

Quantifying the Impacts of Regional Sourcing on Sustainability



Sustainability Initiative Presented by: Rodrigo Errea

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Project Overview

Problem Statement

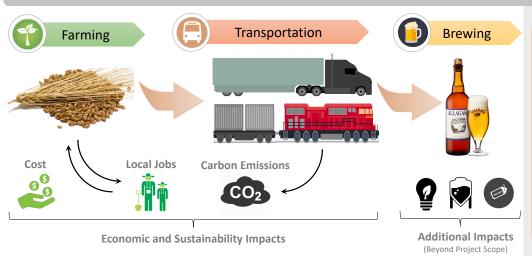
The Allagash Brewing Company is committed to reducing its environmental impact and improving sustainable business practices. To meet its sustainability goals, Allagash asked us to quantify the economic and sustainability impacts of locally sourced Maine grains compared to industrial Midwest grains.







Grain Sourcing



Supplier Landscape

The brewing supply chain involves several steps, starting with farmers processing grains such as barley, wheat, and oats (key ingredients in beer), then transporting those raw materials, then brewing the beer, then bottling the beer, and finally distributing the beer. All of these phases of the supply chain have sustainability and economic impacts. Our project scope focuses upstream on the farming and transportation phases of the supply chain, comparing the impacts of three supplier characteristics: (1) cost, (2) local jobs created, and (3) carbon emissions.

Optimization Modeling

Sourcing Optimization Model

We created a sourcing optimization model to help Allagash determine the right mix of Maine and Midwest suppliers to meet its local sourcing targets while quantifying the impacts on the local economy and CO₂ emissions.

The model minimizes the total cost of Allagash's sourcing decision and deals with each supplier's capacity and sustainability impacts.



| Difference | New Supplier Nilst minus Business As Usus| | Supplier Nilst | Supplier N

tailed Suppl															
											Red Whe	at .			
Total Cost								Name	Category	Xi	Price	Cost	Capacity	GW	LE
\$ 1,089,89	90		Inpu	its						(lb)	(S/lb)	(5)	(lb/year)	(CO2/lb)	(Jobs/pound)
			Outo					Briess	(Midwest)	0	0.1	50	1,000,000	0.93	(
								Maine Grain	s (Local)	375,000	0.61	\$228,356	900,000	0.85	0.0002
Annual Demar	nd							Supplier 3		0	0.80	\$0		0.85	0.0002
Total Beer Dem		(barrels)	Surt	ainability Issue	(1)	May/Min Va	alue Total Value	Supplier 4		0	0.76	\$0		0.85	0.0002
TOTAL DEEL DESI	lbs/Barrel*			al Warming -		1.000.000		Supplier 5		0	0.61	\$0		0.85	0.0002
Sarley	S/			Economy - N			- 113	Supplier 6		0	0.80	50		0.85	0.0002
Red Wheat*			CC LOCO	i conony ii	111 (2003)			Supplier 7		0	0.65	50		0.85	0.0002
Dat								Supplier 8		0	0.40	\$0		0.85	0.0002
Total		4.500.000	Loral	Sourcing Mini	mum (lbs)	500.	000 500.000	Supplier 9		0	0.78	\$0		0.85	0.0002
*Estimates		4,500,000		Sourcing Max		500)		Supplier 10		0	0.93	\$0		0.85	0.0002
**White wheat not currently produced in Maine			Local Sourcing Meximum (183)				Total			375,000	\$0.61	\$228,356	1,900,000	317,535	84.4
	not currently prod	ered in Maine													
	not currently prod	luced in Maine						Midwest Tota		0	\$0.10	\$0	1,000,000	0	0
	not currently prod	suced in Maine							ı						
	not currently prod	luced in Maine						Midwest Tota		0	\$0.10 \$0.61	\$0	1,000,000	0	0
***White wheat n			Oats					Midwest Total Local Total		0 375,000	\$0.10 \$0.61	\$0 \$228,356	1,000,000 900,000	317,535	84
**White wheat n	not currently prod Category	zi	Oats Price	Cost	Capacity	GW	LE	Midwest Tota	Category	0 375,000 Xi	\$0.10 \$0.61 Barley Price	\$0 \$228.356 Cost	1,000,000 900,000 Capacity	0 317,535 GW	8-
**White wheat in	Category	Zi (10)	Oats Price (S/lb)	(S)	(lb/year)	(CO2/lb) ((lobs/pound)	Midwest Total Local Total Name	Category	0 375,000 Xi (/b)	S0.10 S0.61 Borrley Price (S/Ab)	\$0 \$228.356 Cost (S)	1.000,000 900,000 Capacity ((0/year)	0 317,535 GW (CO2/lb)	8/
"White wheat n	Category (Midwest)	Zi (%) 250,000	Oats Price (S/lb) 0.1	(S) \$25,000	(/b/year) 1,000,000	(CO2/lb) (0.71	(Jobs/pound) 0	Midwest Total Local Total Name	Category (Midwest)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Baricy Price (\$/\delta) 0.2	\$0 \$228,356 Cost (\$) \$750,000	1,000,000 900,000 Capacity (lb/year) 15,000,000	0 317,535 GW (CO2/b) 0.99	8/ L (Jobs/pound
White wheat in lame liness surora Mills	Category (Midwest) (Local)	Zi (%) 250,000 125,000	Osts Price (S/lb) 0.1 0.69	(S) \$25,000 \$86,533	(lb/year)	(CO2/lb) (0.71 0.57	(lobs/pound) 0 0.00023	Midwest Total Local Total Name Briess Maine Malth	Category (Midwest) ouse (Local)	0 375,000 Xi (/b)	\$0.10 \$0.61 Bariley Price (S/lb) 0.2 1.00	\$0 \$228,356 Cost (\$) \$750,000 \$0	1,000,000 900,000 Capacity (10/year) 15,000,000 700,000	GW (CO2/b) 0.99 0.94	(/obs/pound
White wheel n lame lriess surora Mills daine Grains	Category (Midwest)	25 (16) 250,000 125,000 0	Osts Price (S/lb) 0.1 0.69 0.48	(S) \$25,000 \$86,533 \$0	(lb/year) 1,000,000 700,000	(CO2/lb) (0.71 0.57 0.57	(Jobs/pound) 0 0.00023 0.00023	Midwest Total Local Total Name Briess Maine Malth Blue Ox	Category (Midwest)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Bariey Price (\$/\text{lb}) 0.2 1.00 0.90	\$0 \$228,356 Cost (S) \$750,000 \$0 \$0	1,000,000 900,000 Capacity (lb/year) 15,000,000	GW (CO2/lb) 0.99 0.94 0.94	8/ (/obs/pound 0.0002 0.0002
Note wheat note that the same triess surrors Mills Maine Grains upplier 4	Category (Midwest) (Local)	Zi ((b) 250,000 125,000 0	Oats Price (S/lb) 0.1 0.69 0.48 0.80	(\$) \$25,000 \$86,533 \$0 \$0	(/b/year) 1,000,000 700,000 -	(CO2/lb) (0.71 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023	Midwest Total Local Total Name Briess Maine Maith Blue Ox Supplier 4	Category (Midwest) ouse (Local)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Baricy Price (S/hb) 0.2 1.00 0.90 10.00	\$0 \$228.356 Cost (5) \$750,000 \$0 \$0 \$0	1,000,000 900,000 Capacity (10/year) 15,000,000 700,000	GW (CO2/lb) 0.99 0.94 0.94	8/ (/obs/pound 0.0002 0.0002 0.0002
ibme Iriess urora Mills Maria Grains upplier 4 upplier 5	Category (Midwest) (Local)	Zi (/b) 250,000 125,000 0 0	Octs Price (S/b) 0.1 0.69 0.48 0.80 0.77	(S) \$25,000 \$86,533 \$0 \$0 \$0	(lb/year) 1,000,000 700,000	(CO2/lb) (0.71 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023	Midwest Total Local Total Name Briess Maine Maith Blue Ox Supplier 4 Supplier 5	Category (Midwest) ouse (Local)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Barley Price (S/hb) 0.2 1.00 0.90 10.00 0.70	\$0 \$228.356 Cost (5) \$750,000 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity (10/year) 15,000,000 700,000	GW (CO2/lb) 0.99 0.94 0.94 0.94	0.0002 0.0002 0.0002 0.0002
Name Striess Surprise Maline Grains Supplier 5 Supplier 6	Category (Midwest) (Local)	25 (70) 250,000 125,000 0 0	Price (\$/b) 0.1 0.69 0.48 0.80 0.77 0.69	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0	(/b/year) 1,000,000 700,000 -	(CO2/lb) (0.71 0.57 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Math Blue Ox Supplier 4 Supplier 5 Supplier 6	Category (Midwest) ouse (Local)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Bariley Price (\$/\delta\) 0.2 1.00 0.90 10.00 0.70 0.57	\$0 \$228.356 Cost (S) \$750,000 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity (10/year) 15,000,000 700,000	GW (CO2/lb) 0.99 0.94 0.94 0.94 0.94	(/obs/pound 0.0002 0.0002 0.0002 0.0002
White wheat in wame Briess Aurora Mills Waine Grains Supplier 4 Supplier 5 Supplier 6 Supplier 7	Category (Midwest) (Local)	Zi (fb) 250,000 125,000 0 0	Oats Price (5/lb) 0.1 0.69 0.48 0.80 0.77 0.69 0.48	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0 \$0	(/b/year) 1,000,000 700,000 -	(CO2/lb) (0.71 0.57 0.57 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Maith Blue Ox Supplier 4 Supplier 6 Supplier 7	Category (Midwest) ouse (Local)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Bariley Price (\$/\text{h}) 0.2 1.00 0.90 10.00 0.70 0.57 0.90	\$0 \$228,356 \$228,356 \$5 \$750,000 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity (10/year) 15,000,000 700,000	GW (CO2/hb) 0.99 0.94 0.94 0.94 0.94 0.94	(/obs/gound 0.0002 0.0002 0.0002 0.0002 0.0002
iame iriess surora Mills Aupplier 5 supplier 6 supplier 7 supplier 8	Category (Midwest) (Local)	Zi (fb) 250,000 125,000 0 0 0	Octs Price (S/b) 0.1 0.69 0.48 0.80 0.77 0.69 0.48	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0 \$0 \$0	(/b/year) 1,000,000 700,000 -	(CO2/b) (0.71 0.57 0.57 0.57 0.57 0.57 0.57 0.57	(Jobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Malth Blue Ox Supplier 6 Supplier 6 Supplier 7 Supplier 7	Category (Midwest) ouse (Local)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Baricy Price (\$/\text{b}) 0.2 1.00 0.90 10.00 0.70 0.57 0.90 0.36	\$0 \$228.356 (5) \$750,000 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity ((b/year) 15,000,000 700,000 	0 317,535 GW (CO2/b) 0.99 0.94 0.94 0.94 0.94 0.94	0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002
lame Iriess surora Mills faine Grains supplier 4 supplier 5 supplier 6 supplier 7 supplier 8 supplier 8 supplier 9	Category (Midwest) (Local)	Zi (re) 250,000 125,000 0 0 0	Price (S/b) 0.1 0.69 0.48 0.80 0.77 0.69 0.48 0.41 0.88	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	(/b/year) 1,000,000 700,000 -	(CO2/lb) (0.71 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Matth Blue Ox Supplier 4 Supplier 5 Supplier 7 Supplier 7 Supplier 8 Supplier 9	Category (Midwest) ouse (Local)	0 375,000 XG (/b) 3,750,000	\$0.10 \$0.61 Bariley Price (S/lb) 0.2 1.00 0.90 10.00 0.70 0.57 0.90 0.36 0.94	\$0 \$228,356 \$228,356 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity (10/year) 15,000,000 700,000	GW (CO2/lb) 0.99 0.94 0.94 0.94 0.94 0.94 0.94 0.94	0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002
Name Briess Surpora Mills Maine Grains Supplier 5 Supplier 5 Supplier 5 Supplier 7 Supplier 8 Supplier 9 Supplier 9 Supplier 9 Supplier 9	Category (Midwest) (Local)	Zi (fb) 250,000 125,000 0 0 0 0	0.65 Price (5/lb) 0.1 0.69 0.48 0.80 0.77 0.69 0.48 0.41 0.81	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0 \$0 \$0	(/b/year) 1,000,000 700,000 -	(CO2/hb) (0.71 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Maith Blue Ox Supplier 5 Supplier 5 Supplier 8 Supplier 8 Supplier 9	Category (Midwest) ouse (Local)	X6 (ib) 3,750,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	\$0.10 \$0.61 Barley Price (\$/\delta) 0.2 1.00 0.90 10.00 0.70 0.57 0.90 0.36 0.94 0.70	\$0 \$228.356 Cost (5) \$750,000 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity ((b/year) 15,000,000 700,000 	GW (CO2/hb) 0.99 0.94 0.94 0.94 0.94 0.94 0.94 0.94	(Jobs/pound 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002
Wame Sriess surors Mills walne Grains supplier 5 supplier 5 supplier 5 supplier 5 supplier 7 supplier 8 supplier 9 supplier 10 fotal	Category (Midwest) (Local)	Zi (%) 250,000 125,000 0 0 0 0 0 0 0 0 375,000	Outs Price (S/b) 0.1 0.69 0.48 0.80 0.77 0.69 0.48 0.41 0.88 0.76 0.76 50.30	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	(lb/year) 1,000,000 700,000	(CO2/b) (0.71 0.71 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Malth Blue Ox Supplier 4 Supplier 5 Supplier 6 Supplier 9 Supplier 9 Supplier 10 Total	Category (Midwest) ouse (Iscal) (Iscal)	375,000 XG ((b) 3,750,000 0 0 0 0 0 0 0 0 0 0 0 0	50.10 50.61 Barley Price (S/hb) 0.2 1.00 0.70 0.50 10.00 0.70 0.50 0.94 0.70 0.94 0.70 0.94	\$0 \$228.356 (\$) \$750,000 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity (lb/year) 15,000,000 700,000 700,000	GW (CO2/b) 0.99 0.94 0.94 0.94 0.94 0.94 0.94 0.94	L (/obs/pound) 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002
	Category (Midwest) (Local)	Zi (fb) 250,000 125,000 0 0 0 0	0.65 Price (5/lb) 0.1 0.69 0.48 0.80 0.77 0.69 0.48 0.41 0.81	(S) \$25,000 \$86,533 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	(lb/year) 1,000,000 700,000	(CO2/hb) (0.71 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57	(lobs/pound) 0 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023 0.00023	Name Briess Maine Maith Blue Ox Supplier 5 Supplier 5 Supplier 8 Supplier 8 Supplier 9	Category (Midwest) ouse (Iscal) (Iscal)	X6 (ib) 3,750,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	\$0.10 \$0.61 Barley Price (\$/\delta) 0.2 1.00 0.90 10.00 0.70 0.57 0.90 0.36 0.94 0.70	\$0 \$228.356 Cost (5) \$750,000 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	1,000,000 900,000 Capacity ((8/year) 15,000,000 700,000 700,000	GW (CO2/hb) 0.99 0.94 0.94 0.94 0.94 0.94 0.94 0.94	0