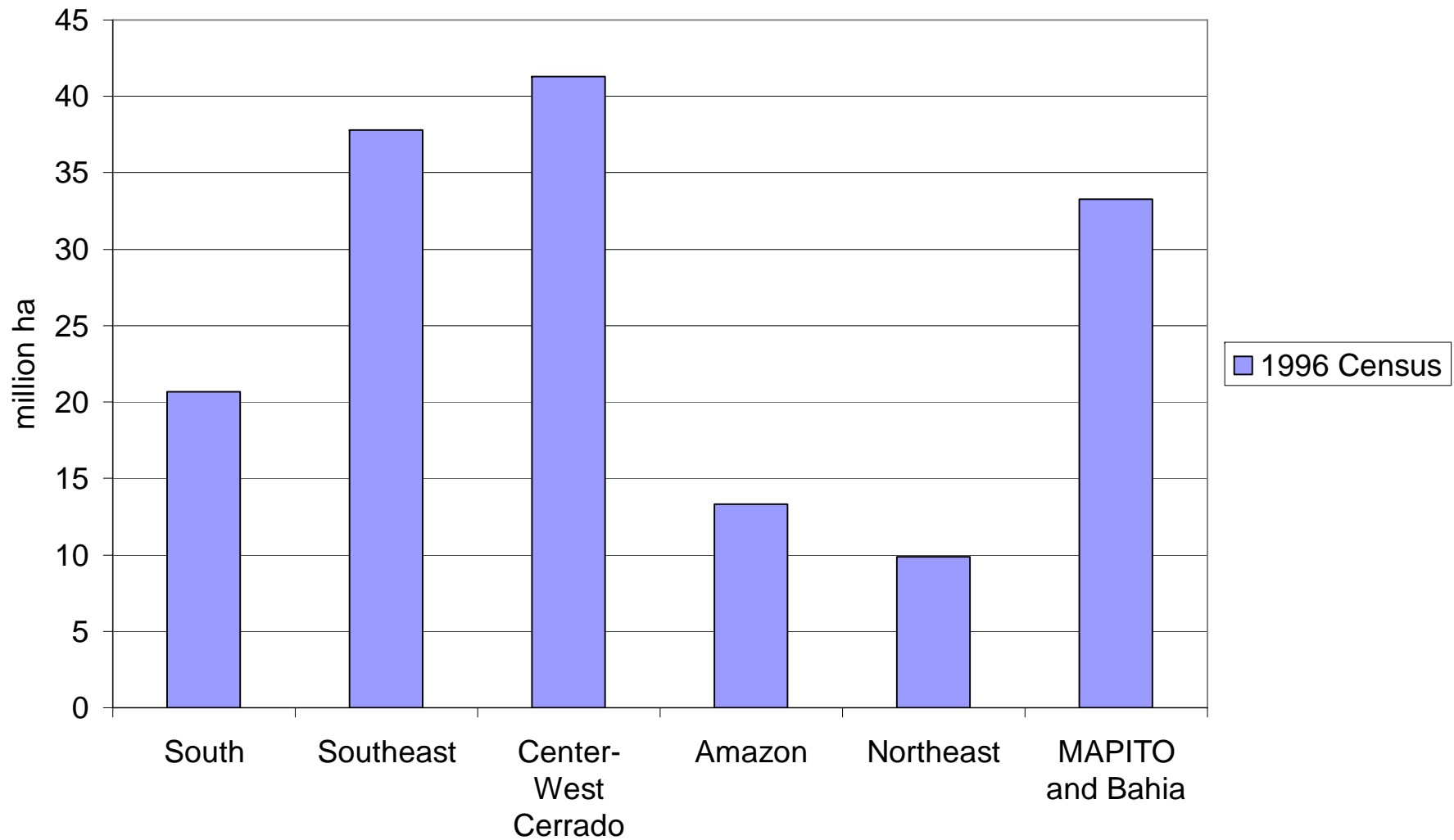
Need Brazilian Data to Answer These Questions

- Brazil is unique in that it has
 - A large frontier with less than perfect enforcement of environmental laws
 - An indigenous population in frontier and a large number of settlers
 - A large market for legal and illegal forest products
 - A huge cattle herd (180 to 200 million)
 - Large amount of underutilized land
 - Low crop yields for some crops
 - Low cattle stocking rates

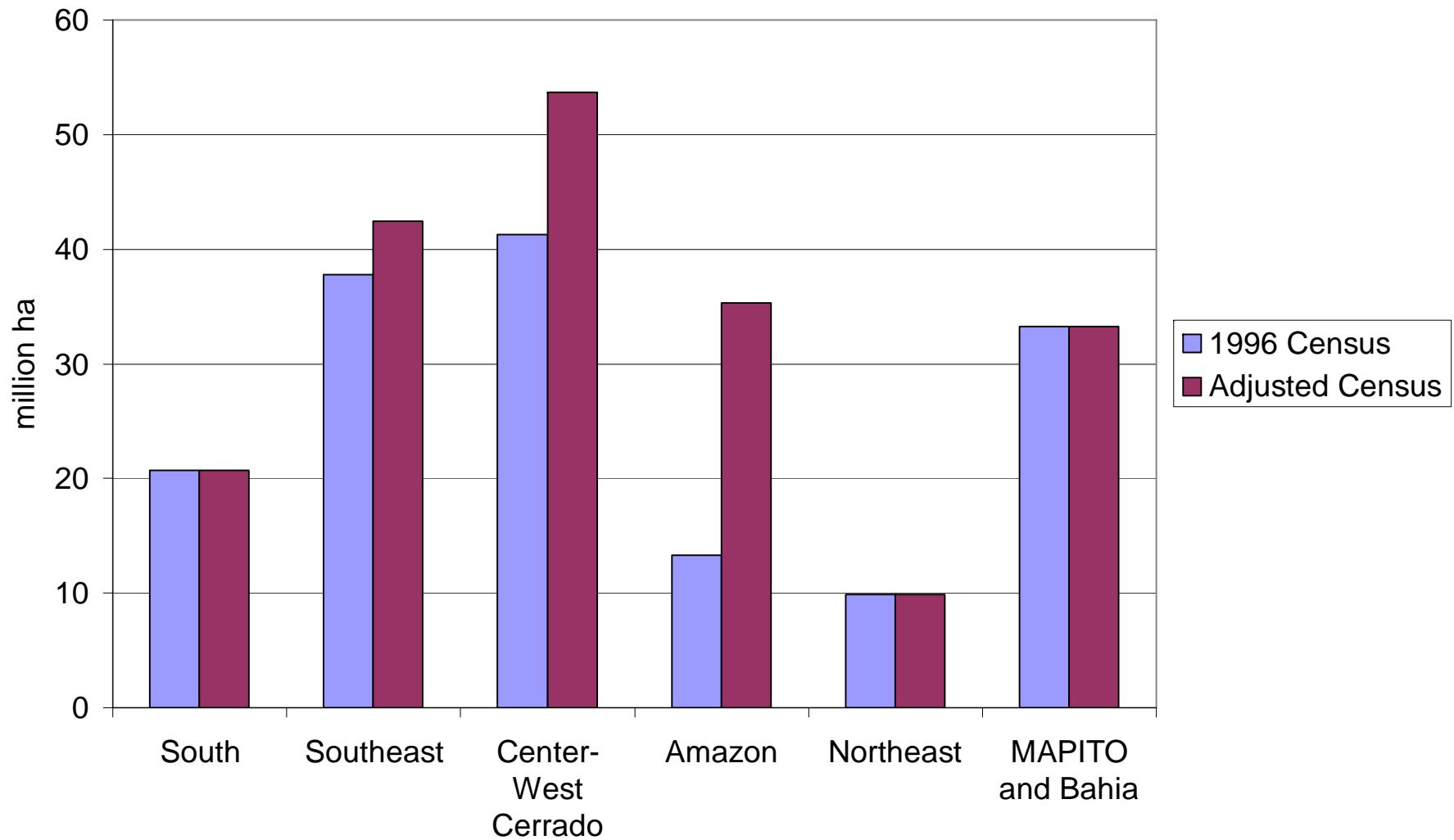
Generic Supply Models for Brazil Inadequate for ILUC Analysis

- In generic model, increased crop prices will increase the returns from cleared land.
 - Hence expanded biofuels is responsible for loss in carbon stocks from woody shrubs and forest.
- In generic model, no possible role for illegal logging that results in increased pasture, which then is used to feed cattle.
- Will increased crop prices result in intensification of cattle production in regions where crops expand?

How much pasture was there in Brazil in 1996?



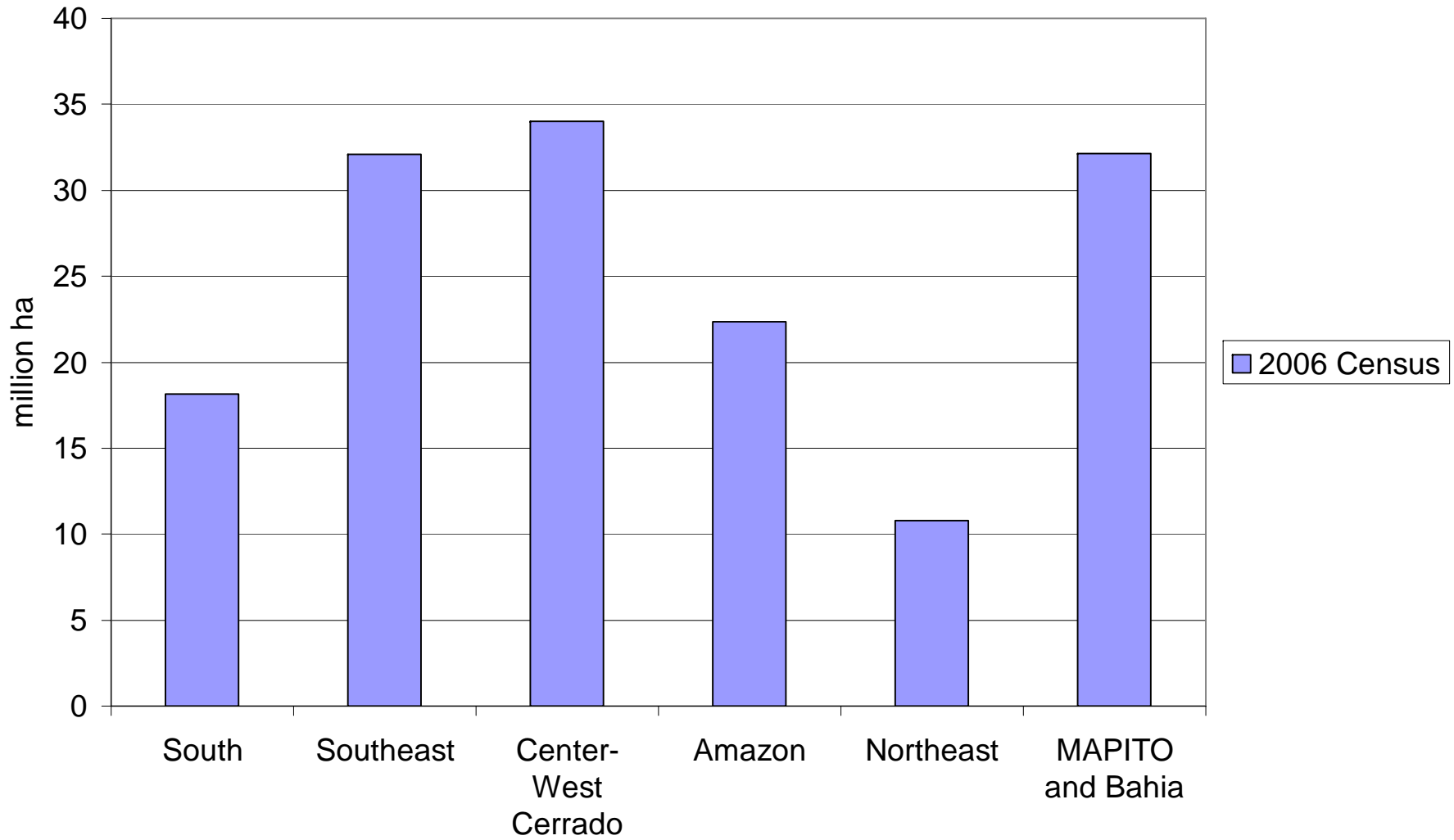
How much pasture was there in Brazil in 1996?



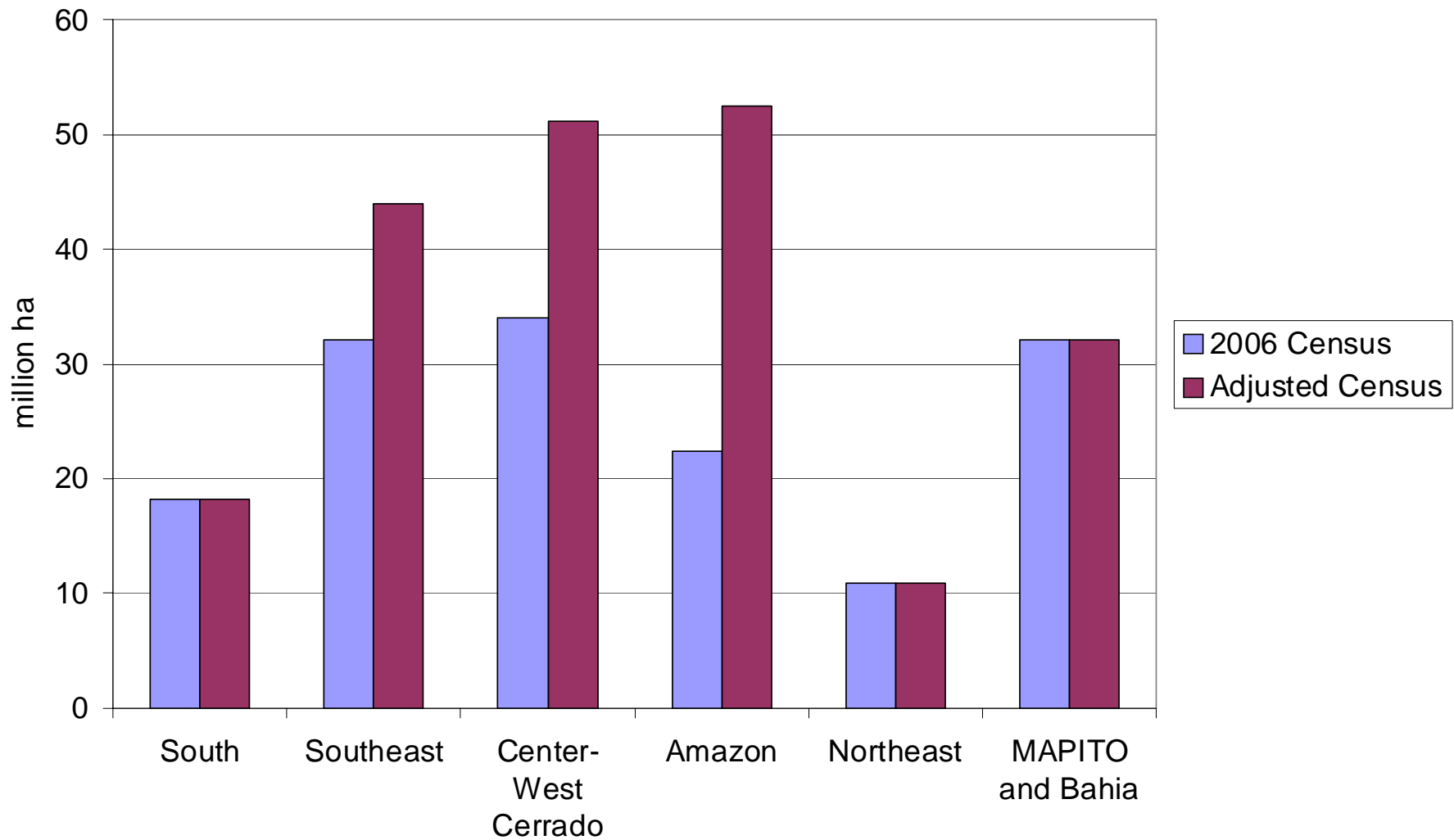
Percent Error in 1996 Census



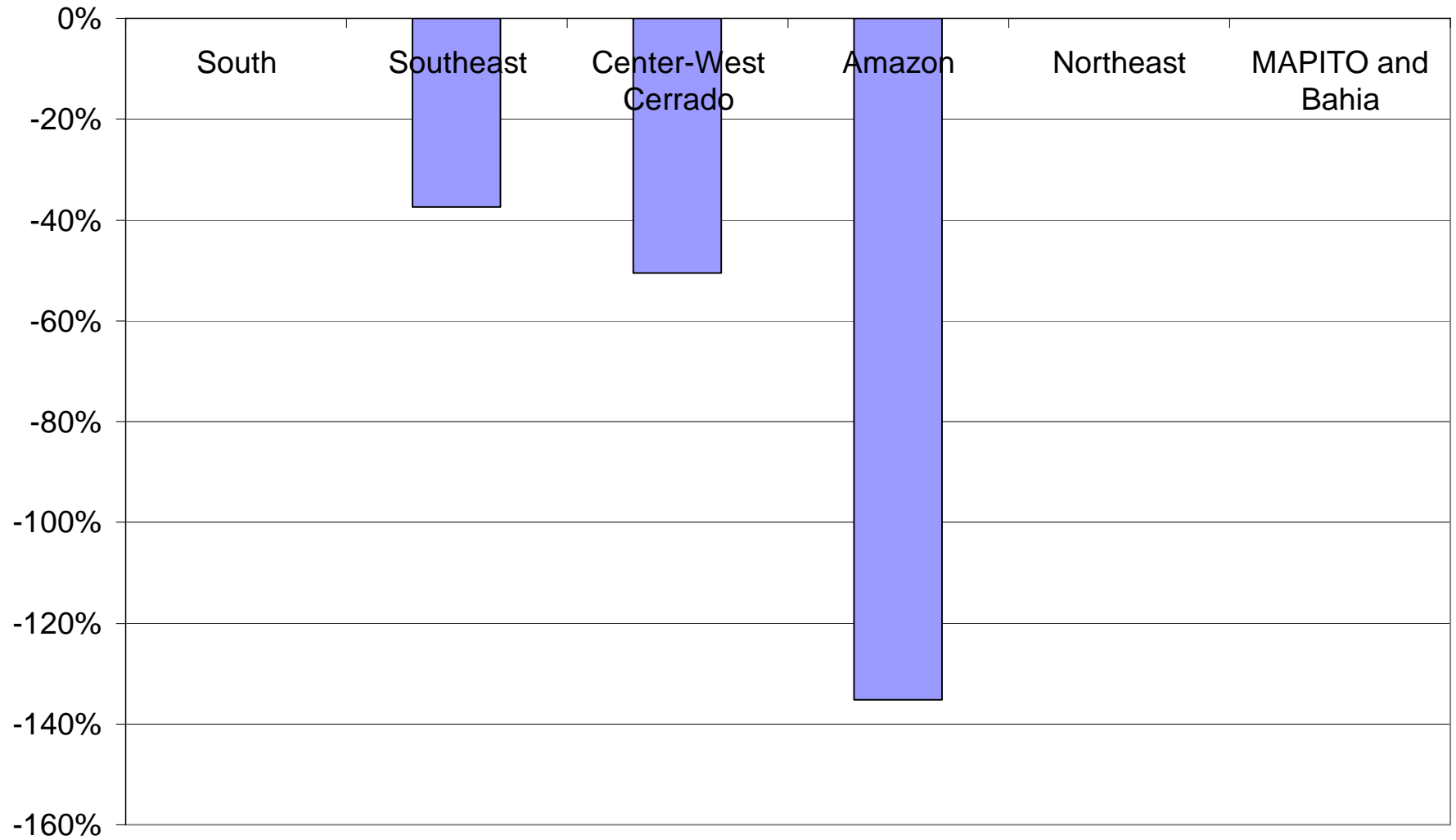
How much pasture was there in Brazil in 2006?



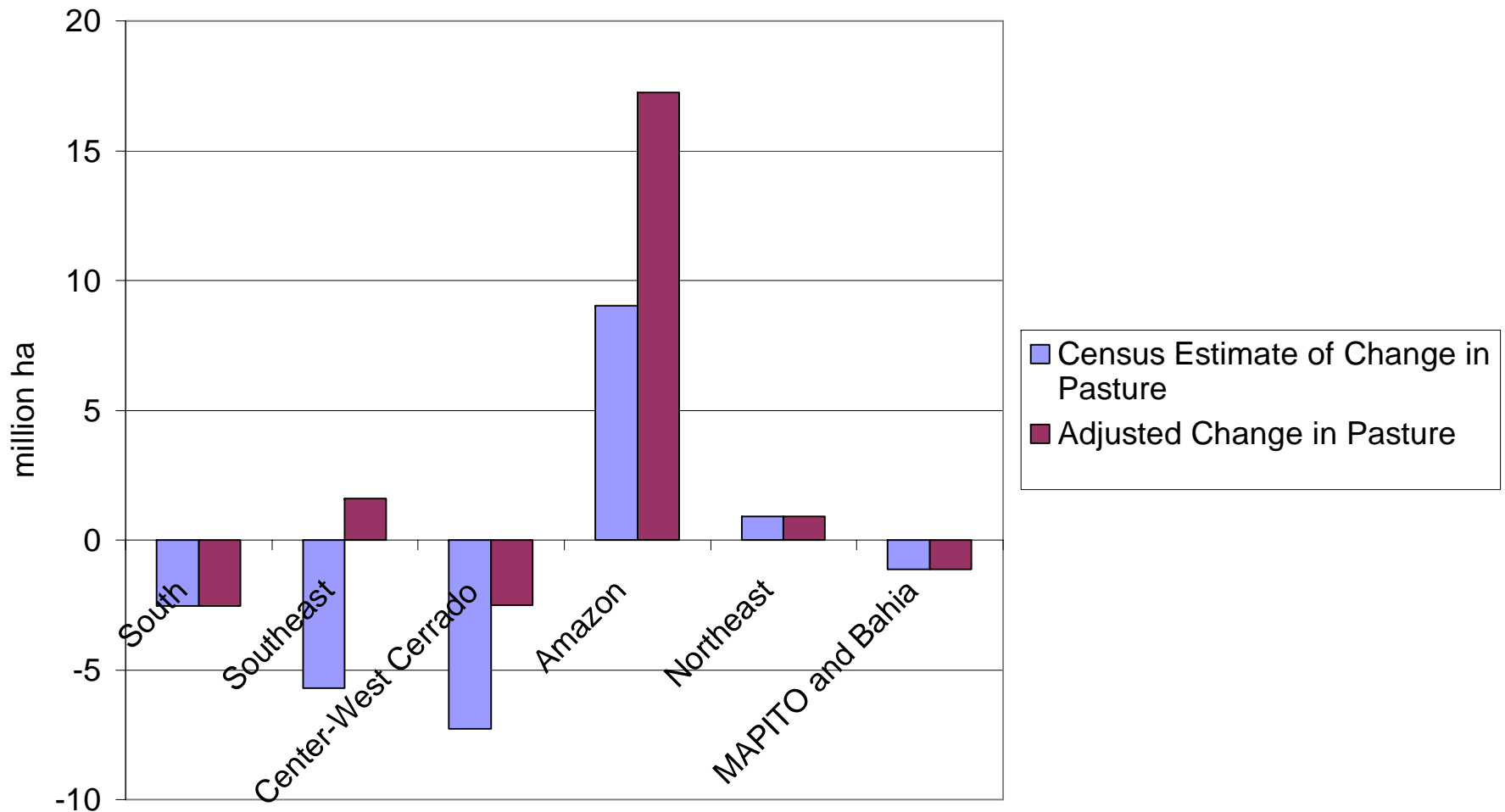
How much pasture was there in Brazil in 1996?



Percent Error in 2006 Census



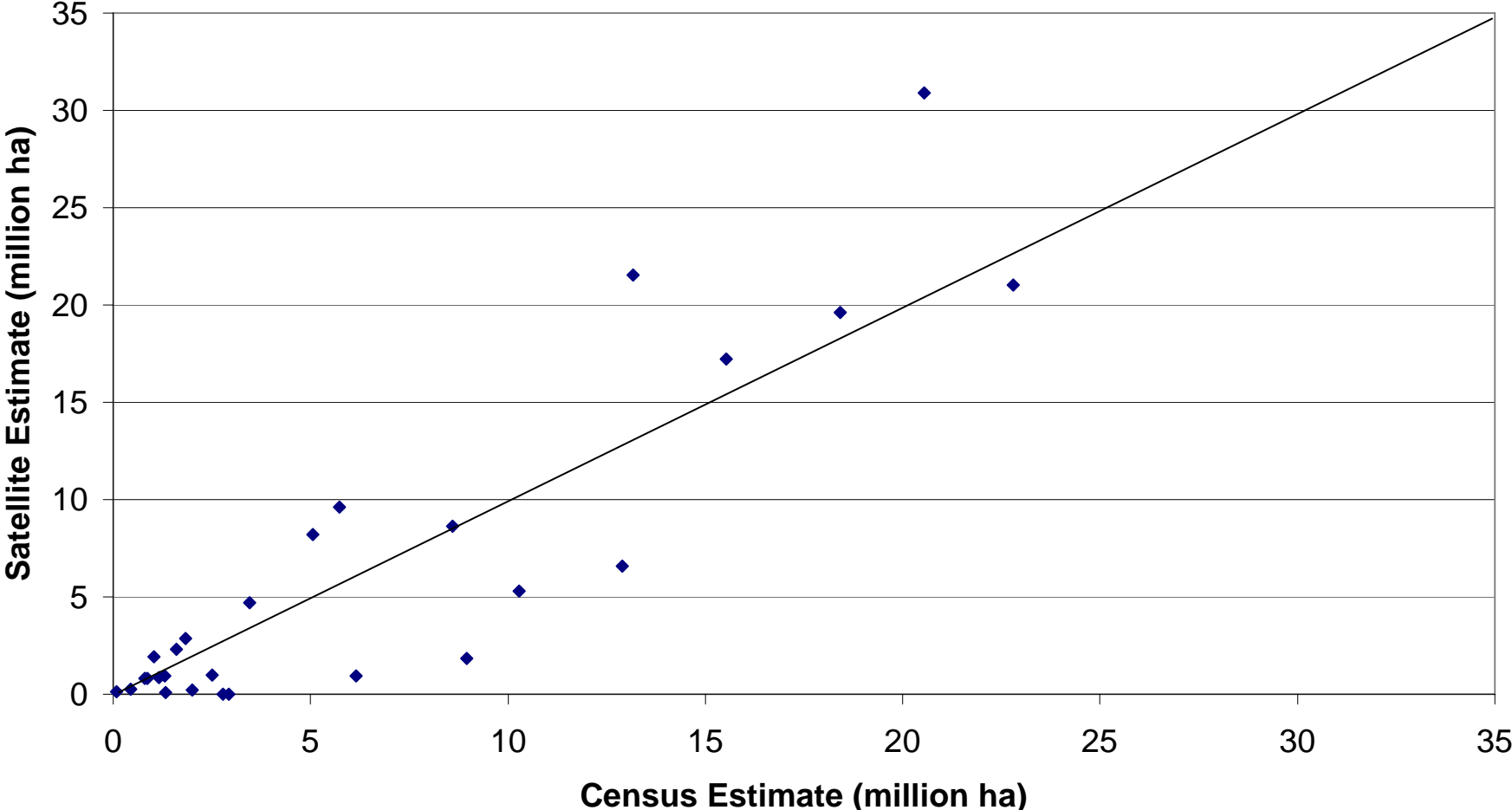
How much did pasture change in Brazil from 1996 to 2006?



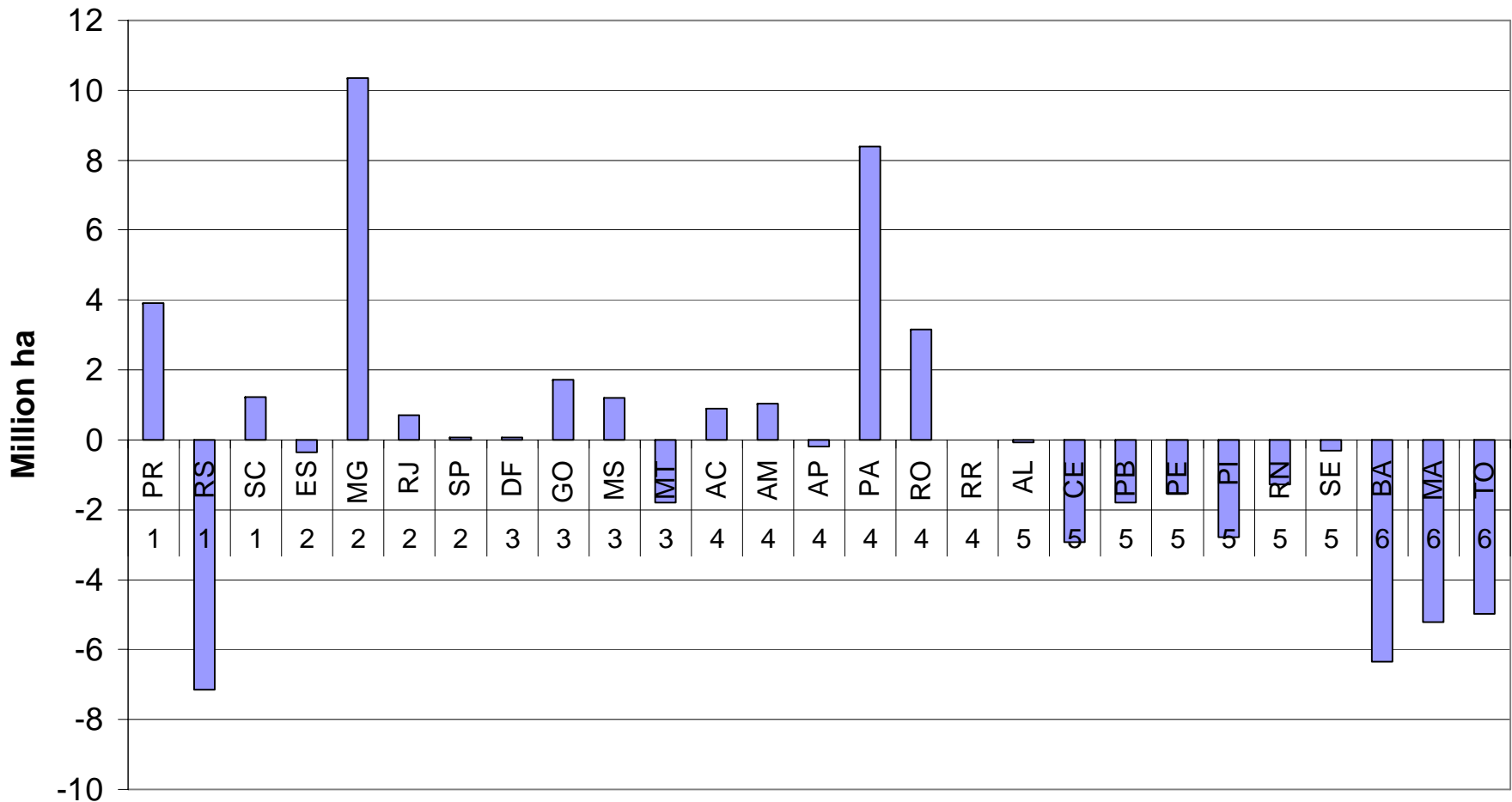
What is “Pasture”?

- Natural pasturelands (57.3 million ha),
 - Improved pastures (91.6 million)
 - Degraded pastures (9.8 million ha),
 - Silage area (excluding corn, 4.1 million ha)
 - Forest-pasture integration systems (8.1 million ha).
-
- Total from Census = 170.9 ha
 - Total in our model in 2006 = 204 million ha

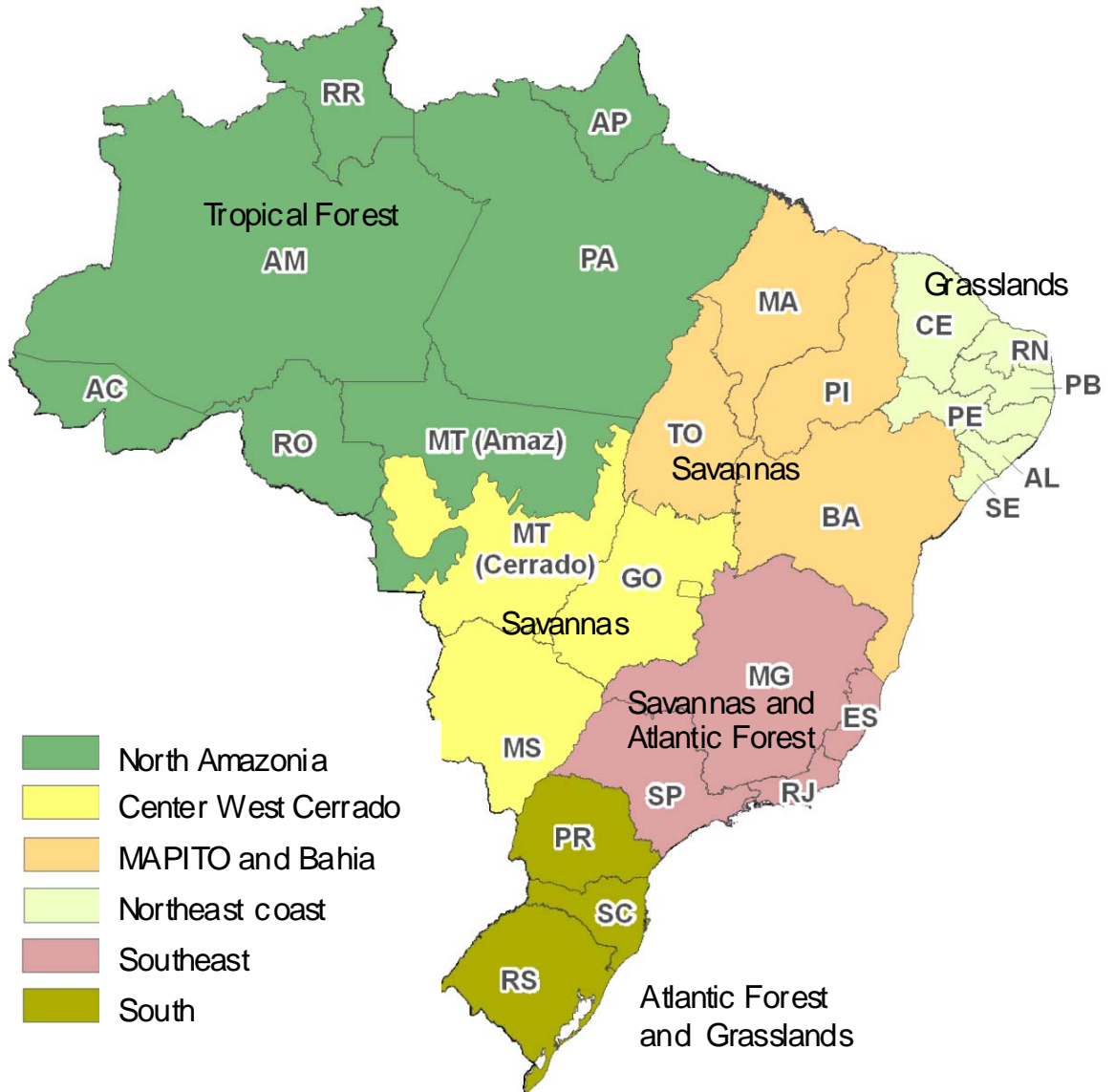
A Comparison of Census and Satellite Estimates of Pasture in Brazil in 2006



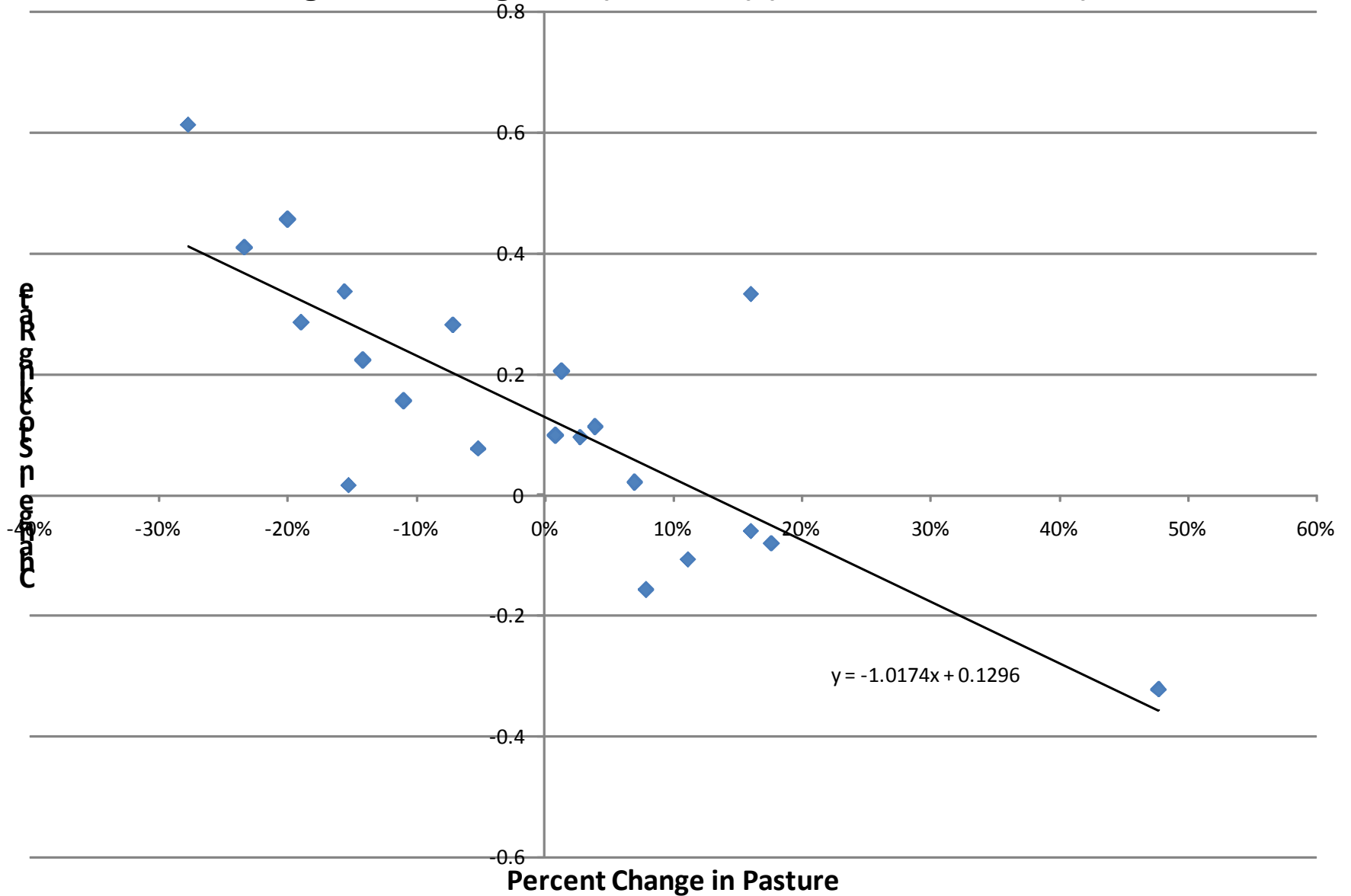
2006 Difference between Census and Satellite Estimates of Pasture (Satellite minus Census)



Macro-Regions Used in the Brazilian Land Use Model



Relationship Between % Change in Pasture (1996 to 2006) and the Change in Stocking Rate (Head/ha) (Non-Amazon States)



Tentative Findings

- Expansion of cropland in many parts of Brazil accommodated by decreased pasture
- Uncertain how much pasture has increased since 1996.
- If cattle herd has increased more than pasture, then causal pathway runs from cattle rather than crops expansion.
- Expansion of biofuels will not increase Brazilian cattle herds

Questions

- What are the premises underpinning approaches for assessing land use changes?
- What are most important data for improving land use estimates?
- What are the major sources of uncertainty in land use estimates?

Data Outside the U.S.

- In Brazil, how much pasture is there? How many cattle are there?
- Not a problem of language because we are working with Brazilians.
- Quality of data is simply poor.

How Well Do Generic Supply Models Predict Region-Specific Changes in Different Countries?

- Do we really need quality data and detailed knowledge of agriculture in different regions in different countries?
 - Yes in the United States for policy analysis
 - Yes in Brazil for land use change analysis
- We are trying to find out in Argentina and China

How Well Do Generic Supply Models Predict Region-Specific Changes in Different Countries?

- Do we really need quality data and detailed knowledge of agriculture in different regions in different countries?
 - Yes in the United States for policy analysis
 - Yes in Brazil for land use change analysis
- We are trying to find out in Argentina and China

Concluding Thoughts

- We need NASS data for all countries to reduce uncertainties involved with land use change analysis
- We need increased knowledge of country-specific drivers of agricultural management decisions
- Both of the above needed for analysis of food security policies and climate change policies.