

# ***Modelled vs. Observed Land Use Change - Why the Difference?***

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## *What the Models Say*

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- All of the models project an increase in cropland and a decrease in forests and pasture areas in the region that requires the biofuel and in other parts of the world.
- Many modellers resist any attempt to reconcile the model results with the real world observations.
- While this resistance was perhaps justified in the first few years of expanded biofuel use, there is now a significant amount of data available and it doesn't match the model results.

# *Some Definitions*

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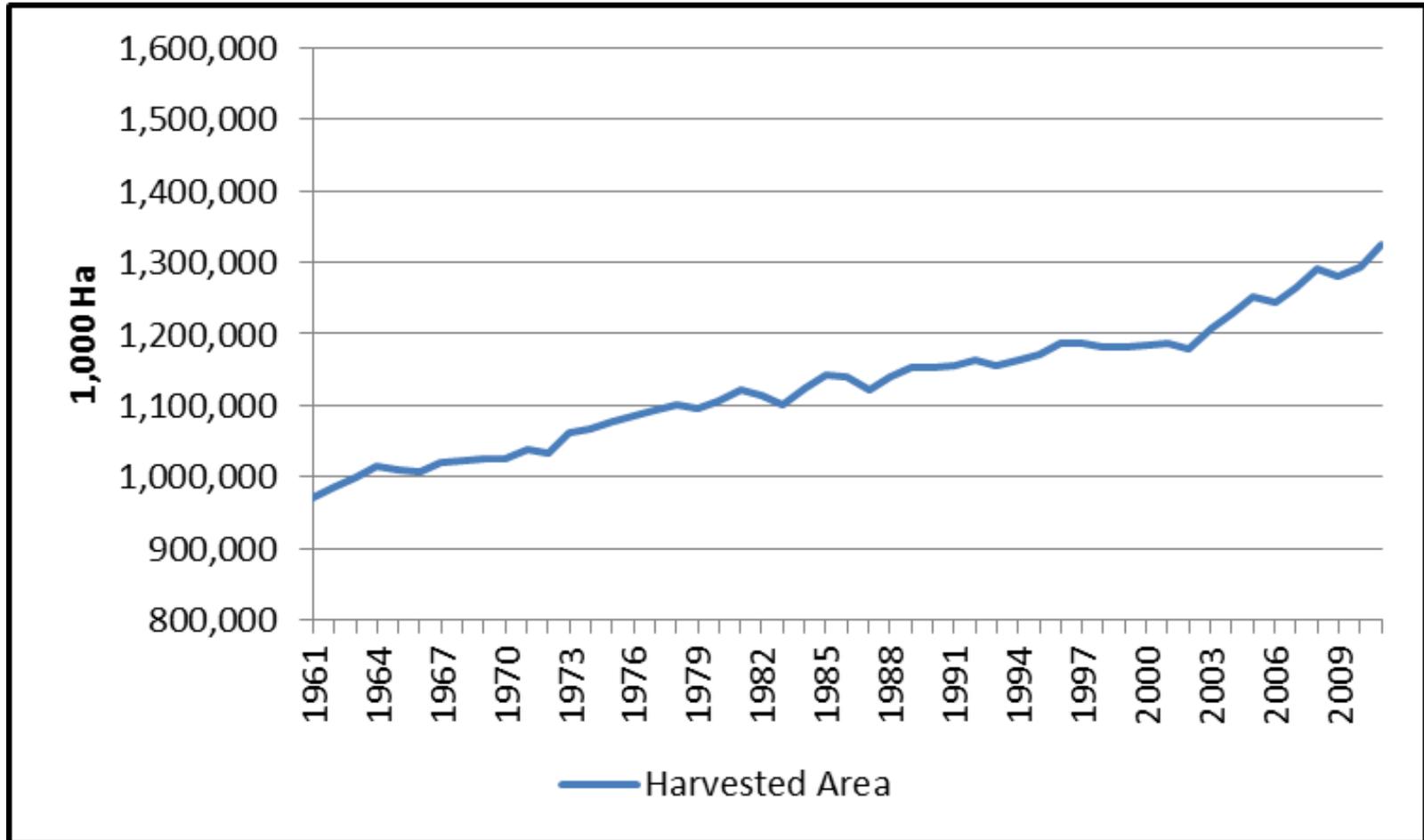
- Crop Land
  - Land that has been cleared for growing crops including land that may have been fallow in past 5 years. FAO arable land.
- Harvested Area
  - Crop land that produced a crop. In a double crop system harvested area is counted each time a crop is produced in a year.
- Harvest Frequency
  - Ratio of harvested area to crop land.
- Idle Land
  - Difference between Crop Land and Harvested Area.

# *What Do Models Use?*

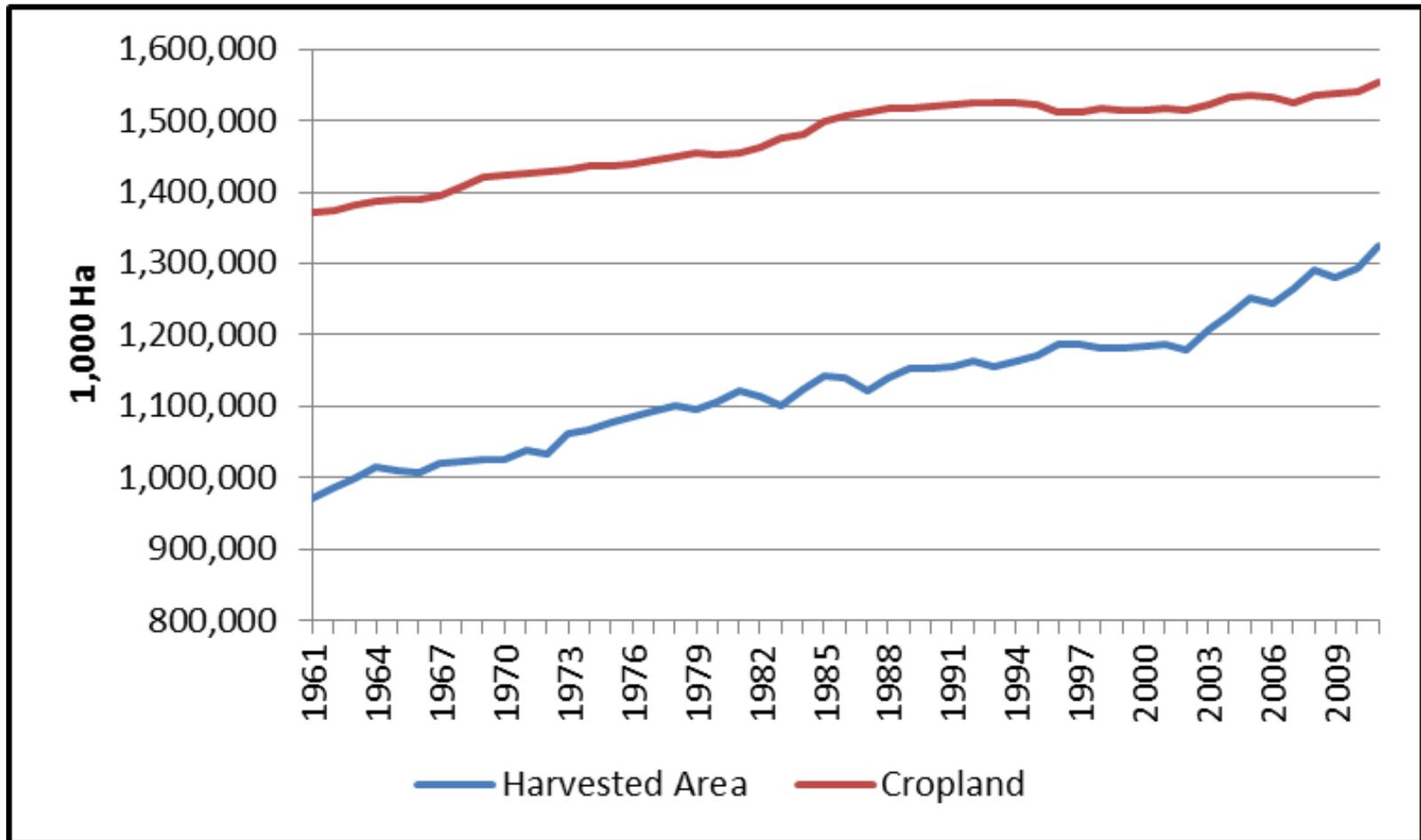
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- Most ILUC models have used a mixture of land types.
- Harvested area is provided by crop.
- Total crop land is usually used, but the difference between harvested area and crop land is usually not reconciled, nor is it usually accessible within the models.
  - There are a few exceptions and the models have been slowly adding some land categories that fall into the gap between crop land and harvested area.
- Most models assume that an increase in harvested area require an equivalent increase in crop land.

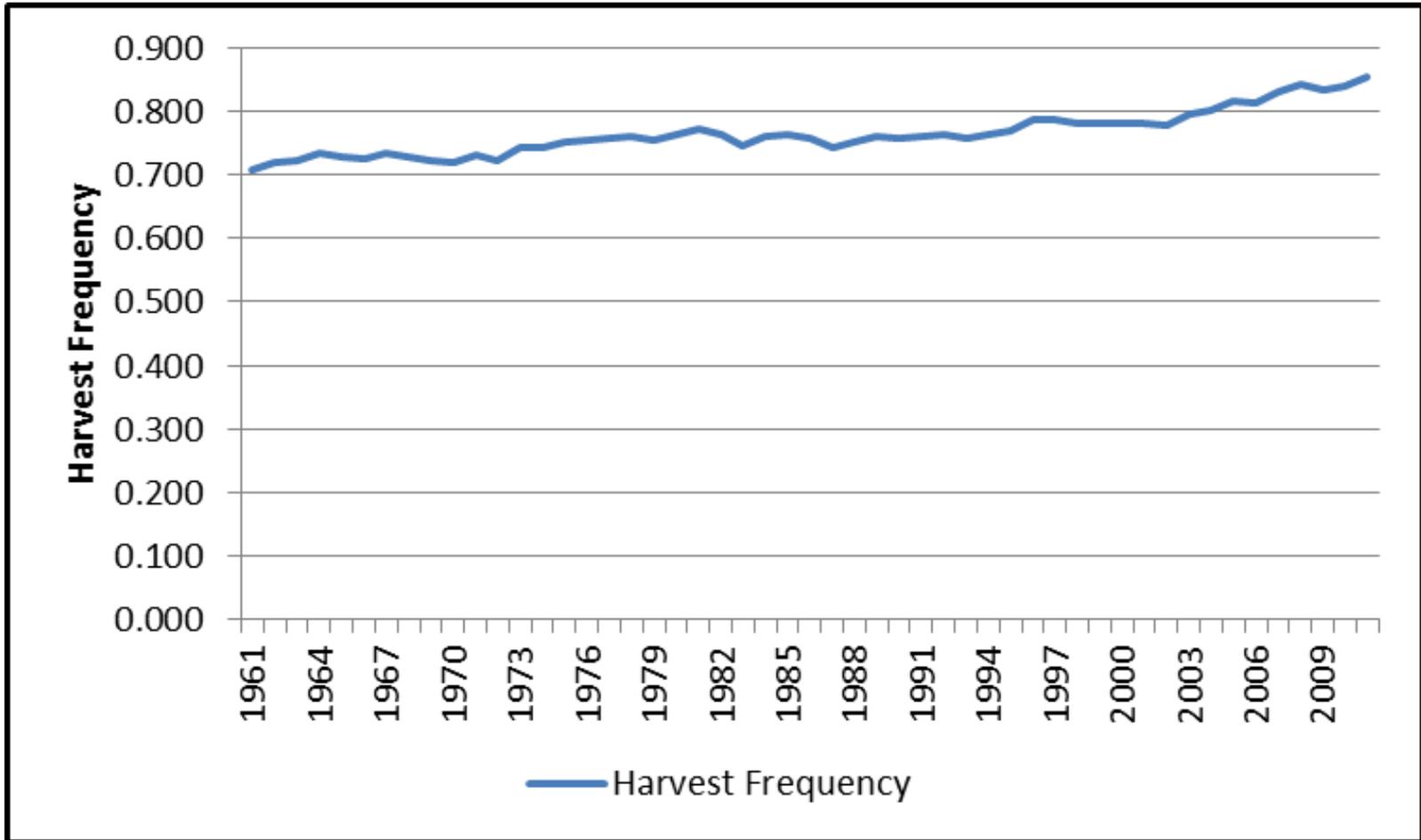
# Global Harvested Area Change



# Global Crop Land Change



# Existing Land is Better Utilized

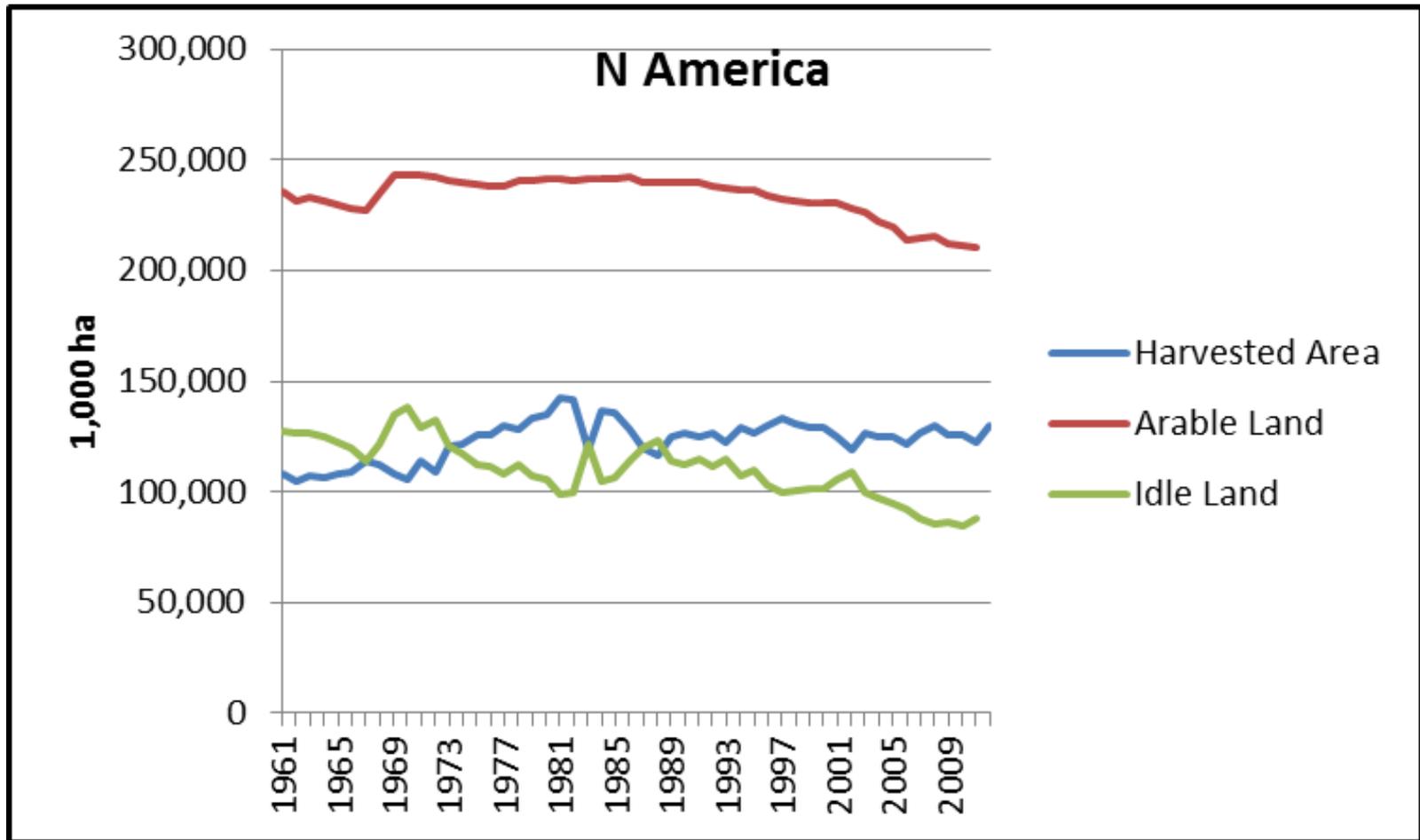


# $\Delta$ Harvest Area $\neq$ $\Delta$ Crop Land

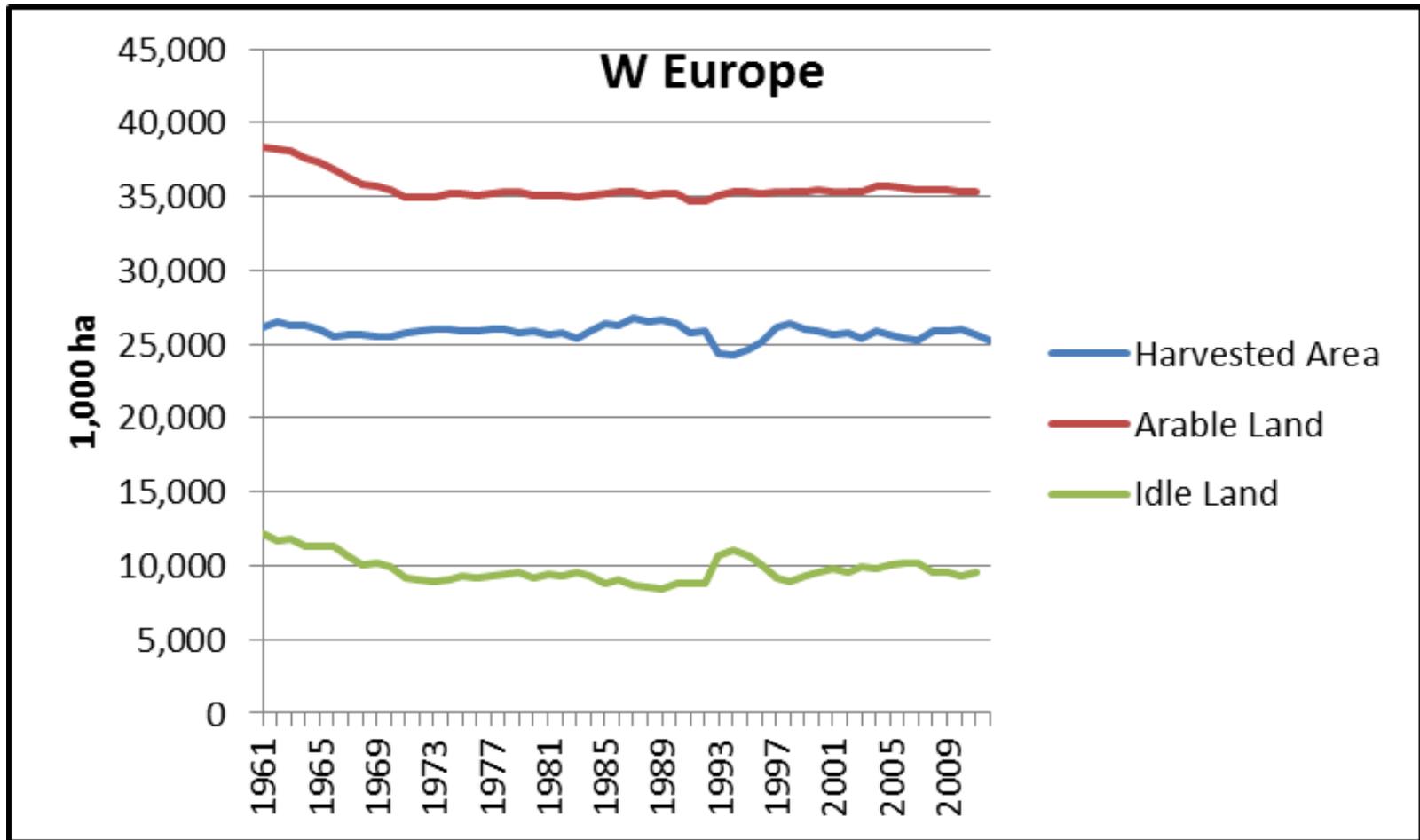
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- 75% of the increase in harvested area in the last decade has come from increased harvest frequency
  - We are making better use of existing land.
    - Increased double cropping
    - Reduced summerfallow
    - Reduced crop land pasture (crop land temporarily in pasture).
- Since the models do equate a change in harvested area with an equal change in crop land they grossly overestimate the real world impact.
- The world land use change patterns are not homogenous.

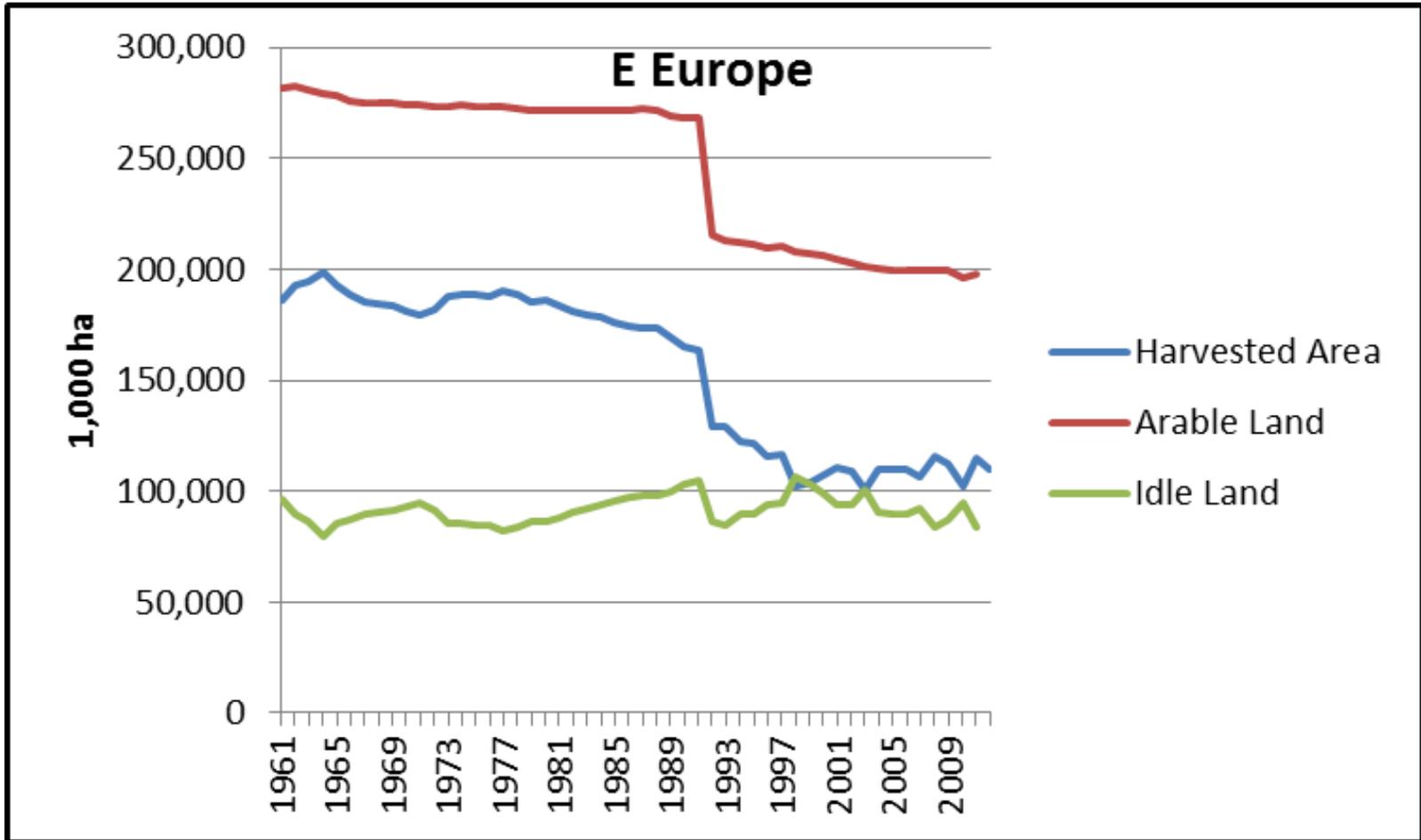
# North America



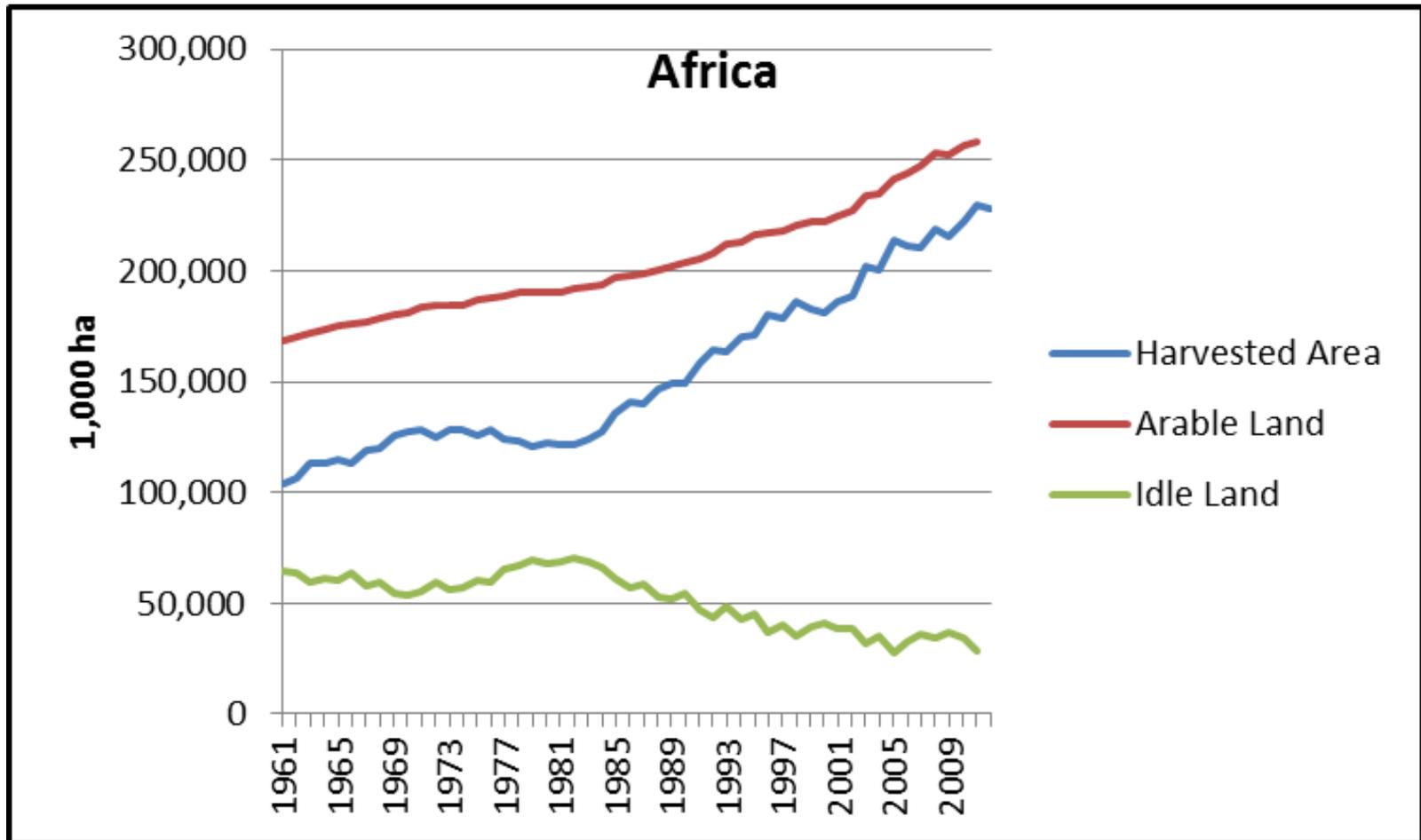
# Western Europe



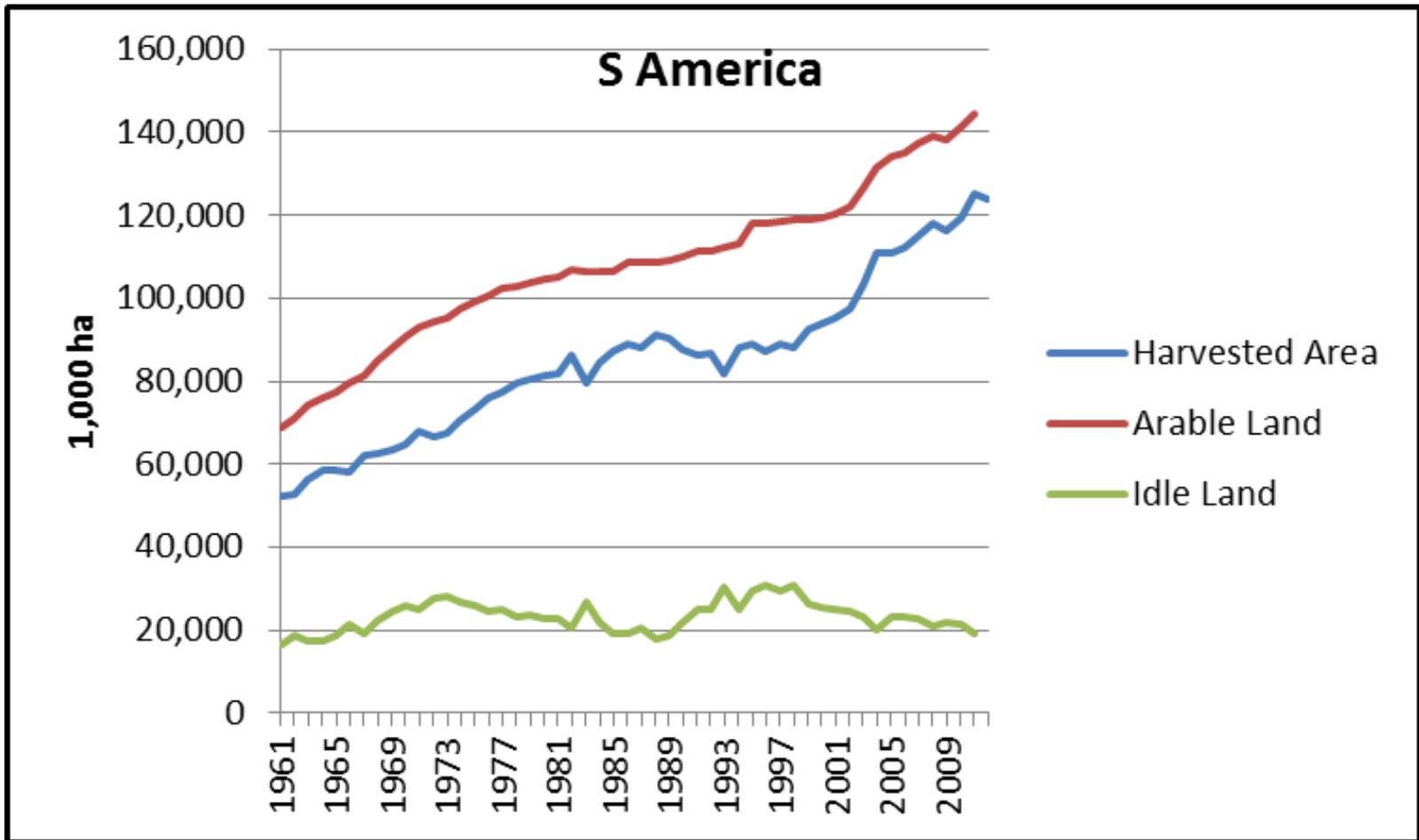
# Eastern Europe



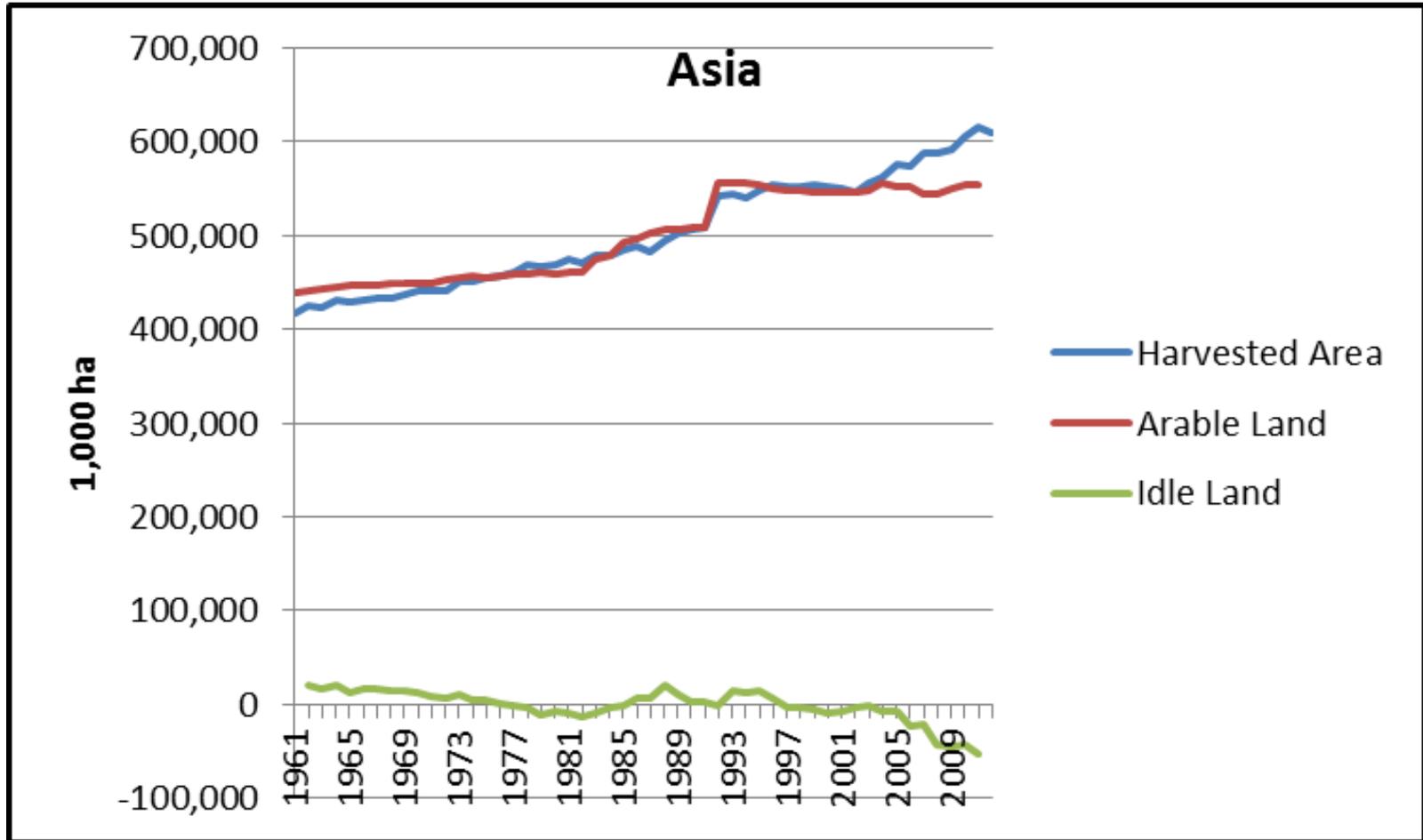
# Africa



# South America



# Asia



# *Harvest Frequency Drivers*

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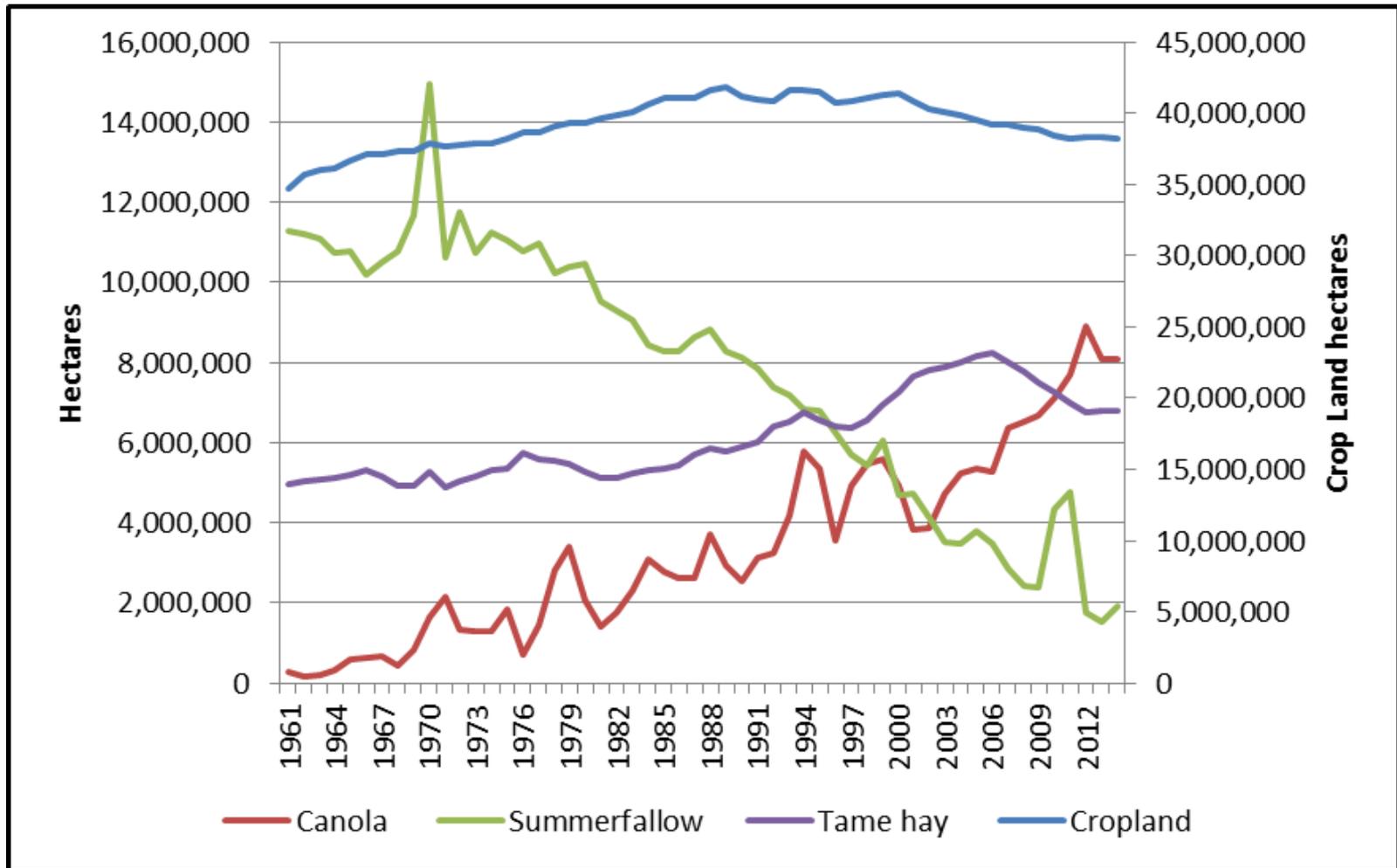
- The drivers of increased harvest frequency are different in different regions.
- Many countries have good quality data that allows the identification of the drivers.
- The next slides provide a North America perspective.

## *Canada Detail*

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- Crop land peaked in 1989. Since then it has decreased by 9% but harvested area in annual crops has increased by 6%.
- There has been a large reduction in summerfallow area in the past decade.
  - Coincides with increased adoption of no till agriculture and the emergence of canola/rapeseed as a major crop. Large build in soil carbon.
  - Small drop in seeded pasture.
  - Double cropping is not a factor due to short growing season.

# Canada Detail

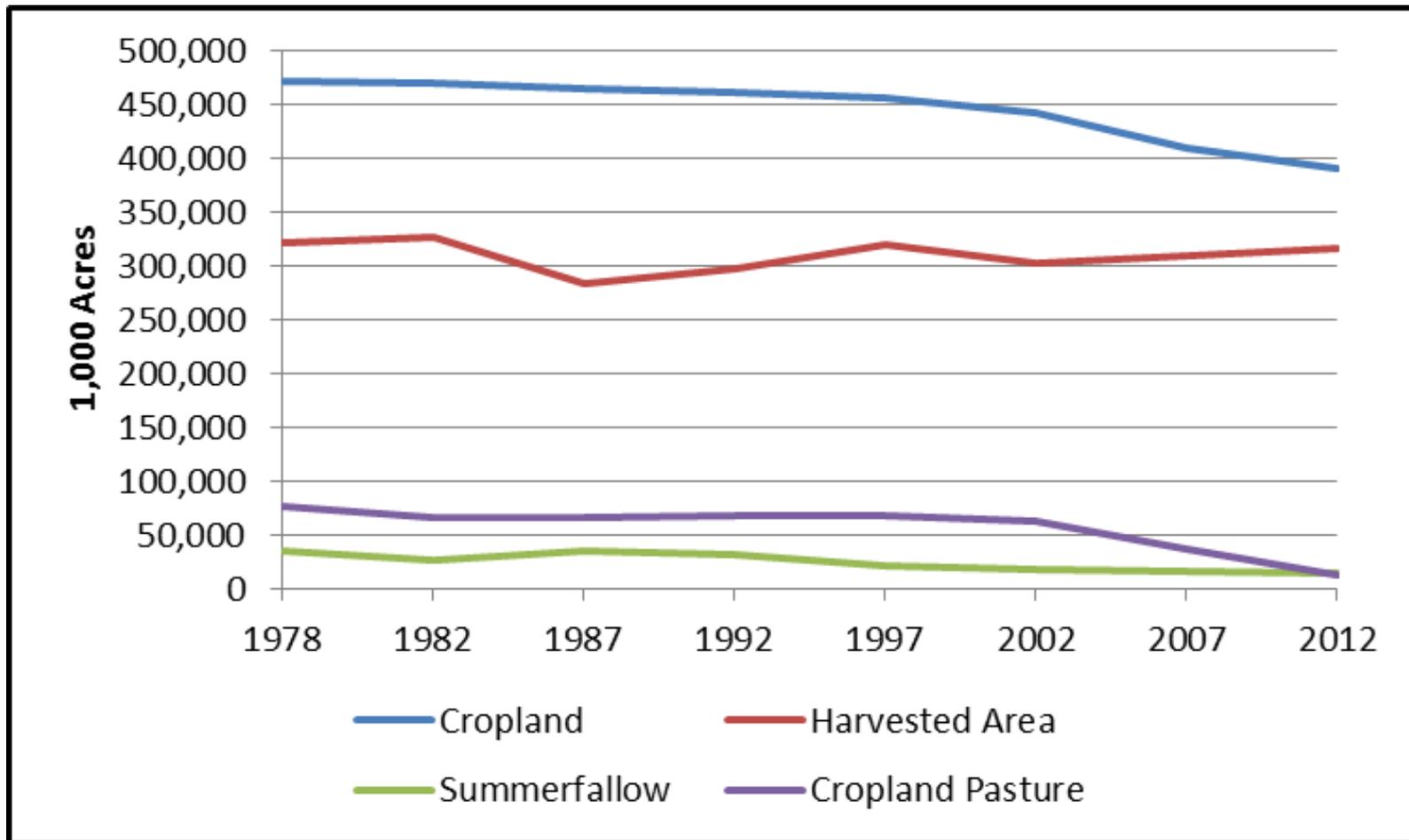


## *US Detail*

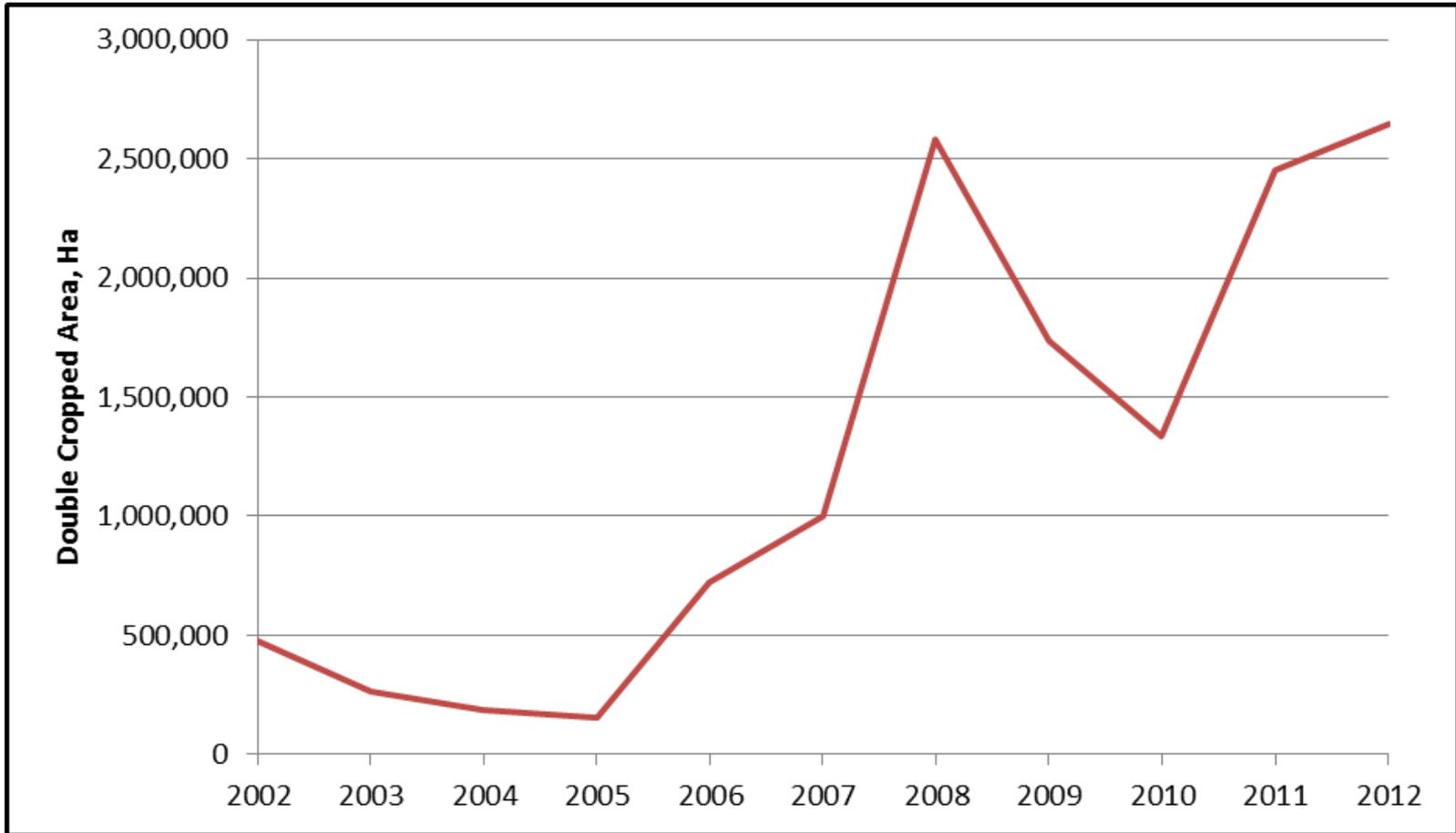
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- Similar trends in the United States
  - Reduction in crop land
  - Harvested area has been flat to a small increase.
- Increased double cropping.
- Small reductions in fallow area and crop land pasture.

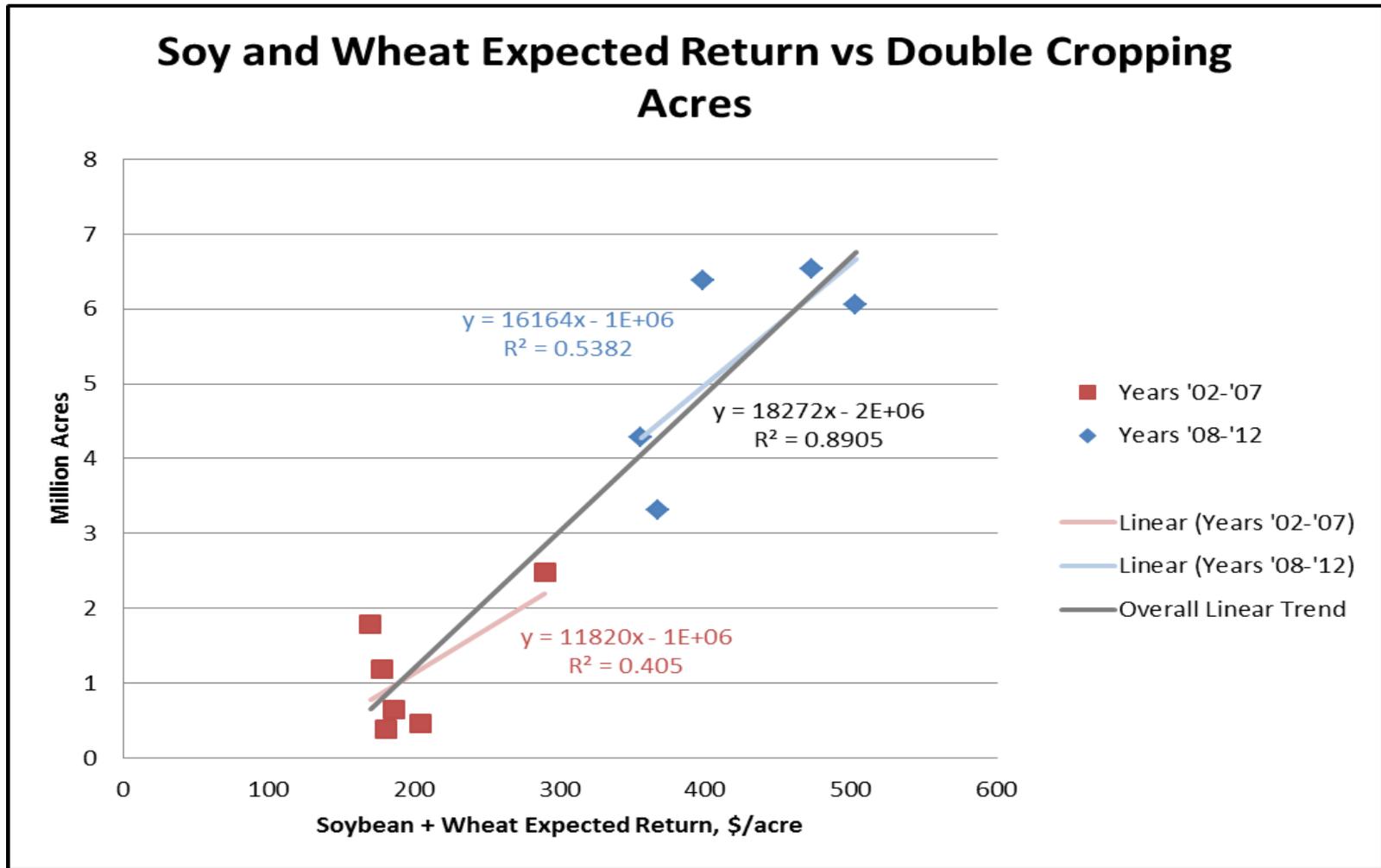
# US Land Use



# Double Cropping



# Double Cropping Drivers

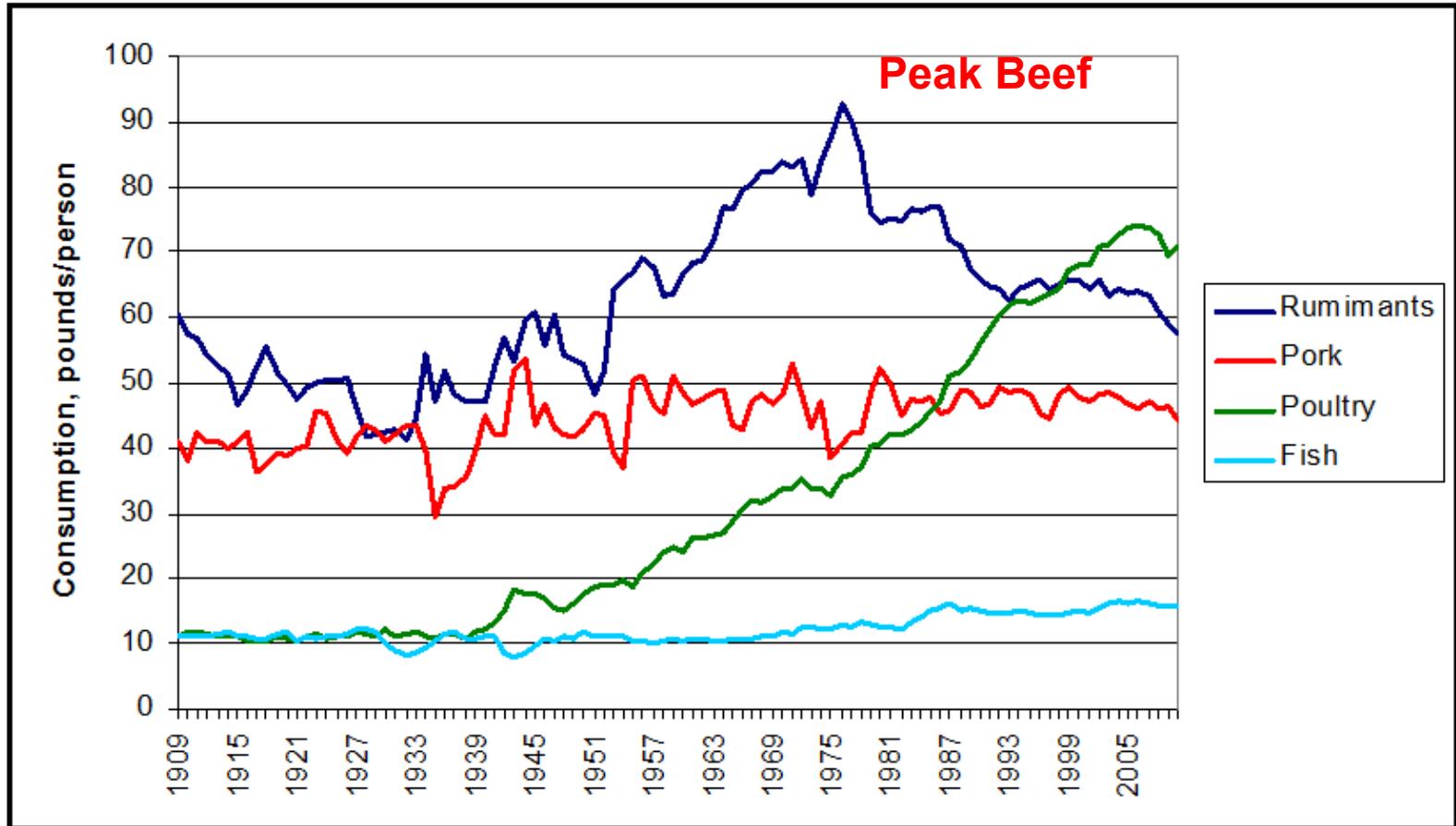


# *Disappearing Demand*

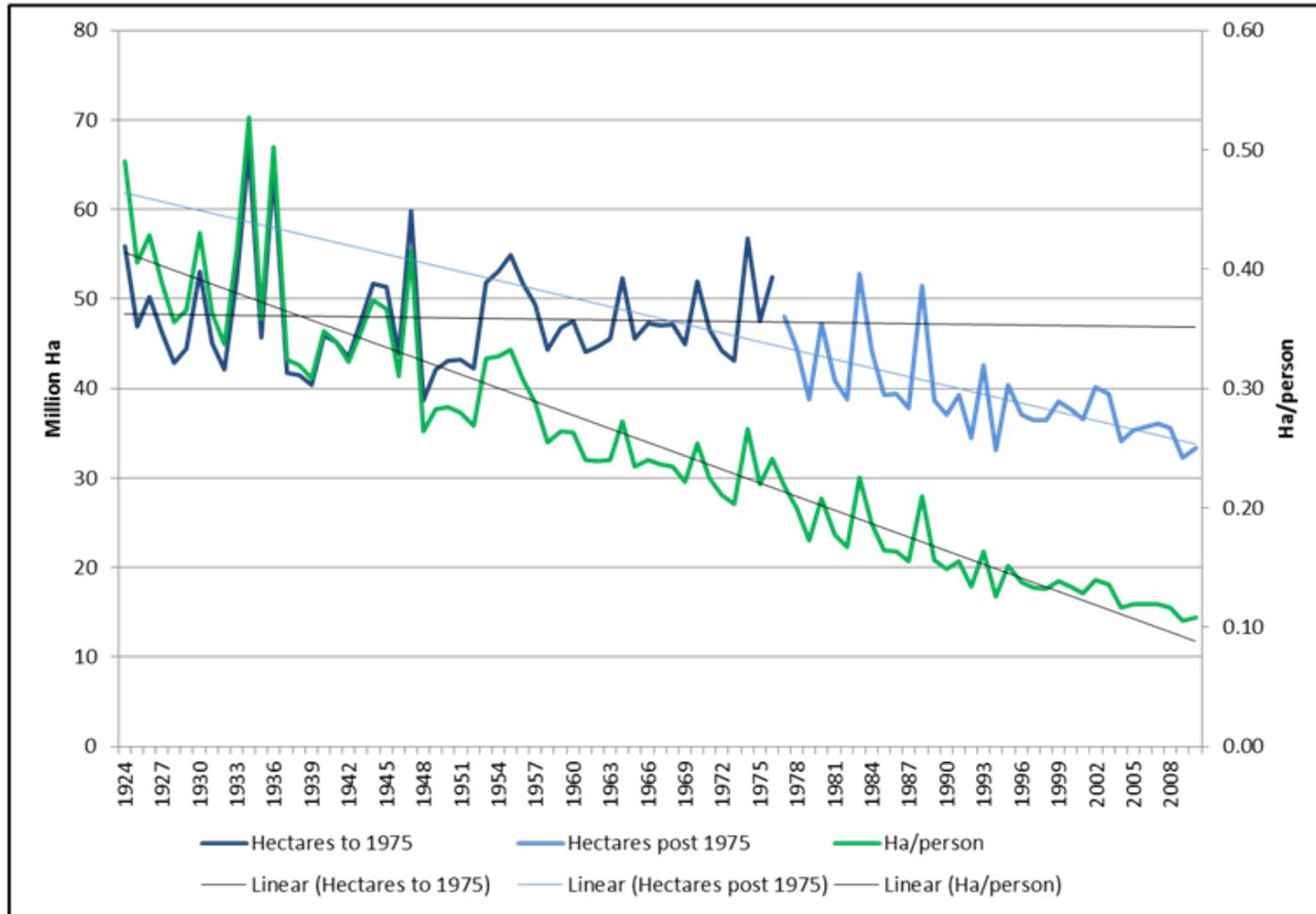
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- Changes in diets, increased crop yields, improved livestock feeding efficiency, are overwhelmingly offsetting population increases and higher food consumption rates in the US and to a lesser extent Canada.
- Net impact is a reduction in the land required to supply livestock feed.

# Disappearing Demand



# Impact on Land Demand



# Summary

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- Most ILUC models overestimate ILUC emissions because they don't properly account for crop land that is not fully utilized.
- All regions of the world are making more productive use of existing crop land.
- In the developed world there is no evidence of an increase in crop land, but there has been some increase in harvested area.
  - More double cropping
  - Less summerfallow
  - Less crop land pasture/seeded hay
  - Demand for land from traditional industry is also dropping.



**Questions?**

**(S&T)<sup>2</sup>**