

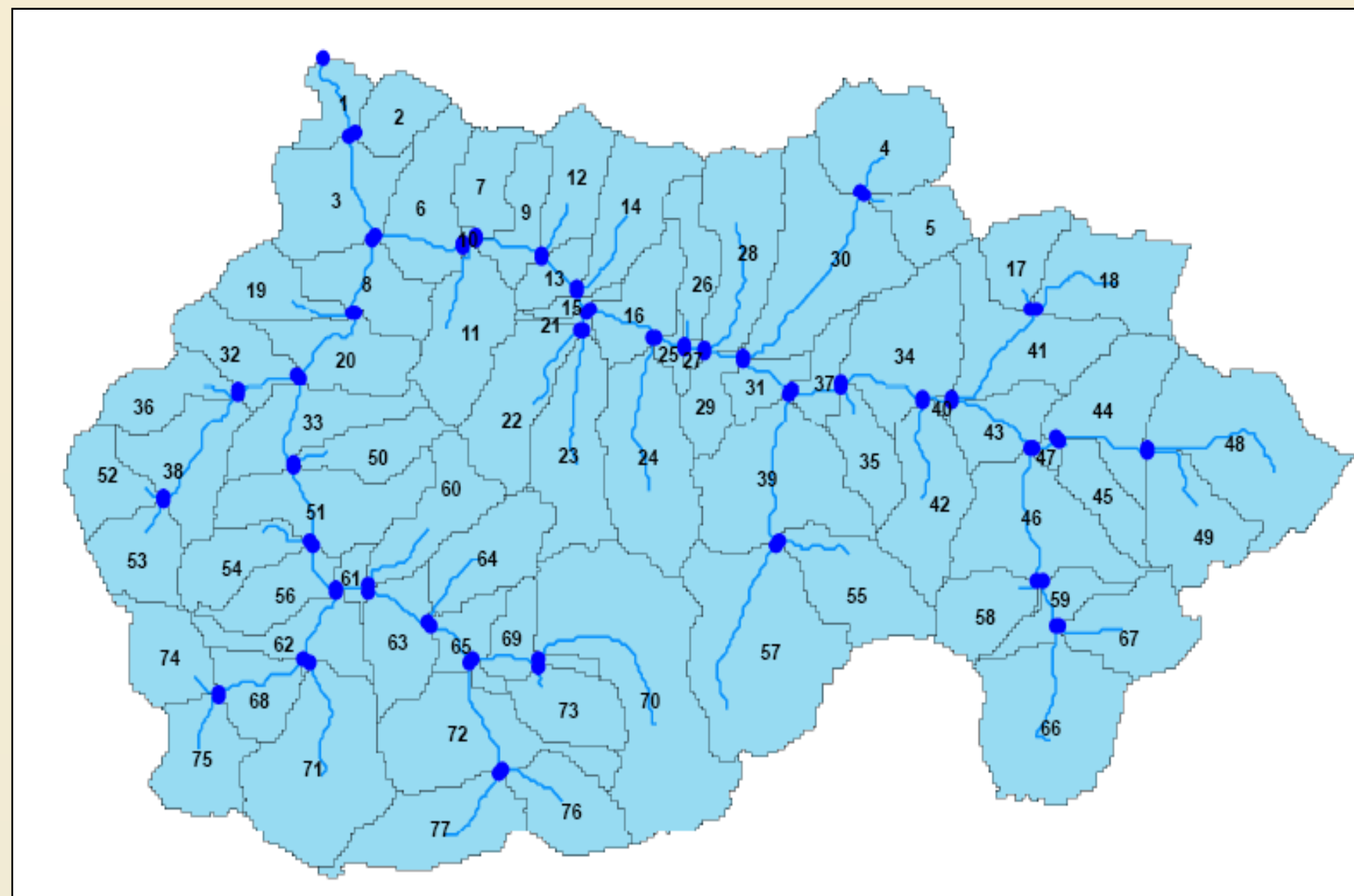
Economic and Environmental Impact of Agricultural Land-Use Change for Energy Crop Production in Different ENSO Phases

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Energy security is an important concern, in the United States, in addition to the ramifications of a petroleum based economy such as global climate change, and national security. In 1978, U.S. Department of Energy (DOE) established the Bio-energy Feedstock Development Program (BFDP) to develop new crops and cropping systems that could be used as bio-energy feed-stocks. Further development of bio-fuels is a goal of the current administration. However, plans to increase the development of energy crops as part of bio-fuels development may have localized consequences for water quality in the form of agricultural non-point source pollution, which should be addressed through local watershed level policies.

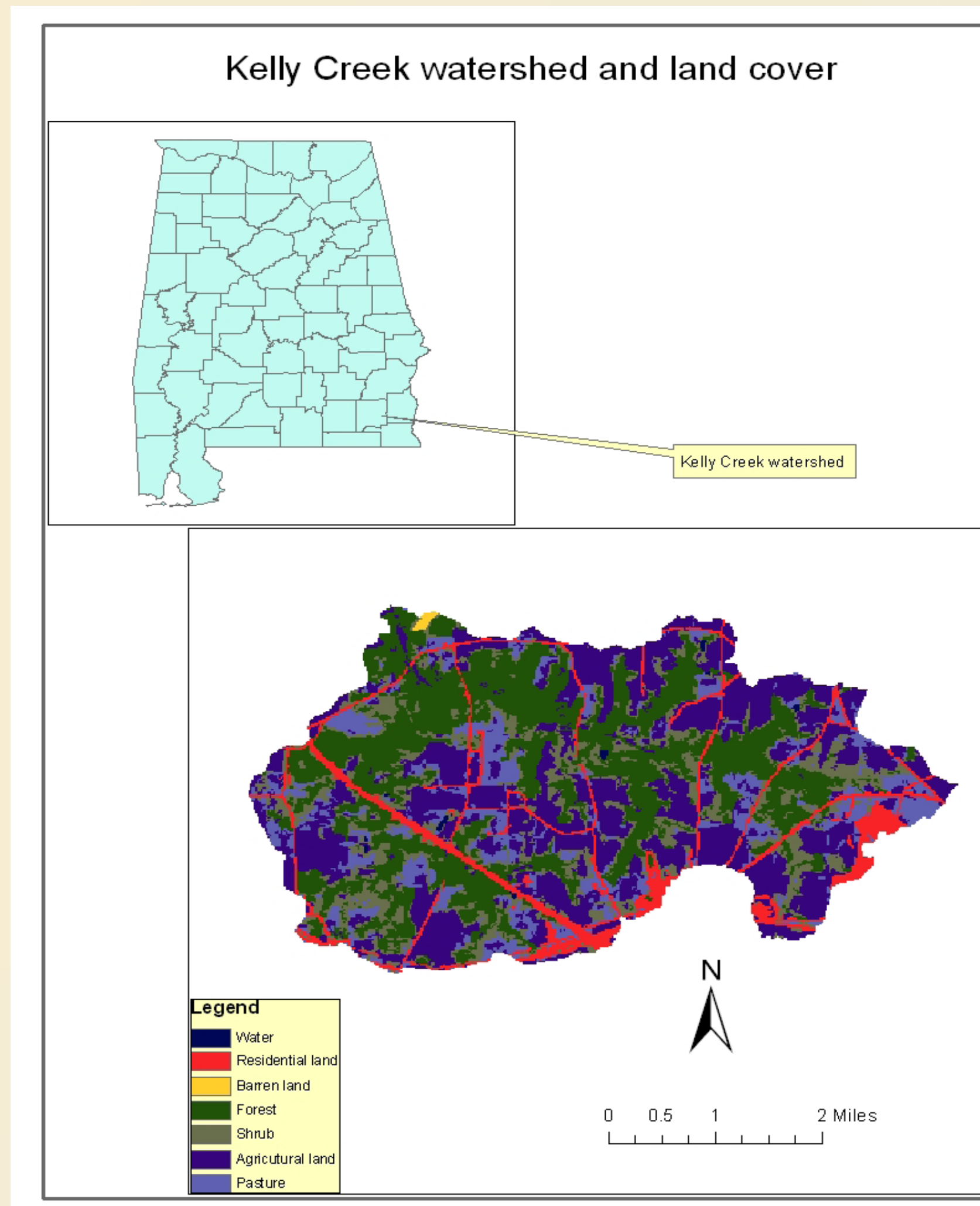
The main objective of this study is to examine the impact of energy crop cultivation by way of changing the traditional agricultural use of the watershed to planting energy crops.

MAP OF KELLY CREEK SHOWING THE STREAMS



Kelly is a community located substantially outside the boundaries of any incorporated place in Dale County, Alabama, centered at latitude 31.324 and longitude 85.655. The elevation is 167 feet. Kelly Creek is characterized by several narrow streams that divide the entire community into several watersheds. Ho et al (2006), used SWAT to divide Kelly Creek into 77 sub-watersheds based on land use and soil type. Using the crops suitable Kelly Creek sub-watersheds, cotton, corn, peanut, and soybeans. The study estimates optimal output and profit for the watershed under different weather scenarios to determine the optimal use of the land in the Kelly Creek.

This study uses Agricultural Policy Environmental Extender (APEX) to estimate crop yields and optimal profits on 66 sub-watersheds. Profits are examined and compared when the 66 sub-watersheds are cropped with corn, soybeans, and cotton respectively using 2007/2008 prices that takes into consideration the increased price of corn due to the increased demand for ethanol. The environmental impacts of these activities are also examined for run-offs, nitrogen, phosphorus as non point sources of pollution.

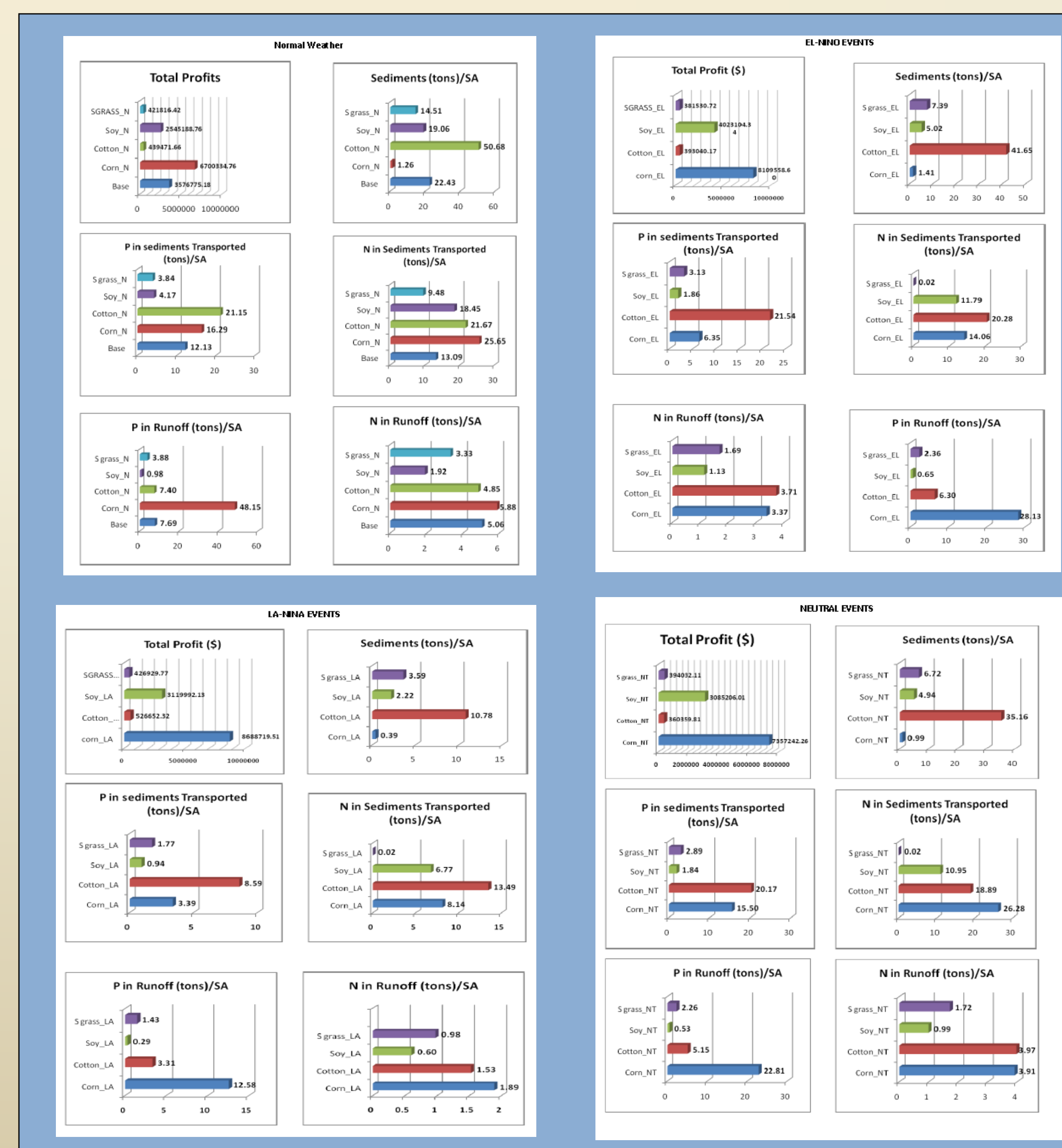


GAMS (General Algebraic Modeling Systems) is then used to optimize the profit of the farmer subject to constraints like land area in each watershed, costs, and sediment loss, nitrate loss, and phosphate loss from the area when crops that can be used to produce ethanol are planted in place of the traditional crops in this watershed. The result of the GAMS output allocates the watershed to the cultivation of corn due to its' profitability and switch grass being the least pollutant .

Koltrain (2001) reports that there are currently 56 ethanol producing plants in United States producing about two billion gallons of ethanol annually and the profitability of ethanol has been the driving force in this expansion. He explains that the return on investment in an ethanol plant is about 50 percent with ethanol priced at \$1.77 per gallon in 2001. The current plan to eliminate methyl tertiary butyl ether (MTBE) from gasoline with the 1990 passage of the Clean Air Act Amendment by the congress will make ethanol more valuable as an octane booster in gasoline as it replaces the lost MTBE volume, because ethanol contains higher oxygen content than MTBE. Nalley and Hudson (2003) report that MBTE has the tendency to pollute groundwater when leached from underground storage tanks and can cause bad taste and odor at very low concentrations. The United States Department of Energy (DOE) also plans to reduce the currently high production cost of ethanol to 60 cents per gallon by 2015. All these could result in low cost biomass that will make ethanol competitive with gasoline and will better penetrate the market than it is currently doing.

Energy independence, Green House Gas (GHG), and clean air from vehicle emission are the three main drivers for increased ethanol production. This could call for an increased demand for dedicated crops to provide additional contributions to United States' energy use mix. This increase in demand for energy crops would make them economically competitive with the traditional crops.

- ❖ The results show that corn, a very good source of ethanol will be profitable for the farmers, however, it is one of the largest sources of nitrogen, phosphorus, and runoff that are non- source point pollutant
- ❖ Switch grass, that is a source of cellulose ethanol does not seem to be very profitable, but the least pollutant
- ❖ It is expected that with the increase demand for ethanol and the relatively easier of extracting cellulose, the price of switch grass will make it a choice option for the farmers
- ❖ Soybeans, a good source of bio-diesel is also very profitable and contributes relatively lower pollutant
- ❖ This study helps the farmer to decide the best crop to adopt during any of the ENSO phases



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