Biomass Supply Chain
Angelica Rios

The University of Texas at San Antonio, San Antonio TX, 78249

Name: *Angelica Rios*
Status: *Junior, Undergraduate Student*
Department: *College of Engineering*
Area of Study: *Finance*
USDA/UTSA Mentor(s): *Dr. Krystel Castillo*

WeARE Research Area

This research compiles different studies and analyzes their methods and models used for biomass supply chain management and is inputted into a state-of-the-art matrix. The main model types that were found in this study are Mixed Integer Linear Programming, Simulation Models, and Geographical Information System (GIS) based Decision Support Systems (DSS). My focus was finding more stochastic models as there are many unknown variables when looking at supply chain management.

Motivation or Background

Supply chain management (SCM) involves collecting biomass, converting it, and transporting it with detailed coordination between suppliers and consumers. With the different studies and their corresponding models used; we can focus on optimization at each level of the SCM process. In achieving optimization at each level, the time, energy, and supplies used would be minimized. As a finance major, time and supplies being minimized are critical because it helps cut costs and companies can invest the money saved in other departments resulting in growth. Also, optimizations cut back waste and as an environmental enthusiast, this makes me happy. An example is carbon emission minimization; by cutting down on transportation time waste, there would be less gas emission into the air. Although it may not seem like much with just one transport route being optimized, it will certainly add up when optimization is applied at a greater scale and thus will benefit our earth greatly.

Objectives

1.Read academic papers on the different studies about Biomass Supply Chain Management.
2.Use excel to create a state-of-the-art showing the categorization of the works.
3.Analyze the different model types used through out the years.

Methodology

Data was collected from reviews on Supply Chain Management models with a focus on the years between 2005 and present. The categories are separated by model type and research done on harvesting, transport, and storage.

Biomass Supply Chain

Categories	Biomass Harvest	Transport	Storage	Biomass SCM Models				
Subgroups				MILP	Simulation	Dynamic Programming	GIS Based DSS	Stochastic
Year								
2006					Sokhansanj et al.			
2007			Bowersox & Closs		Kumar & Sokhansanj		Ayoub et al.	
2008	Sambra et al.	Ravula et al.		Leduc et al.	Ravula et al.	Geijzendorffer et al.	Panicheli & Edgard	
2009		Rentizales et al.	Rentizales et al.	Eksioglu et al.			Frombo et al.	
				Tursun et al.				
2010				Leduc et al.			Leduc et al.	
				Parker et al.			Velazquez-Marti	
2011				Akgul et al.	Mobini et al.			
				Bowling et al.				
				Zhu et al.				Kostin et al.
2012				Wang et al.			Alam et al.	Chen & Fan
2013		Ebadian						Awudu & Zhang
2014				Gomes et al.		Grigoroudis et al.		Azadeh
				Santibanez - Aguilar et al.				
2015	San Miguel et al.				Strullu et al.			
2016				Miret et al.			Richter et al.	Shabani & Sowlati
							Sahoo et al.	
2017				Roni et al.			Mupondwa et al.	Osmani & Zhang
2018				Sahoo et al.	Ebadian et al.		Kim et al.	Simoes et al.
							De Laporte et al.	
2019				Rodias et al.	Lozano-Moreno et al.		De Laporte et al.	

Figure 1
Biomass Supply Chain - State of the Art Matrix

Results

As shown below, between the years 2014 and 2019, the MILP model has been the most used and the GIS was used the second most. I hope to see an increase in the Stochastic and Simulation models in the following years.

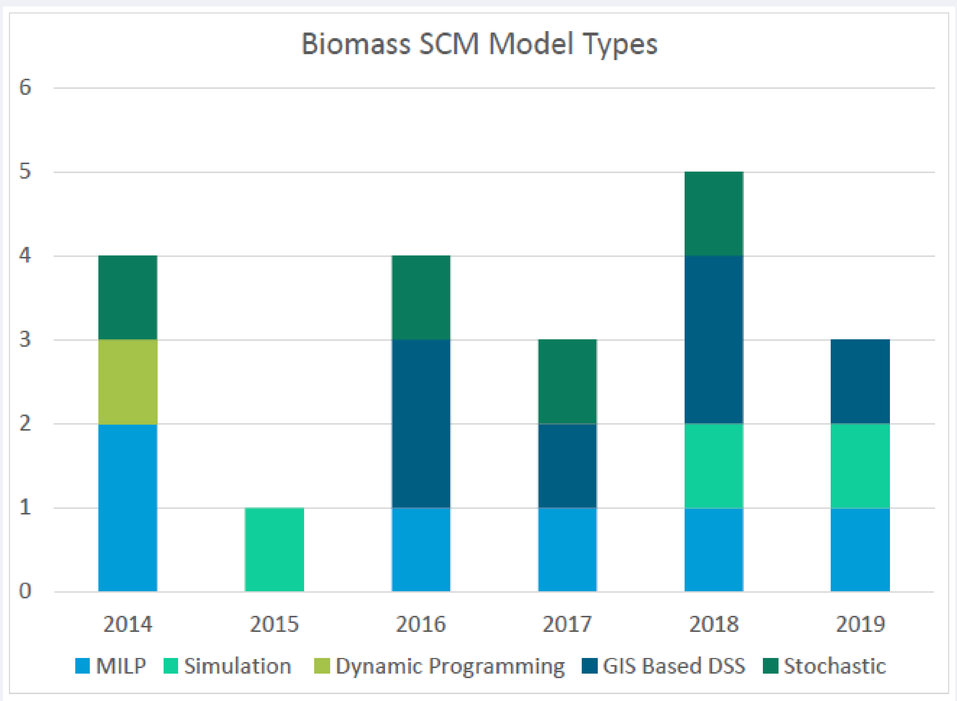

Figure 2
Bar Graph of Model Types in Corresponding Year

Skills and Experience

- Microsoft Excel
- Microsoft PowerPoint
- Data Collecting
- Data Analysis
- Communication
- Coordination

What I Learned

Between the years 2014 and 2019, the Geographical Information System model is used over the Mixed Integer Linear Programming models. However, when we look at these two models in the past two years, MILP model is used much more than the GIS model. I am curious if the GIS models will continue to be used over the MILP or will we see a reversion to the MILP models. I think that the Stochastic models could also start being used in research more.

Future Plans

- In the future, I plan to continue gathering data and analyzing data to improve biomass supply chains integrating socioeconomic impact.
- I will also take the skills and knowledge I have gained from this program and apply it to my future work, not only inside the institute, but outside as well, such as my classes and, later, career.

Acknowledgments

This work is supported by the USDA National Institute of Food and Agriculture, Interdisciplinary Hands-on Research Traineeship and Extension Experiential Learning in Bioenergy/Natural Resources/Economics/Rural project, U-GREAT (UnderGraduate Research, Education And Training) program (2016-67032-24984).

References

- Nasim Zandi Atashbar, Nacima Labadie & Christian Prins (2018) Modelling and optimization of biomass supply chains: a review, International Journal of Production Research, 56:10, 3482-3506, DOI: 10.1080/00207543.2017.1343506
- Nunes, L.J.R., Causer, T.P., Ciolkosz, D. “Biomass for Energy: A Review on Supply Chain Management Models.” *Renewable and Sustainable Energy Reviews*, vol. 120, 2020, p. 109658., doi:10.1016/j.rser.2019.109658. Accessed: April 22, 2020.
- “Rodias, Efthymios, et al. “Green, Yellow, and Woody Biomass Supply Chain Management: A Review.” MDPI, Multidisciplinary Digital Publishing Institute, vol. 12, 2019, www.mdpi.com/19961073/12/15/3020/htm.

UTSA | Texas Sustainable Energy RESEARCH INSTITUTE