

***Jatropha* Life-Cycle Assessment**

The bio-fuel team, Jennifer Baka, Jorge Bentin and Naoko Maruyama, studied the life-cycle impacts of bio-fuel production in Karnataka. The team worked with Dr. Megha Shenoy of the Resource Optimization Initiative, and visited the University of Agricultural Sciences (UAS) and several of the field sites where staff are experimenting with growing different bio-fuel crops, including *Jatropha*.

Jatropha plant oil (i.e., the oil obtained after crushing the *Jatropha* seeds) and the biodiesel that is refined from it can both be used as fuels in place of diesel. During the field visit, the team learned that UAS were not focusing exclusively on *Jatropha* as a biofuel feedstock but were instead promoting the use of a five different tree oil seeds, and were. Based on data availability, they conducted a preliminary LCA of the energy balance and green house gas (GHG) emissions of *Jatropha* oil and *Jatropha* biodiesel, produced on small scale, decentralized marginal lands, compared to diesel in India.

The team collected data on the inputs for biodiesel production, the cropping structure of the biofuel projects and productivity data of the different tree types. Data on the energy balances of the different inputs and the environmental impacts from producing and using biofuels in Karnataka (ie. resultant emissions) were not collected. Therefore, other published research contained was used this to build the LCA model. The team assumed that no existing vegetation will be cleared to cultivate *Jatropha* on wastelands in Karnataka and only included the credit for the carbon storage potential of *Jatropha* trees. They estimated net energy and greenhouse gas savings from using both *Jatropha* oil and *Jatropha* biodiesel versus diesel because by-product credits exceed the energy and environmental expenditures for both fuels. Utilizing *Jatropha* oil results in a net energy savings of approximately 1 GJ per ha*yr while utilizing biodiesel results in a savings of approximately 1.2 GJ per ha*yr. The GHG emissions results are equally favorable for biofuels. Both *Jatropha* oil and biodiesel usage result in a net GHG emissions savings of around 540 kg CO₂e/ha*yr. In comparison to *Jatropha* oil and biodiesel, diesel consumption results in GHG emissions of approximately 80 kg CO₂e/ha* yr and 67 kg CO₂e/ha*yr.

The findings from this project and the preliminary data and LCA model generated are being incorporated into the doctoral research of Jennifer Baka under the supervision of Professor Robert Bailis at Yale.

LCA system boundaries for *Jatropha* production:

