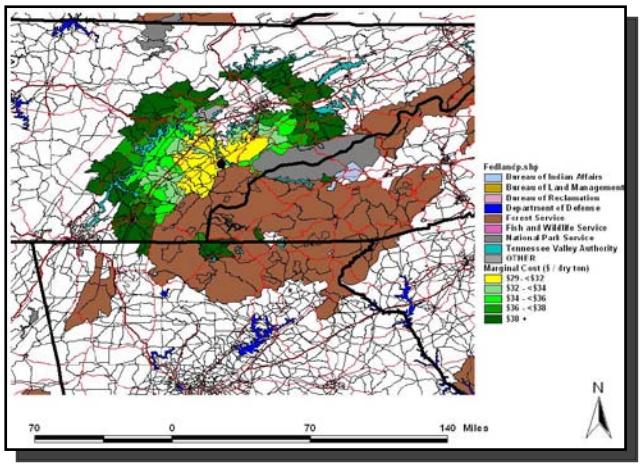
Feedstocks Logistics
Food vs. Fuels Issues

1. How does feedstock logistics relate to location of production issues?



- Regardless of conversion technology, the availability of a sustained annual supply of biomass with consistent quality characteristics dictates the potential of any biorefinery site. As such, to the extent that logistics issues impact that supply it is at the heart of the biofuels and bioenergy industry.
- Ultimately, the scale of any biorefinery operation will be determined by access to feedstock, and feedstock that meets process specifications. Since scale of the operation will ultimately determine the number of refineries required to meet projected goals, this directly impacts location of production.
- Transportation network is a vital consideration in feedstock delivery costs, and can draw from assymetric, or non-concentric biosheds (as illustrated by the BioSAT analysis above, *conducted by T. Young, J. Perdue, and A. Hartsell*). The development of cooperatives and other biomass feedstock staging systems that can reduce delivery costs for a larger distance will impact biorefinery production volumes and siting decisions.
- Feedstock logistics are impacted by demand from existing biomass-reliant industries. The relationship is complex since residue from primary wood processing facilities is anticipated to be an important and valuable raw material source. These existing industries also benefit from a highly efficient and refined supply chain that could be expanded to reduce logistical barriers to the emerging industry. But, they represent an existing demand that directly competes with any new demand created by the bioenergy/biofuels industry, which has to be an important consideration in identifying potential biorefinery locations.

2. What is the role of feedstock logistics in the food/fiber/fuel debate?

- I believe it is important to expand the context of the question beyond the food/fuel debate. Undeniably the most visible concern, continued development of cellulosic ethanol systems is intended to respond to this issue. In so doing, it is important to recognize potential impacts on the existing industry that relies on woody biomass as a raw material *(as noted above)*. While there is opportunity for synergistic interaction between the two, competition for the resource becomes an important logistics issue.
- An important role of feedstock logistics is to develop an affordable, cellulosic resource for bioenergy and biofuels production from marginal lands, thereby diverting pressure to expand onto lands traditionally reserved for food production. In providing alternative biomass at competitive costs, viable alternatives will emerge. An important aspect of this

involves developing purpose-grown crops that are optimized for maximum yield and processing quality from marginal lands.

- There is a need for innovation in the supply logistics to expand access to alternative cellulosic sectors. Urban waste, demolition wood, forest residue, etc. represent large volumes of cellulosic feedstock; however, the expense associated with collection and pre-processing of this material limits its use. Advances in the consolidation and processing of this type of "low quality" would further deflect attention from lands traditionally reserved for food production.
- Currently, the research and development emphasis is on single-feedstock technologies. It is important to consider development of supply systems that are capable of handling multiple feedstock. This is particularly true for any biomass staging units where preprocessing and other raw material upgrading would occur. The ability to handle different biomass types would likely reduce concerns associated with feedstock supply over the course of a year that might exist for agricultural crops.

3. How can the Air Force contribute to developments in technology, organization, and policy that would accelerate the biofuels industry?

- While there is considerable discussion around the concept of an integrated biorefinery, analogous to petroleum refineries that produce a suite of chemical products. It is important that this vision become a reality for several reasons. The primary reason is simply that the fuels market provides only another commodity outlet for renewable carbon feedstocks. This new expectation does little to increase the value of lignocellulosic materials. That is, wood transitions from lumber to energy while agricultural residue may currently be limited to bedding, or animal feed. Liquid fuel offers little attraction to those producing the biomass for yet another very low profit margin outlet. There has been extensive investment (and rightly so) in advancing technology for biomass to liquid fuels processes; however, that has left little room for similar progress to be made in developing additional industrial chemicals (of greater value) for use as lubricants, monomers, and other value-added molecules. In my opinion, this is an innovation that needs to happen, and I believe it represents an opportunity/need for Air Force research and development investment given their history of technological advancement.
- The Air Force is perhaps better equipped to address logistics than many, if not most, federal agencies. Few organizations are as experienced in delivering critical equipment and components where they are needed. As such, the potential exists to shape the structure of this emerging industry for maximum efficiency, and optimal national security.
- The research investment on producing hydrocarbons from biomass has been limited, given the initial emphasis on ethanol. Given the Air Force's need for this type of fuel, additional support to advance R&D in this area is important. Further, the important capabilities for testing and certification of aviation biofuels should be highlighted and partnerships established to advance this role for emerging fuels. Increased attention to biofuels may also introduce new prospects to more completely define the parameters that constitute acceptable fuels (including acceptable chemical structures/compositions). This would allow greater flexibility in fuel design from biomass technologies, while clearly establishing ultimate targets for performance.