



Brewer Survey Update



Trey Malone
@treymalone3

Assistant Professor and Extension Economist
Department of Agricultural, Food, and Resource Economics
Michigan State University



About Me

Opinion: How can craft beer companies survive? Use ratings

Home Curriculum Vitae Presentations Publications

DR. TREY MALONE
ASSISTANT PROFESSOR OF AGRICULTURE

**Institutional and Behavioral
Economics Section (IBES)**

CHOICES
About Past Issues Sponsors Topics Donate Subscribe Submit

IBES Outstanding Graduate Student Paper Competition

Beer, Policy, and a Changing Global Market



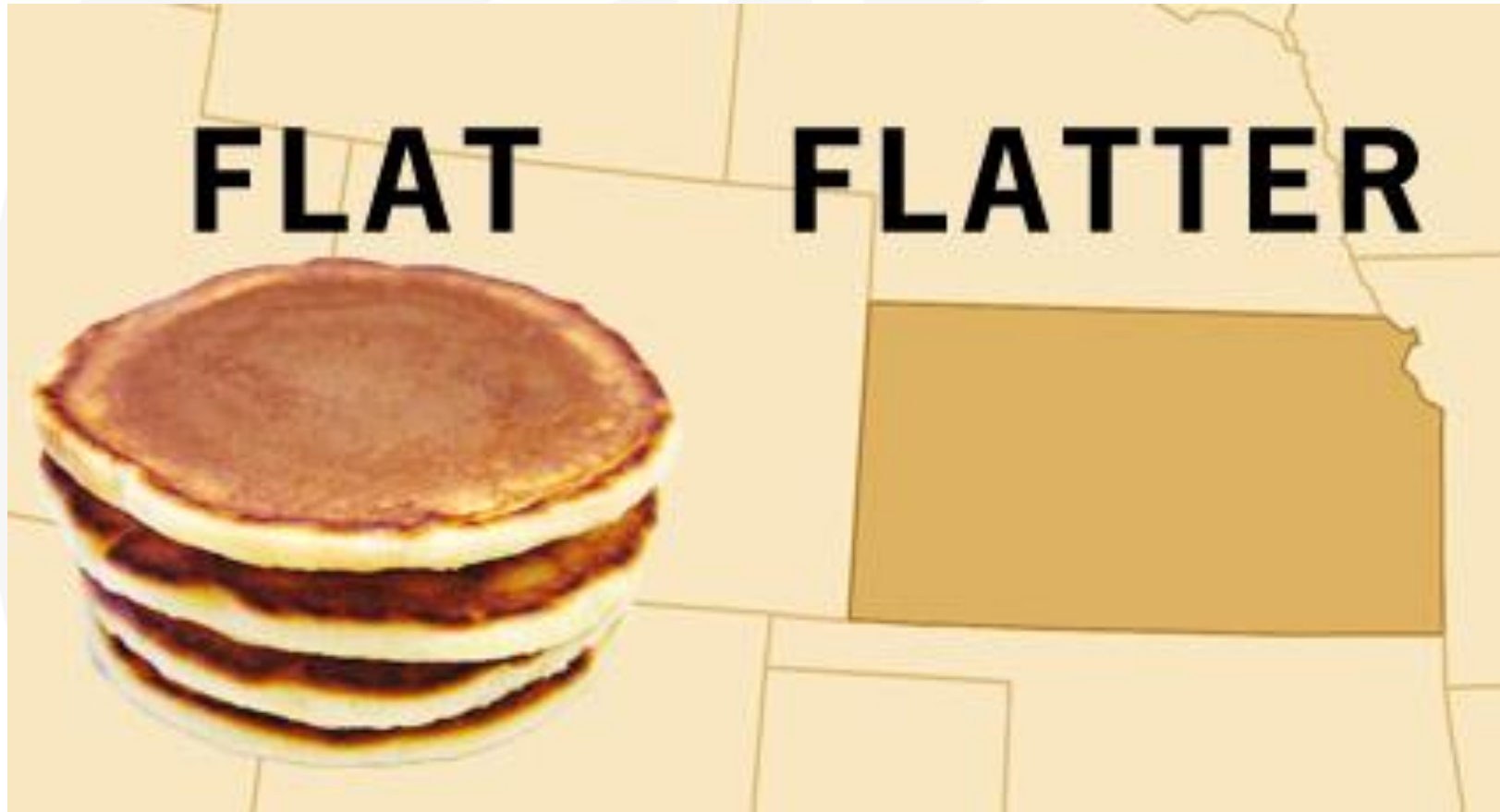
What Do Beer Laws Mean for Economic Growth?
Trey Malone and Martin Stack

Best Paper Winner: Trey Malone, Oklahoma State University, "The Excessive Choice Effect Meets the Market: Experiments on Craft Beer Choice"



HOW RURAL IS OUR LOCAL FOOD POLICY?
By Trey Malone and Brian Whitacre | September 17, 2012 | Print article



Fonstad, Mark, William Pugatch, and Brandon Vogt. "Kansas is flatter than a pancake." *Annals of Improbable Research* 9.3 (2003): 16-18.





Why does marketing matter so much for MI hops?

- More than 800 acres of hops grown in Michigan
 - SE Michigan to the Leelanau Peninsula
 - As far north as the Upper Peninsula
- 153% percent increase in MI hops acreage from 2015-17
- More broadly, the U.S. grows more than 55,000 acres and Michigan ranks fourth outside the Pacific Northwest.



Michigan hops are tied to the rise of craft breweries



+



=

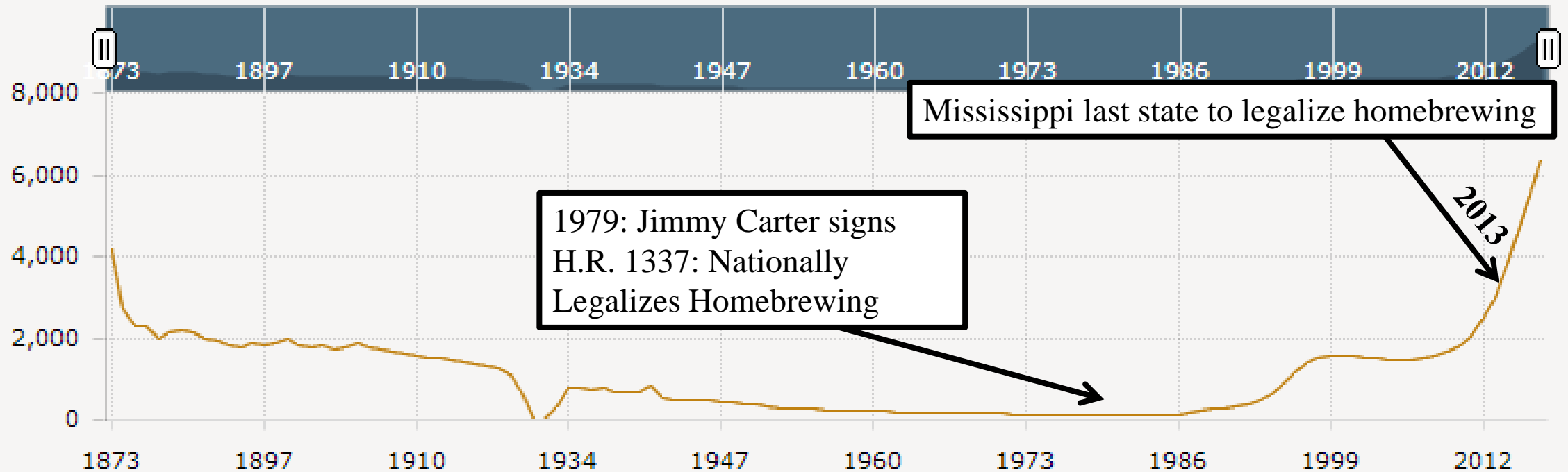




The rise of craft beer

Historical U.S. Brewery Count

Slide the bar at the top of the graph to see number of breweries from 1873 to present day.





U.S. BEER SALES VOLUME GROWTH 2017

OVERALL
BEER
-1.2%

196,278,490 BBLs

5.0%
CRAFT

24,868,276 BBLs

3.2%
IMPORT
BEER

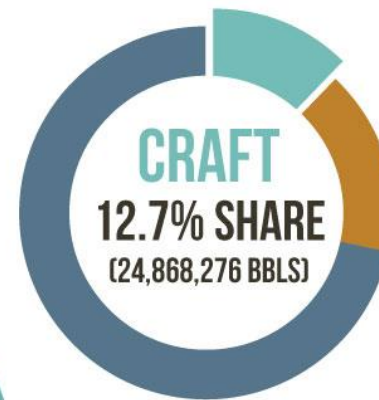
34,428,490 BBLs

3.6%
EXPORT
CRAFT
BEER

482,309 BBLs

OVERALL BEER MARKET
\$111.4 BILLION

CRAFT BEER MARKET
\$26.0 BILLION
8% DOLLAR SALES GROWTH



IMPORT
(34,428,490 BBLs)

OTHER DOMESTIC
(136,981,724 BBLs)

SOURCE: BREWERS ASSOCIATION, BOULDER CO



MICHIGAN BEER SALES, BY THE NUMBERS

Sales of Michigan-made beer rose 9.9 percent in Michigan last year, driven by 16.6 percent growth for the state's two licensed breweries, Bell's Brewery Inc. and Founders Brewing Co. Michigan-made beer also crossed into double digits for 2017 with a 10-percent share of the overall beer market in the state.

LICENSE TYPE	SALES (IN BARRELS)		PERCENT CHANGE
	2017	2016	
Brewery	291,538.87	250,012.51	16.6%
Microbrewery	289,285.01	274,682.02	5.3%
Brewpubs	22,912.70	24,716.10	-7.3%
In-state sales of Michigan-made beer	603,736.58	549,410.63	9.9%
Overall beer sales in Michigan	6,023,118.62	6,138,415.68	-1.9%
Sales of Michigan-made beer as a percentage of overall in-state beer sales	10.0%	9.0%	

SOURCE: MICHIGAN LIQUOR CONTROL COMMISSION TAX DATA



Michigan craft brewery scene (6th most)

- More than 3.1 breweries per 100,000 people
- Almost a million barrels per year
- Consistent growth pattern
- Michigan hops demand is not strictly limited to Michigan – or to the United States



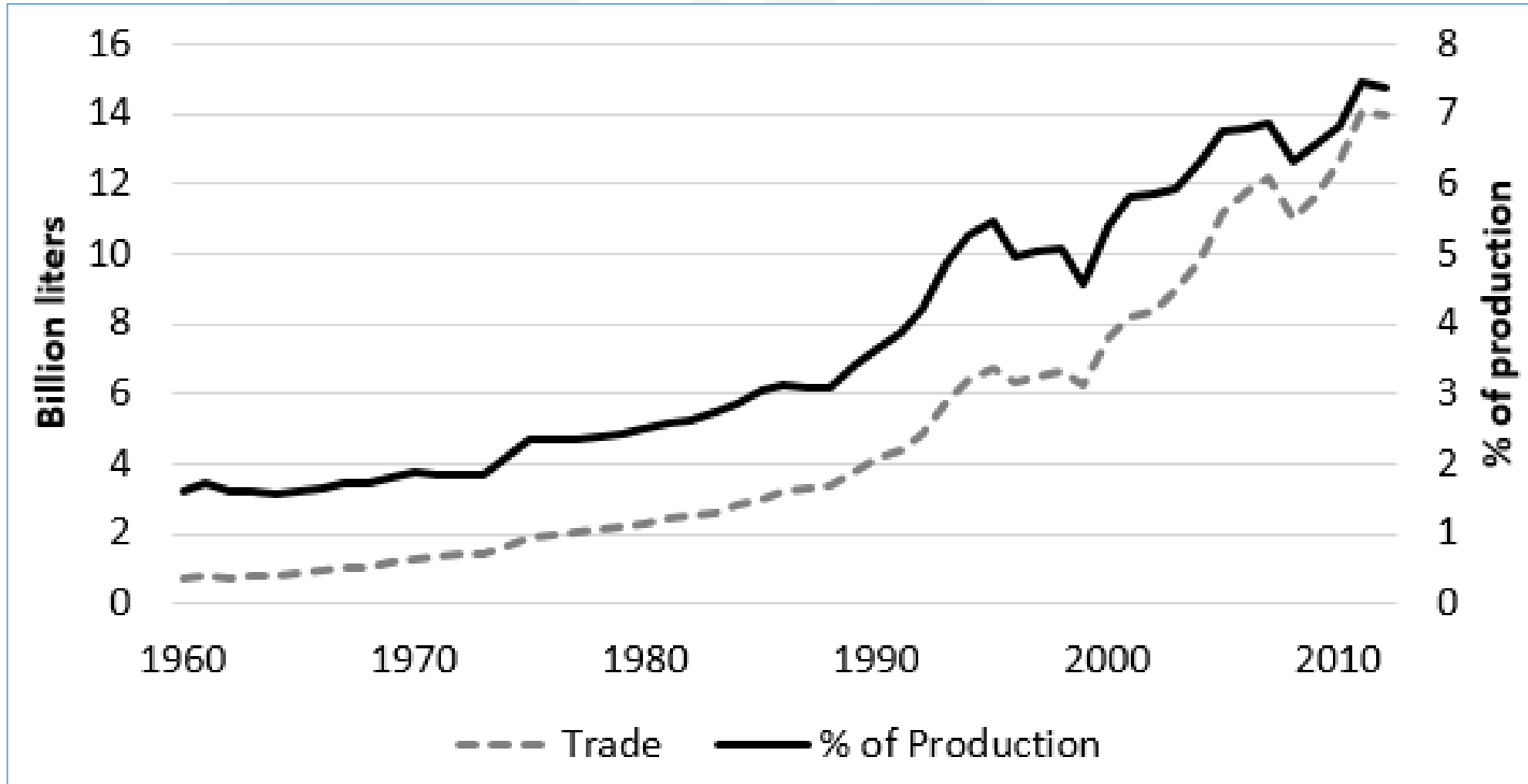
Contributors to Craft Beer Growth

- Demand for Variety
- Increasing Income
- Consumer Associations
- Technology and Capital Markets for Small Brewers
- Inspiration from Traditional Brewers
- Regulations
- and...



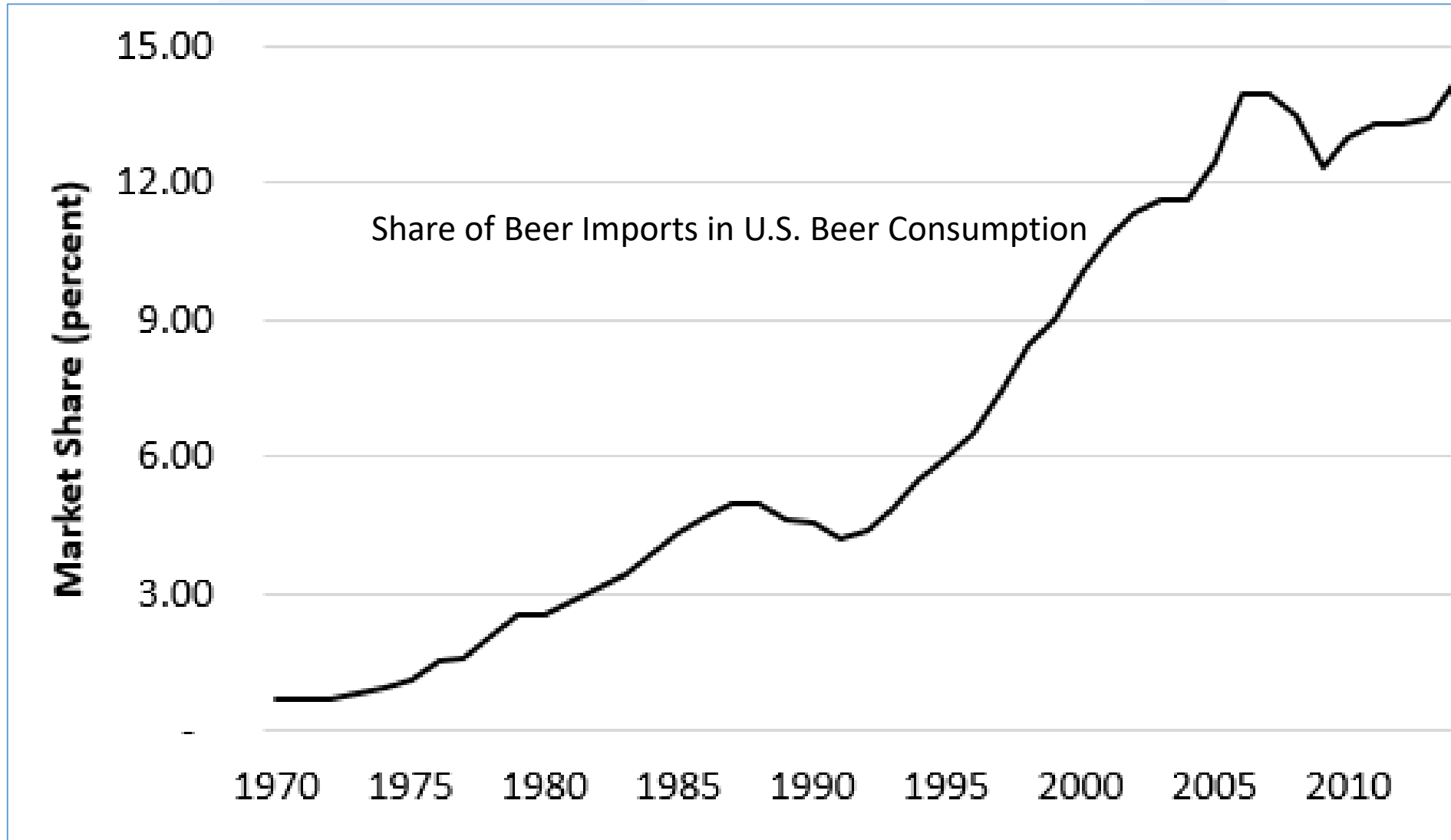
Beer Culture is Local

Beer Trade in the World (billion liters, % of production)



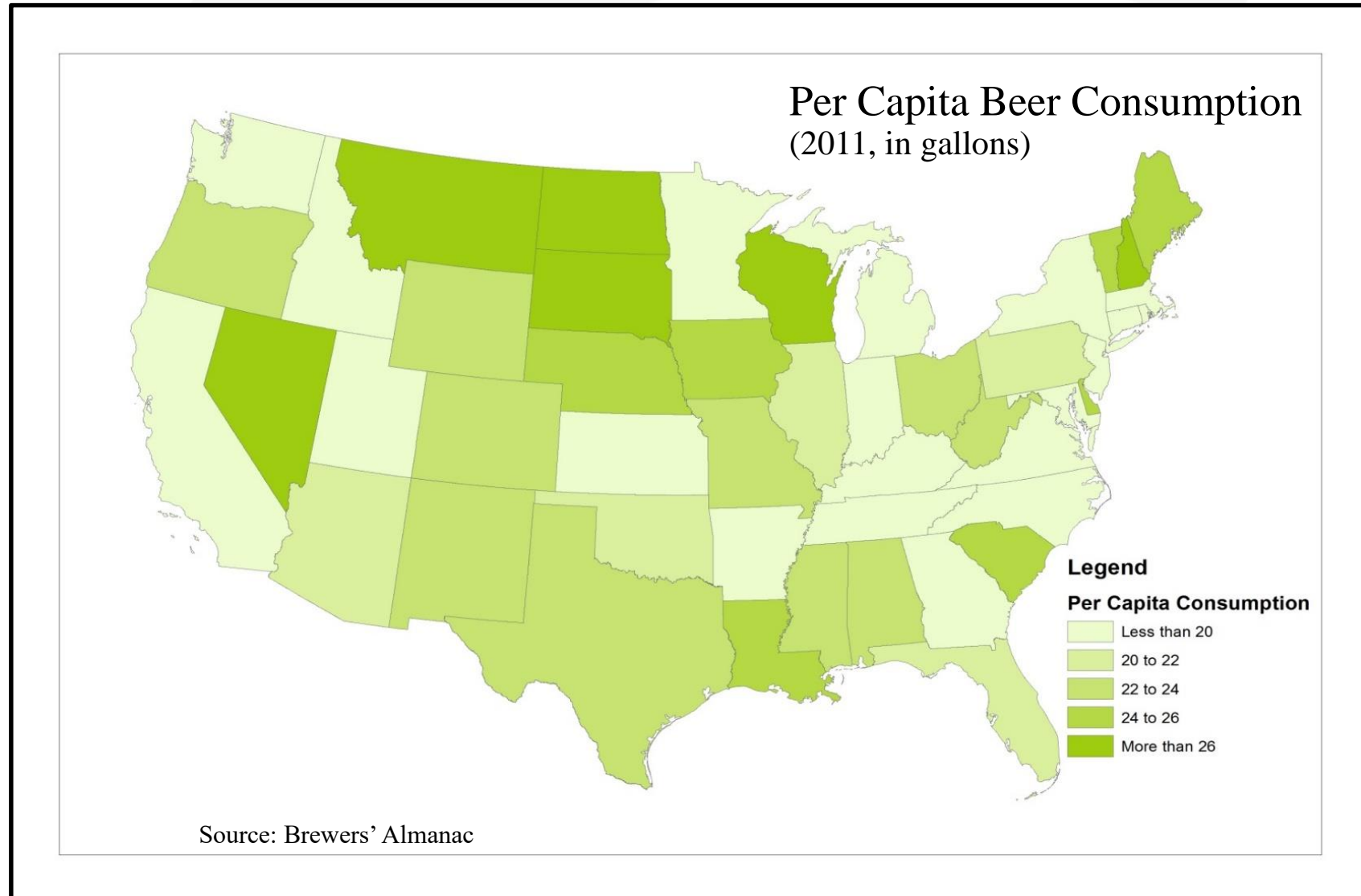


Beer Culture is Local



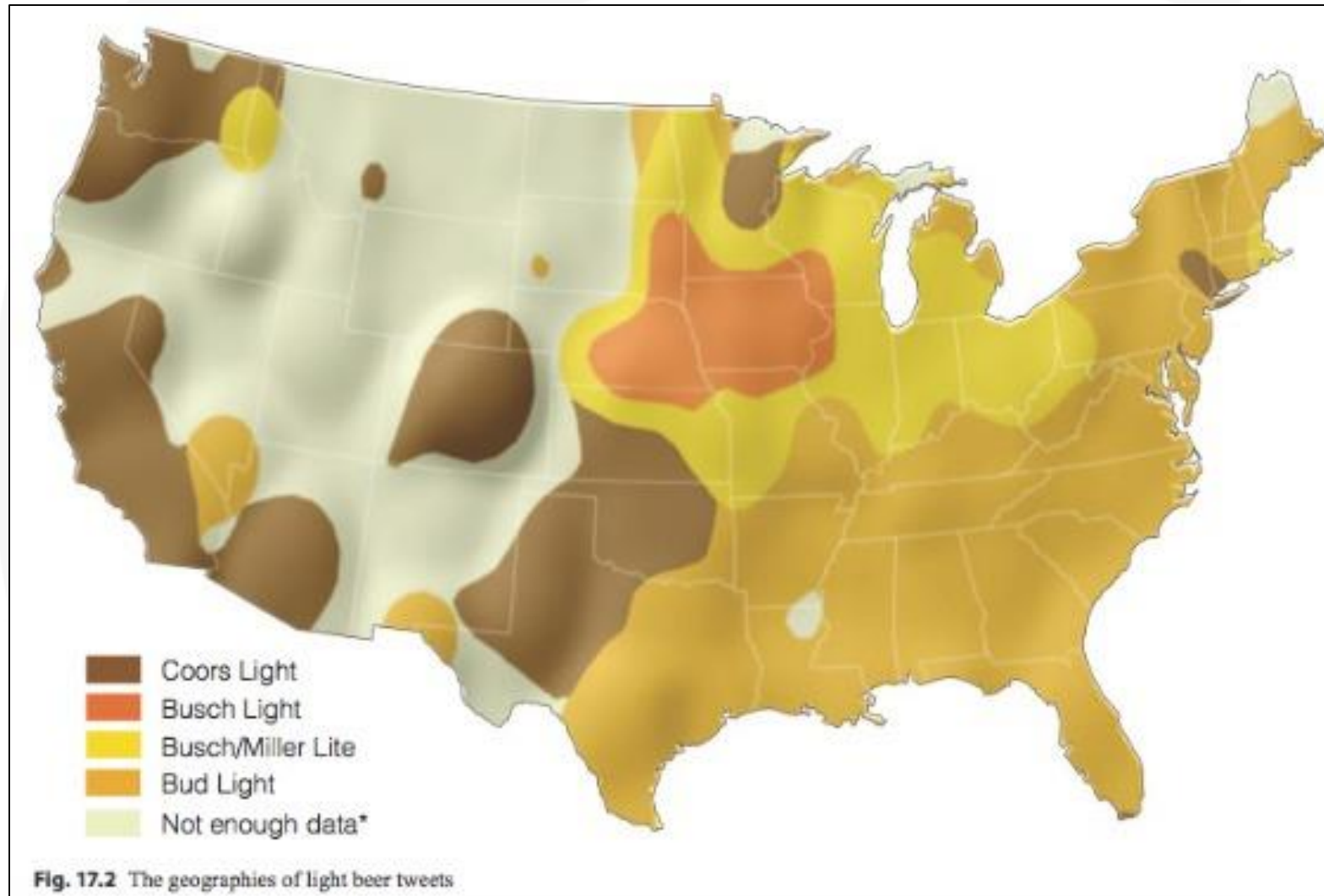


Beer Culture is Local



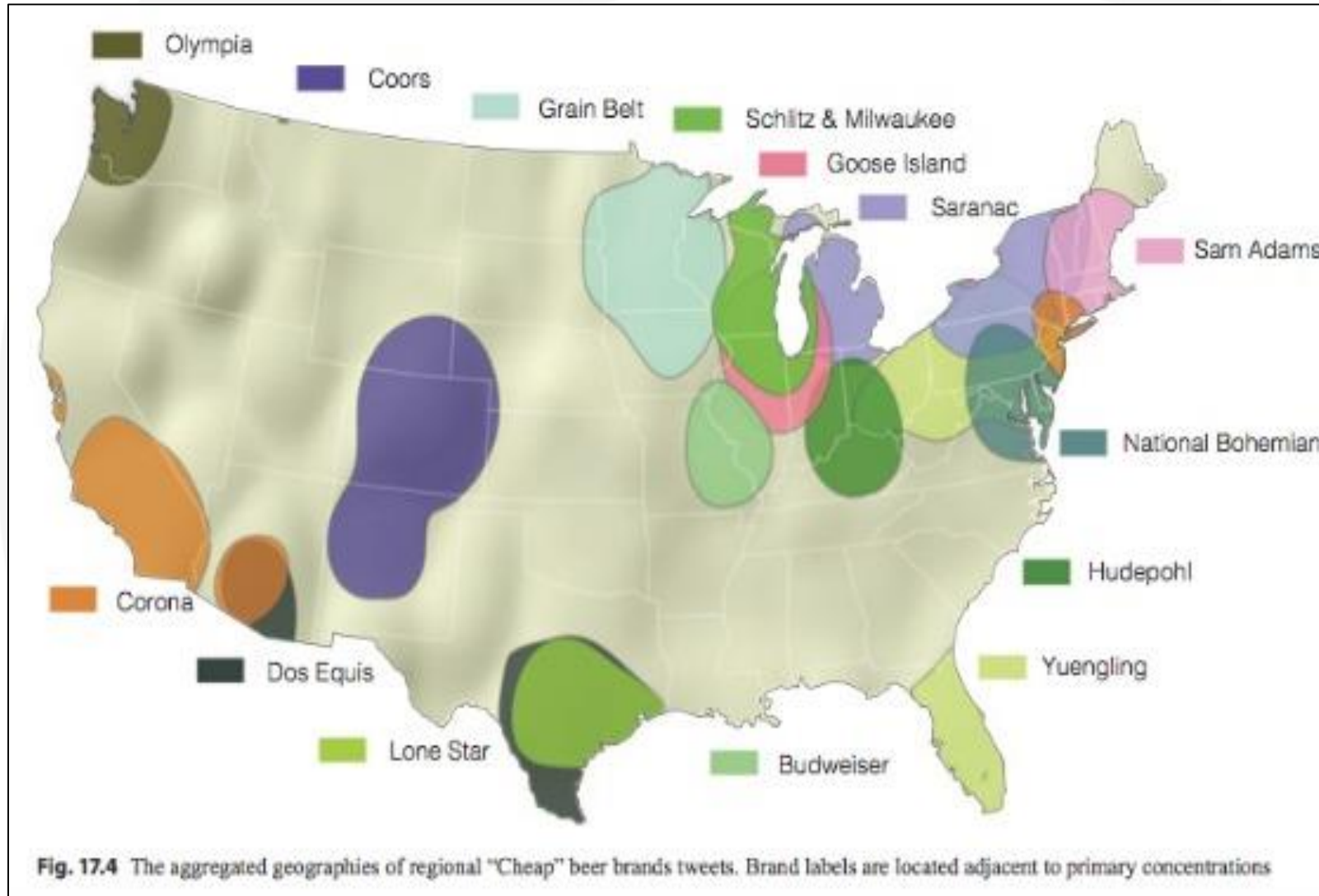


Beer Culture is Local



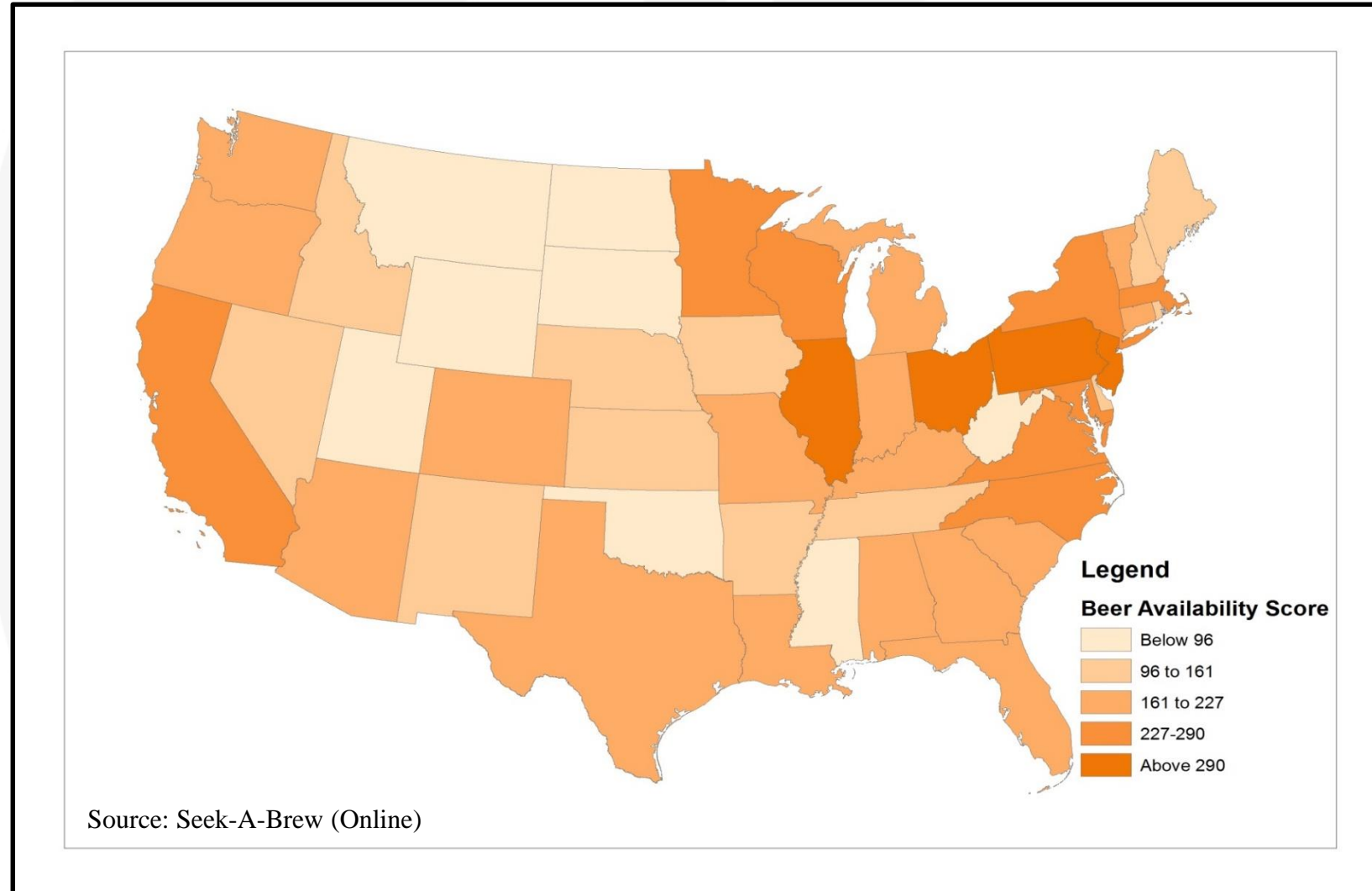


Beer Culture is Local





Beer Availability Scores (2014)





Unpacking What Michigan Breweries Want

Brewer Survey Objectives

- To identify brewer preferences and perceptions of hops in the Great Lakes Region
- To evaluate the likely consequences of regional hops growth strategies
 - Farm Brewery Law
 - USDA GAP
- To classify breweries by their business decisions
 - Marketing
 - Location
 - Purchasing



Survey Design

- Collaboration with:
 - Vincenzina Caputo, MSU AFRE
 - Rob Sirrine, MSU Extension
 - Erin Lizotte, MSU Extension
 - Great Lakes Hops Working Group
 - Hop Growers of Michigan
 - Michigan Brewers Guild



Survey Design

- Hop preference
- Demand for (and definition of) “Local”
- Attributes
- Discrete Choice Experiment
 - Estimating the value of growing region (terroir), GAP certification
- Business Demographics
- Massive amount of data per brewery
 - (median response time = 19 minutes)

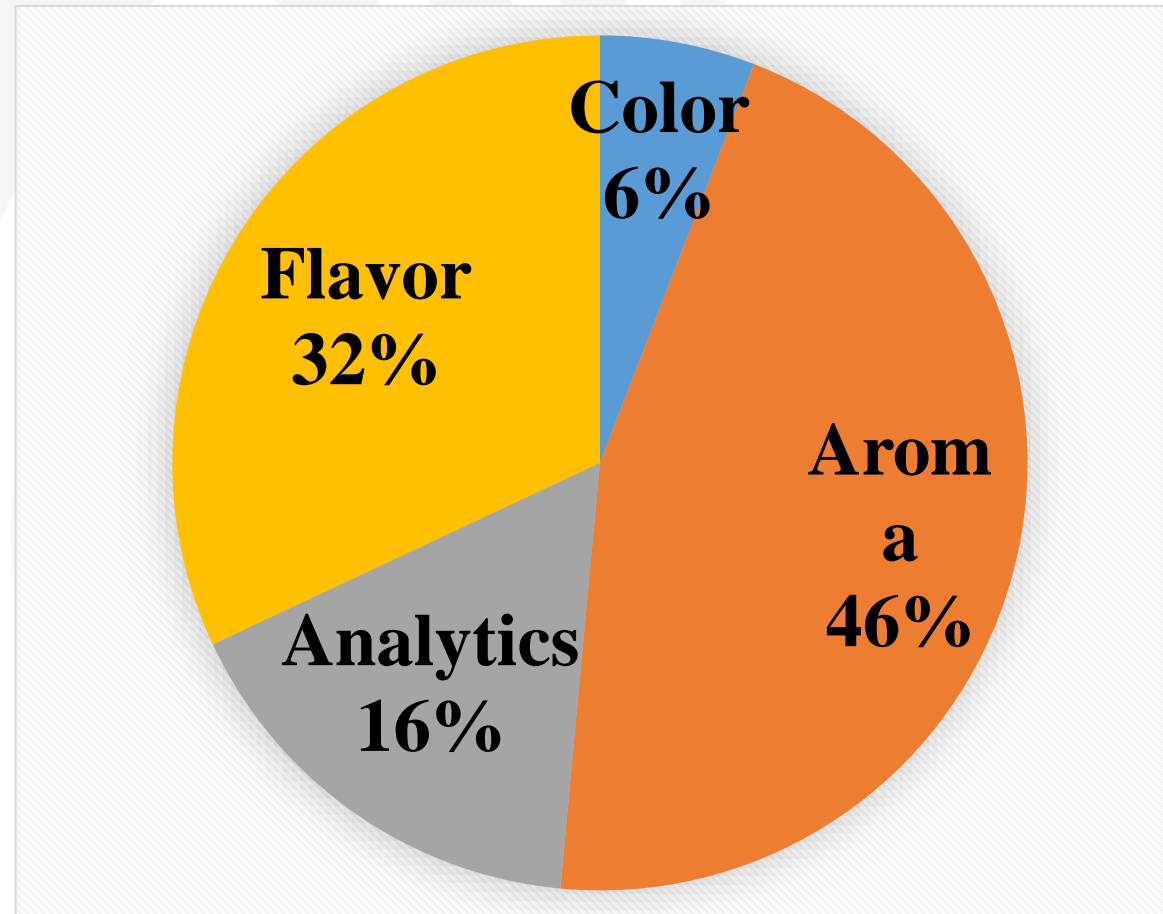


Survey Demographics

- Sent out via Brewers Guilds
- Data collected from February 4 – February 18, 2019.
- 76% of sales from respondents came from taprooms
- Total of 81 breweries
 - 3 Indiana, 71 Michigan, 5 Ohio, 2 Virginia
 - 70 respondents were in charge of hops purchasing

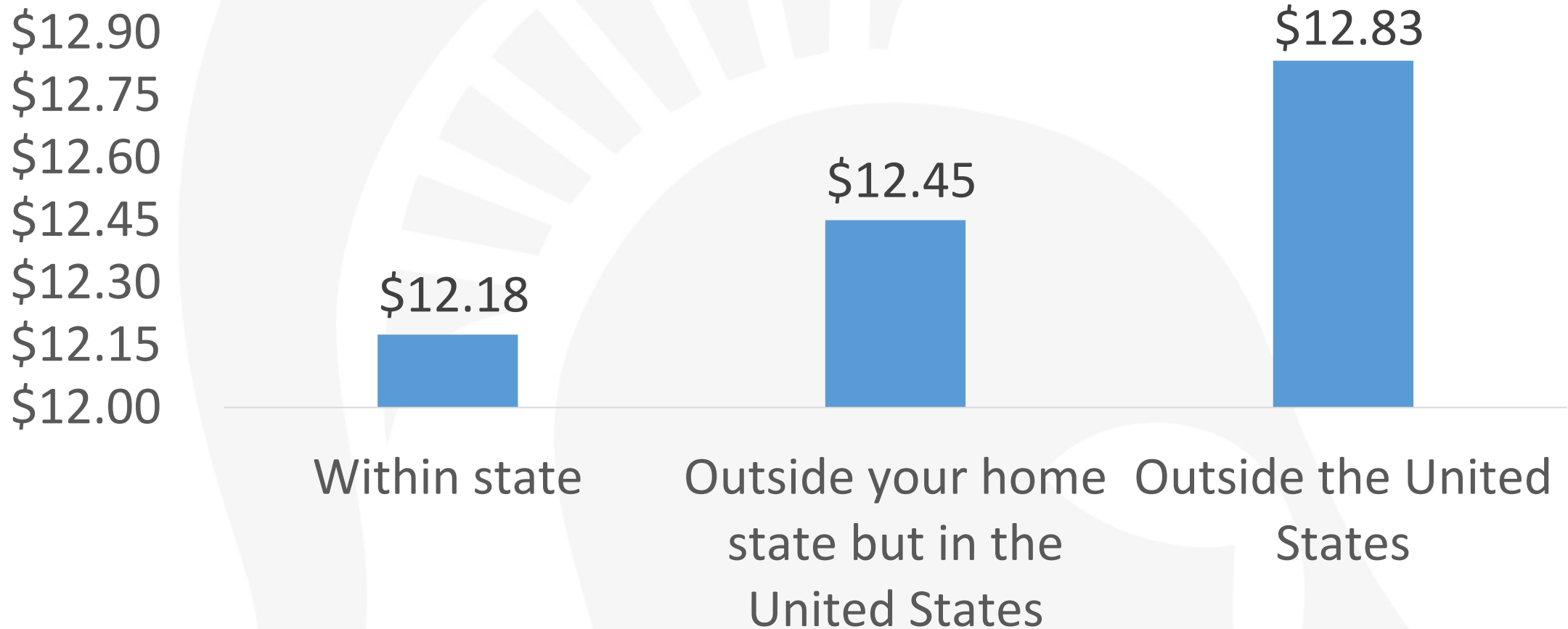


Please identify the importance of the following attributes when you are determining what aroma hops to purchase.



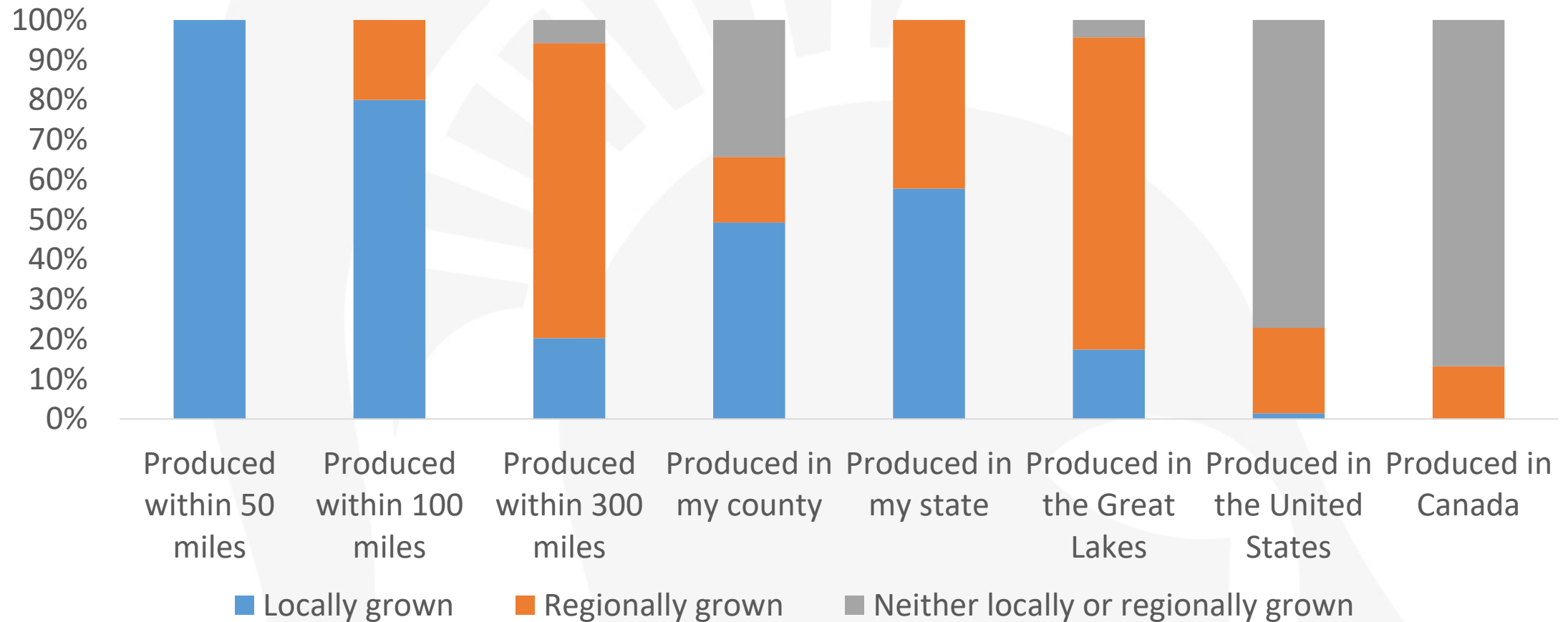


On average, how much did you pay for a pound of hops last year? (in USD\$)



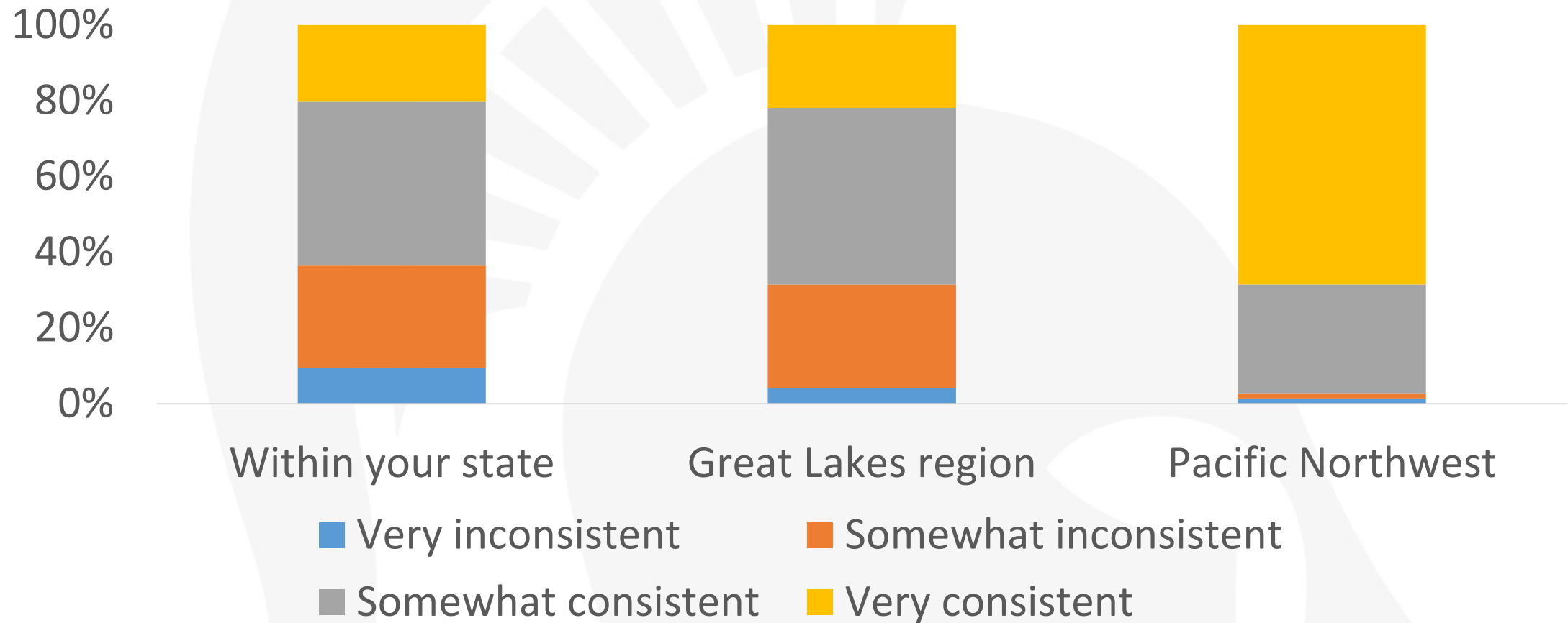


What hops would you consider as locally or regionally grown?



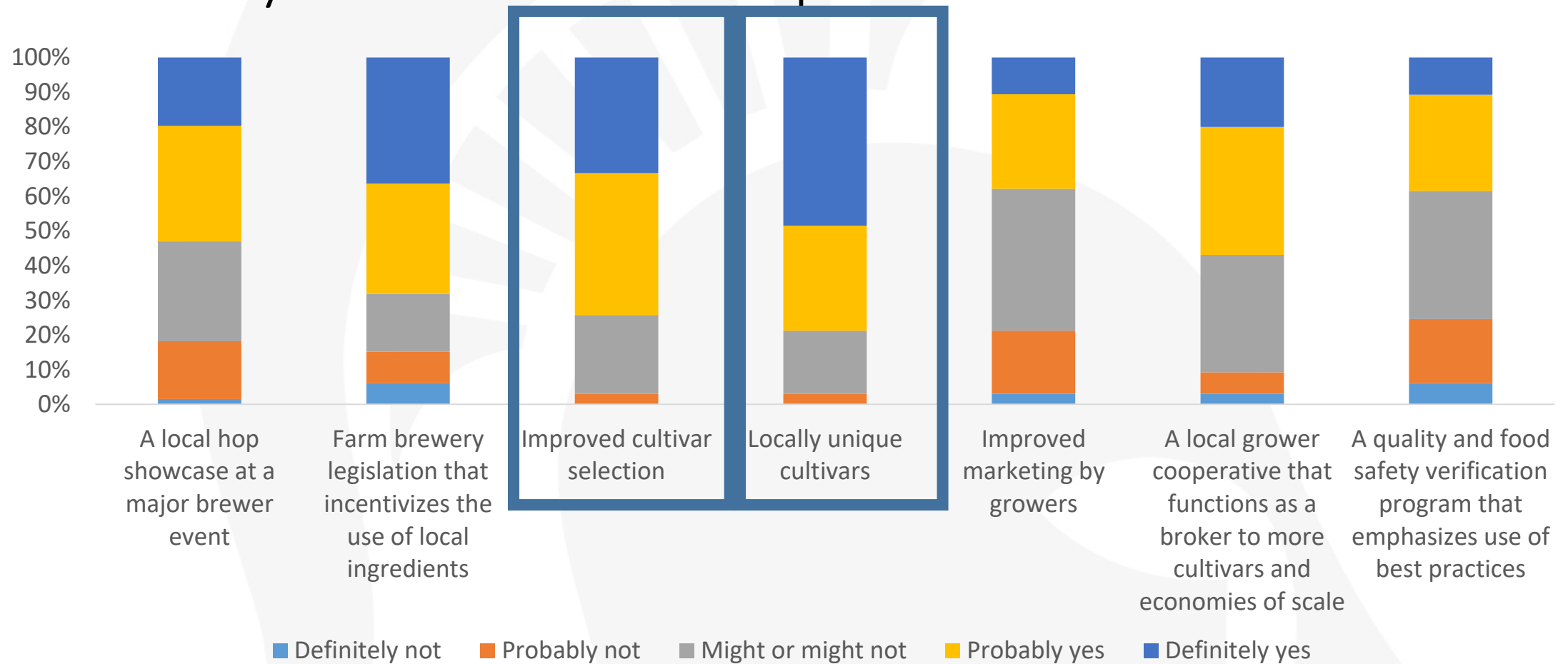


In general, how would you consider the consistency of hops grown in the following regions?





Would any of the following help you decide to utilize or increase your use of local hops?



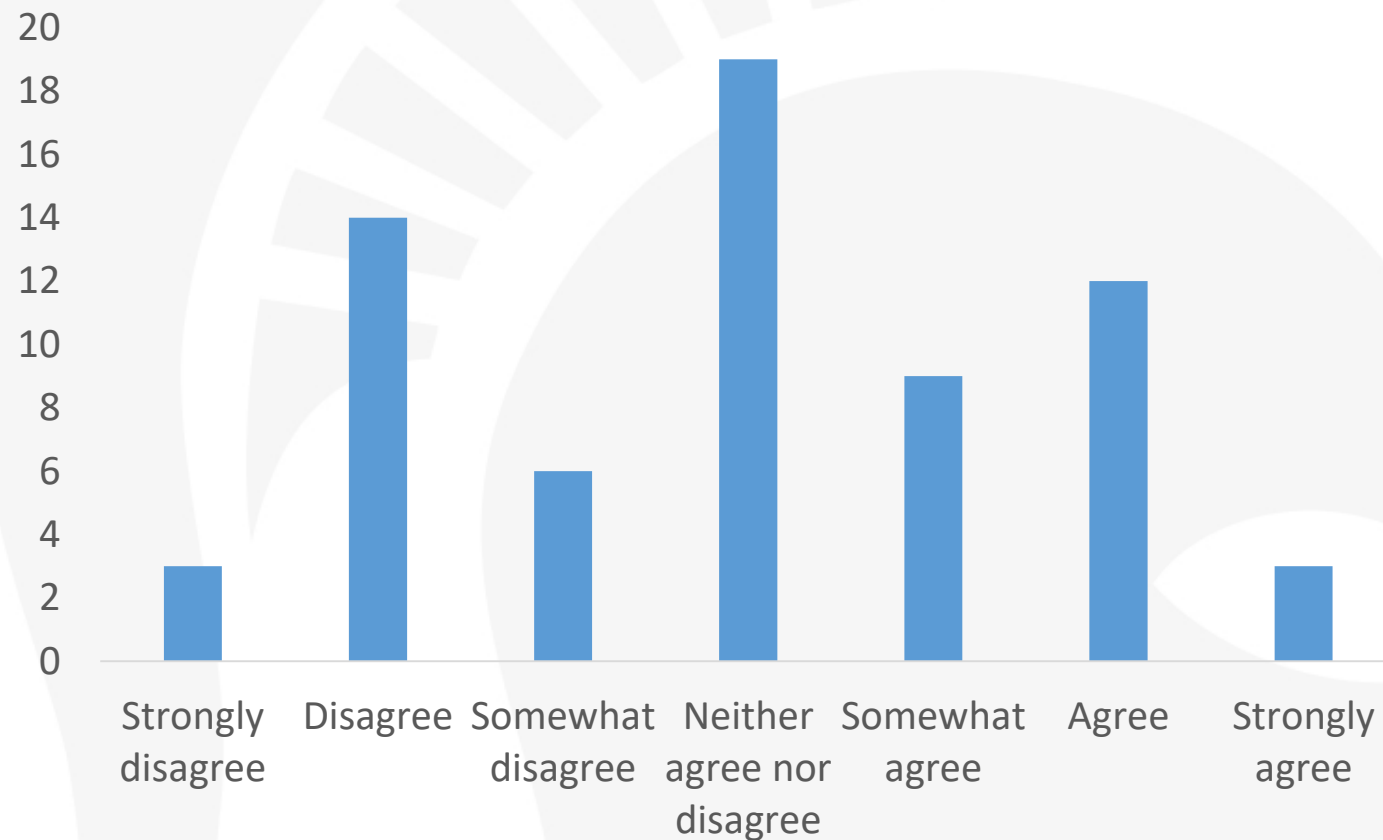


What new and emerging hop cultivars do you think will be important to brewers in the next five years?

Variety	No. Responses
Galaxy	6
Idaho 7	5
Mosaic	4
Citra	4

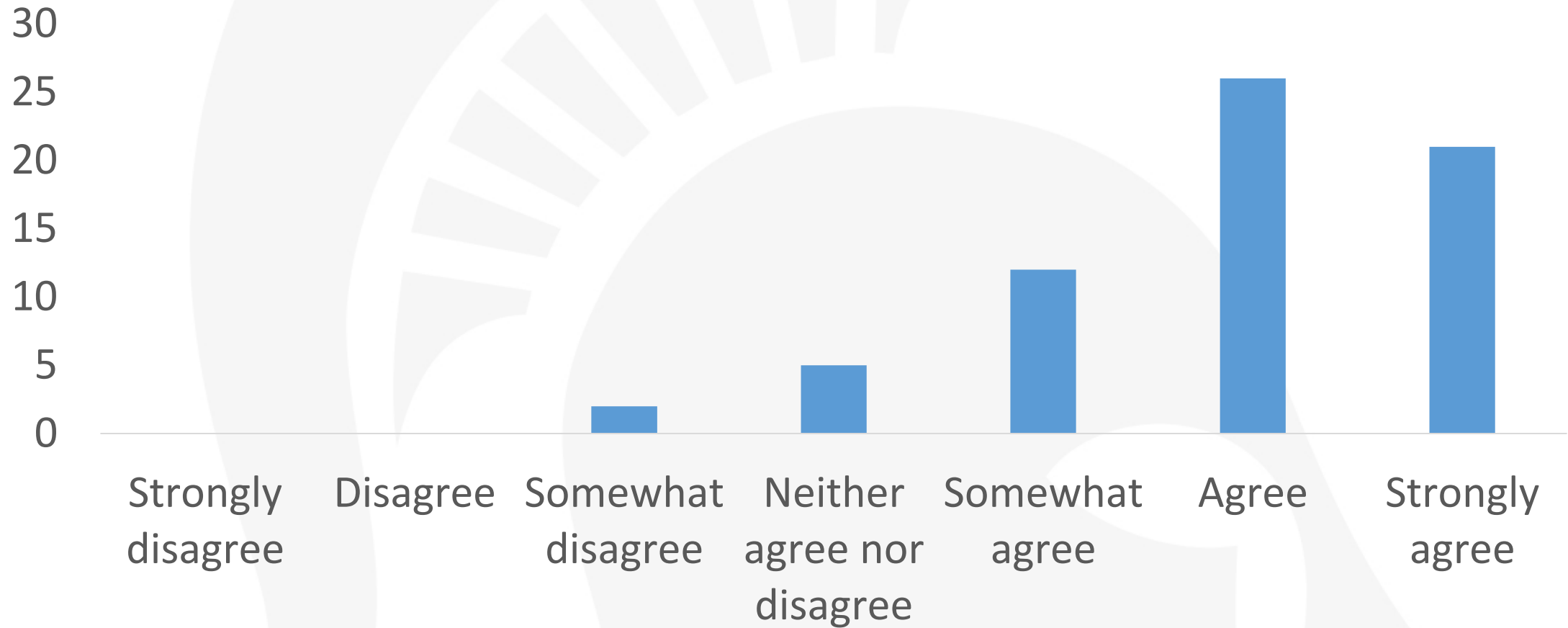


I have been directly contacted by a local hop grower about purchasing hops too often.



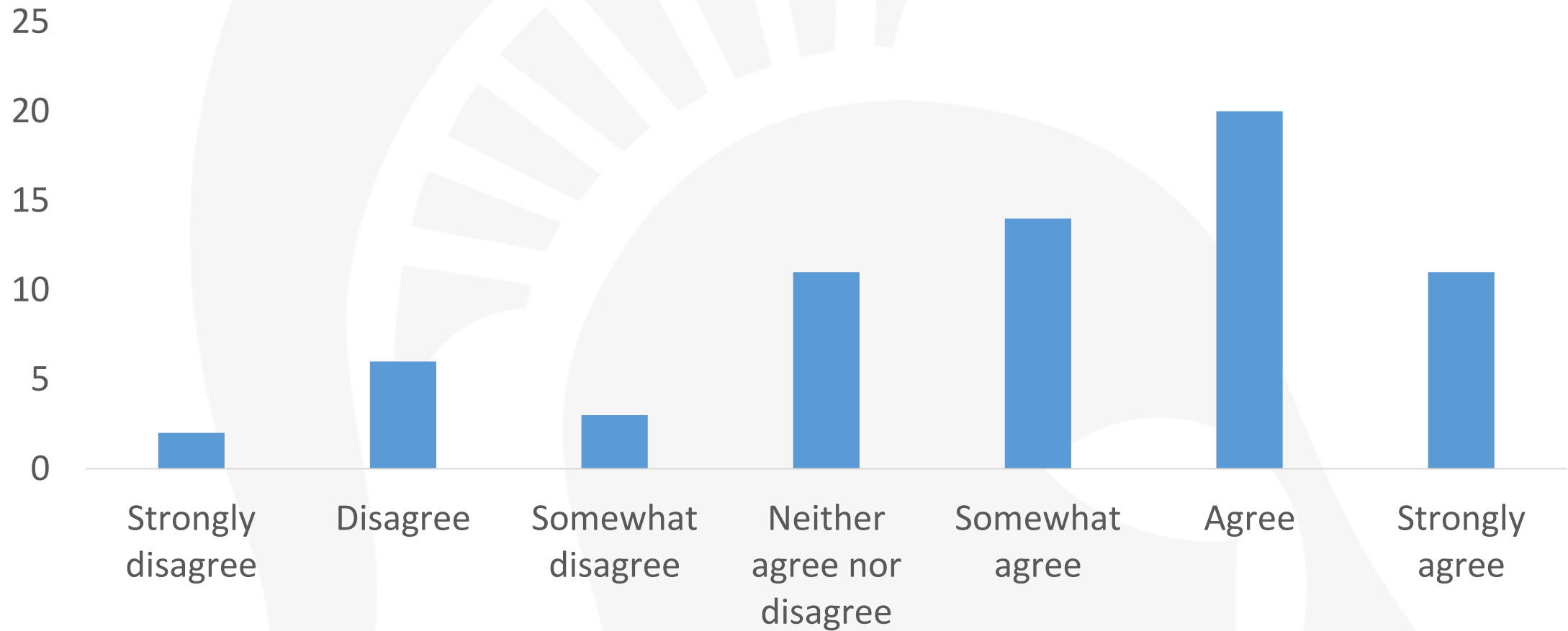


Local hops taste different from hops grown in other states.





Having a program verifying the quality and safety of locally grown inputs has value to me.





Next Steps

- Analyze discrete choice experiment data
- Break down data by brewery size/location
- Develop consumer experiments to correspond with brewer opinions
- **MORE TERROIR TESTING**
 - Example: Tomorrow's Hop Growers of Michigan sensory experiment



More Marketing Resources





- State grower association membership and USA Hops
 - Hop, Breeding and industry research
 - Supplier and Grower Directories
 - Subscription to HOP NEWS, the industry's publication
 - Education modules
 - News on industry events including the annual American Hop Convention



Proprietary Hops

- Owned by the private companies that developed them
 - Examples include Citra, Simcoe, Amarillo, Mosaic
 - (4 of the top 8 hop cultivars by acreage)
- One of the biggest issues confronted by upstart hops growers



\$0.74  per lb	US Cascade 2014	88 lbs 2 × 44 lbs 1 package minimum	T90 Pellet Hopsteiner	\$18.89  per lb	US Citra 2017	1,100 lbs 25 × 44 lbs 1 package minimum	T90 Pellet (2x22 lbs bags) YCH HOPS/Hopunion
\$0.94  per lb	US Cascade 2015	44 lbs 1 × 44 lbs 1 package minimum	T90 Pellet BSG	\$18.90  per lb	US Citra 2017	484 lbs 11 × 44 lbs 2 package minimum	T90 Pellet Haas



Flavors & Aromas

from the percent of essential oil content in hops

Hops are partially comprised of essential oils that dictate flavor and aromatic qualities when added within the last 15 minutes of the wort boil, or when dry-hopped in the fermenter.

Terpenes & other oils

Unsatirical characteristics

Carophyllone

Herbal
Earthy

Humulene

Salty
Herbal
Earthy

Myrcene

Floral
Citrus
Piney

Bitterness

from the percent of alpha acid content in hops

The alpha acid percentage represents the amount of the hop, by weight, that is composed of alpha acids. The alpha acid percentage total encompasses multiple chemicals which all add unique flavor and bittering alpha. The primary acids are Humulone, which is thought to give a desirable "soft" bitterness to the finished beer, and Cohumulone, which has been considered to add a harsher bitterness to beer, and is sometimes avoided.

Cohumulone
Average percentage of the total alpha acid of the hop

Bitterness in beer is measured in International Bitterness Units (IBU) which is measured through the use of a spectrophotometer and solvent extraction. However, during the brewing process IBU can be estimated with the following equation:

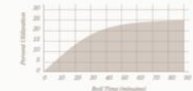
$$IBU = \frac{W_{hop} \times UA \times AS \times 7489}{V_{vol} \times C_{gr}} \times U$$

Where:

W_{hop} = Weight of hops used, in ounces

AS = Alpha acid percent of the hop (range)

U = Utilization is the percent of iso-alpha acid retained over the time of the wort boil, as shown in the chart below.

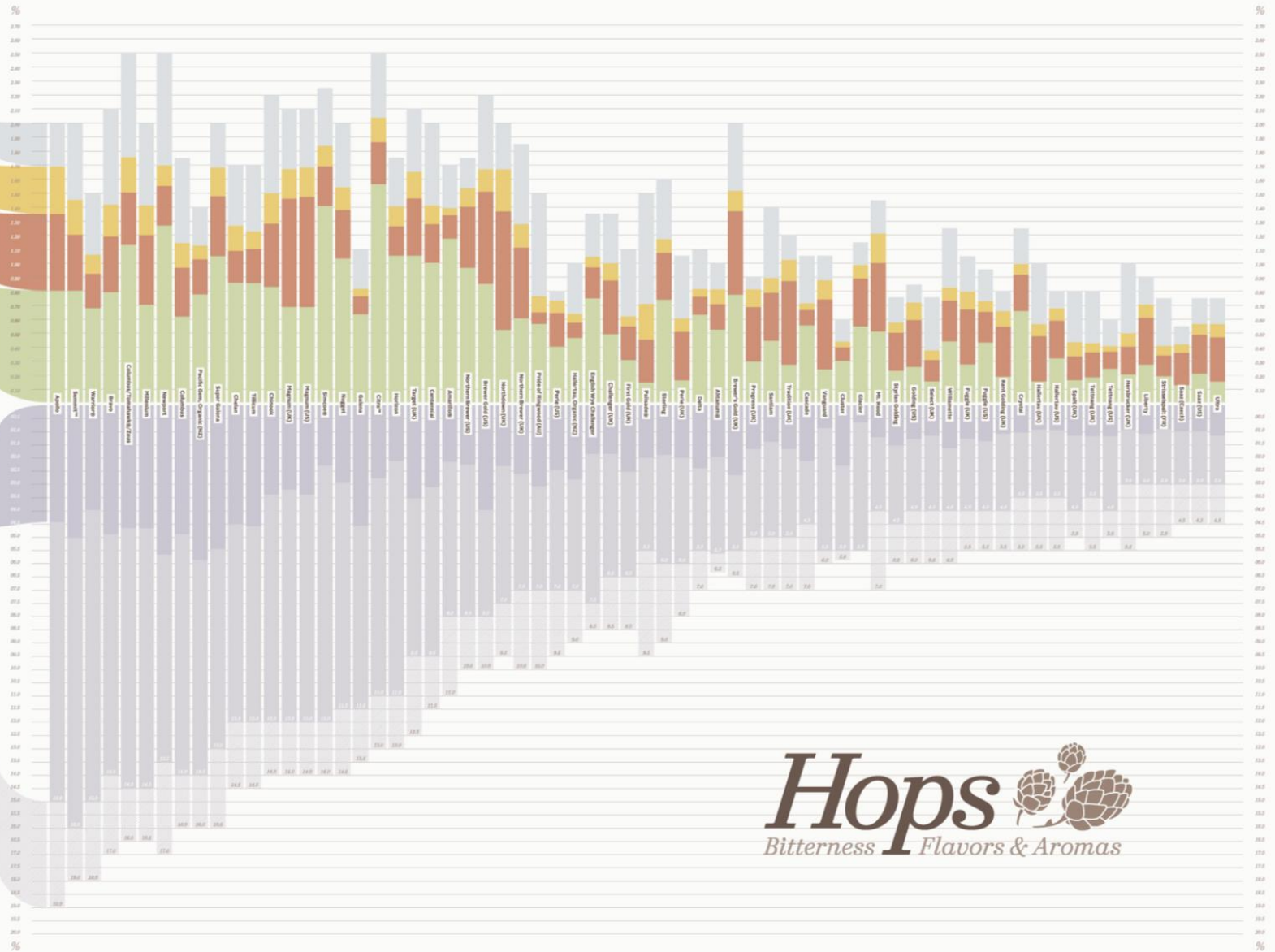


V_{vol} = Volume of final wort in gallons, before pitching yeast

C_{gr} = When the gravity of the boil is less than 1.050, the gravity correction is 1.0. Otherwise, it is calculated with the following equation:

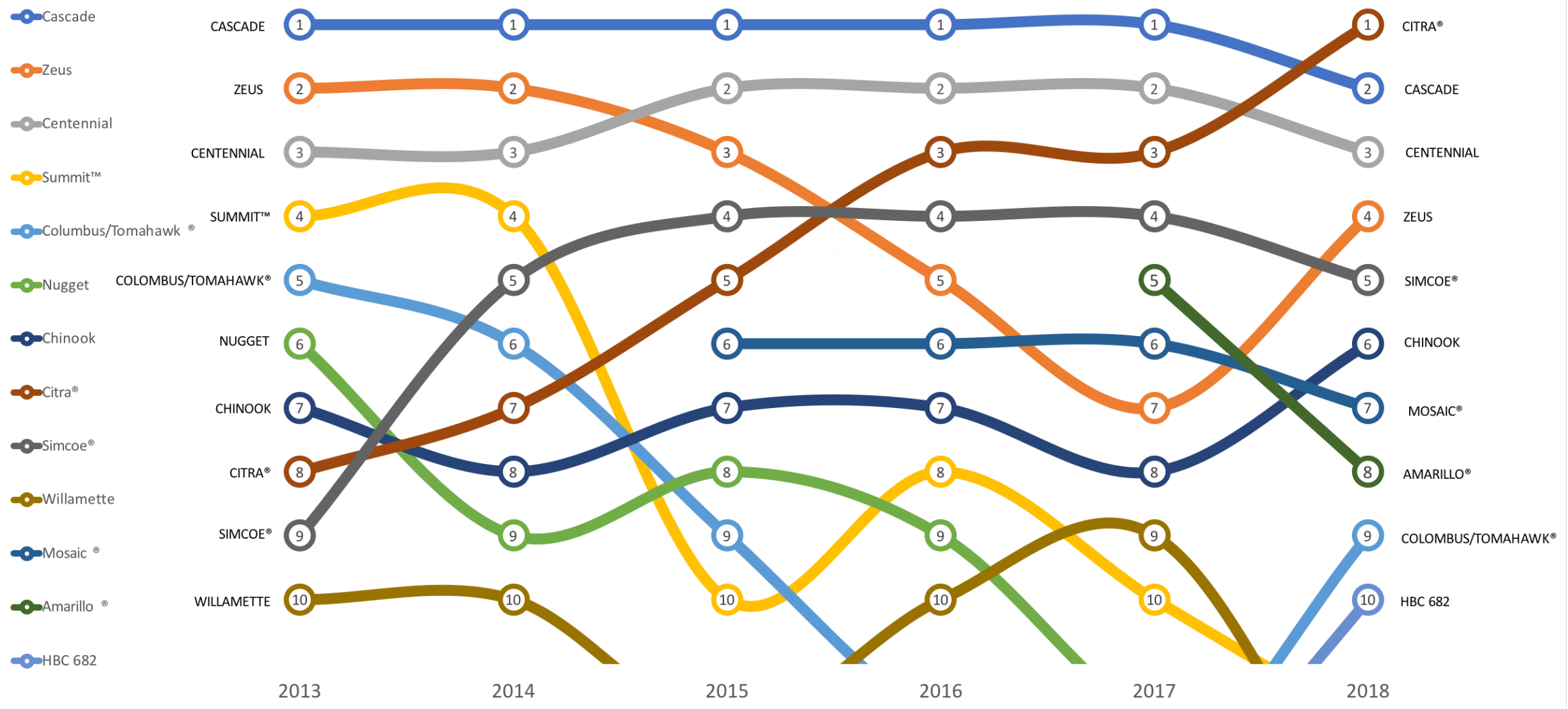
$$C_{gr} = 1 + \frac{SG_{boil} - 1.050}{0.20}$$

SG_{boil} = Specific gravity of the wort in the boil kettle





TOP TEN U.S. HOP CULTIVARS BY ACREAGE





Unique marketing opportunities

- Fresh (wet) hopping
- International markets
- Vertical integration
- Differentiated product (terroir)



What is a fresh hopped beer?

- Produced from the whole cone
 - Different from “dry-hopping” in that it doesn’t use pellets
 - More difficult / unstable to brew
- Highly desirable around harvest

TECH • FUTURE OF WORK

How Sierra Nevada Developed the 'Holy Grail of Beer'

LUXURY • CRAFT BEER

It's Oktoberfest for a Reason. Here's Why Brewers Say Beer Definitely Tastes Best in the Fall





Unique marketing opportunities

- Fresh (wet) hopping
- International markets
- Vertical integration
- Differentiated product (terroir)



Unique marketing opportunities

- Fresh (wet) hopping
- International markets
- Vertical integration
- Differentiated product (terroir)



Changes in global beer consumption

Table 1: Top Five Beer Markets in the World, 1960–2010

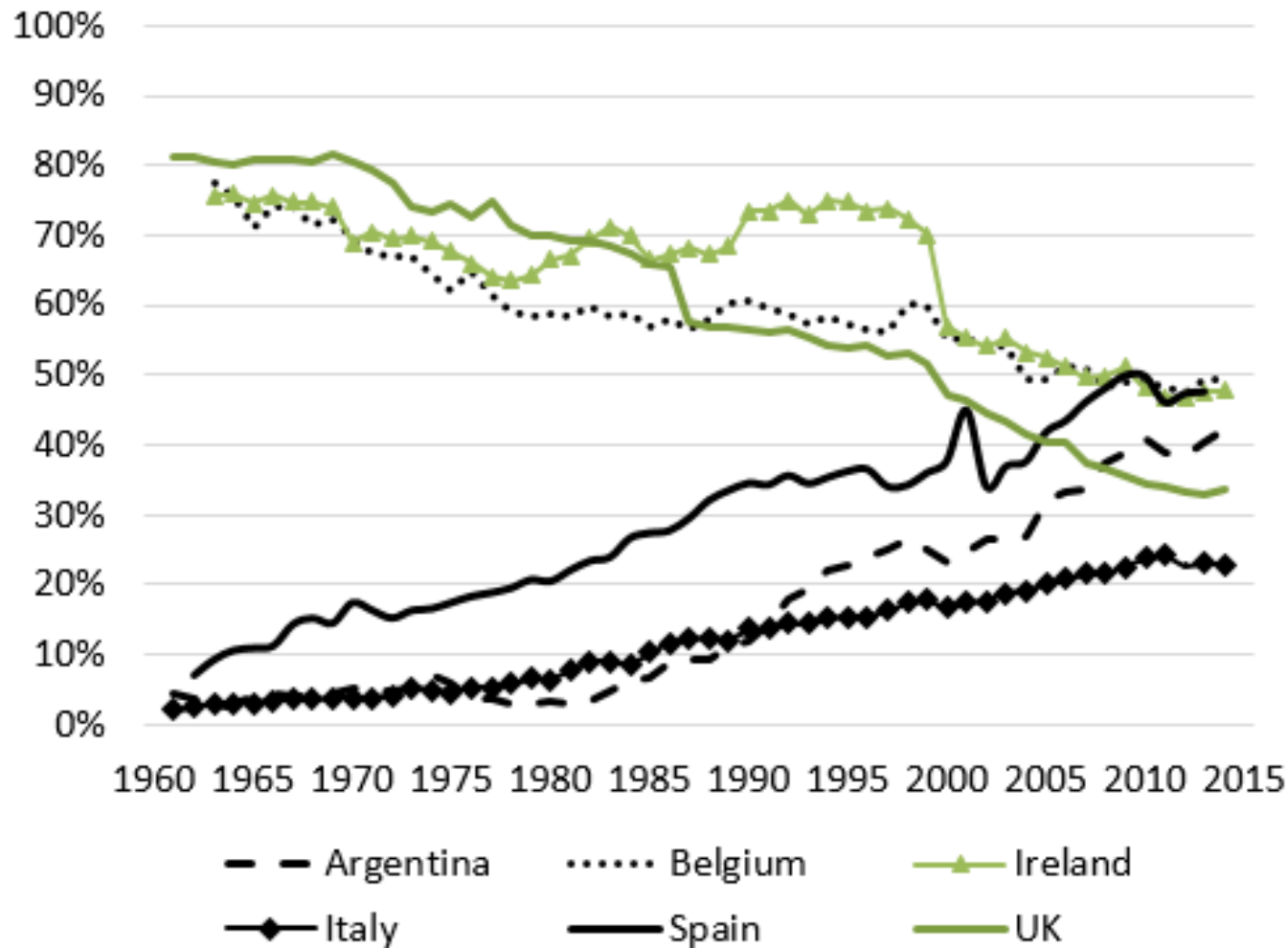
1960	Billion liters	Share of world consumption
1. USA	11.2	26.0
2. Germany	6.8	15.7
3. UK	4.7	10.9
4. Russia (USSR)	2.7	6.2
5. France	1.7	3.9

2010	Billion liters	Share of world consumption
1. China	45.5	25.8
2. USA	25.6	14.5
3. Brazil	12.8	7.3
4. Russia	9.9	5.6
5. Germany	8.1	4.6

Source: Swinnen and Briski (2017).

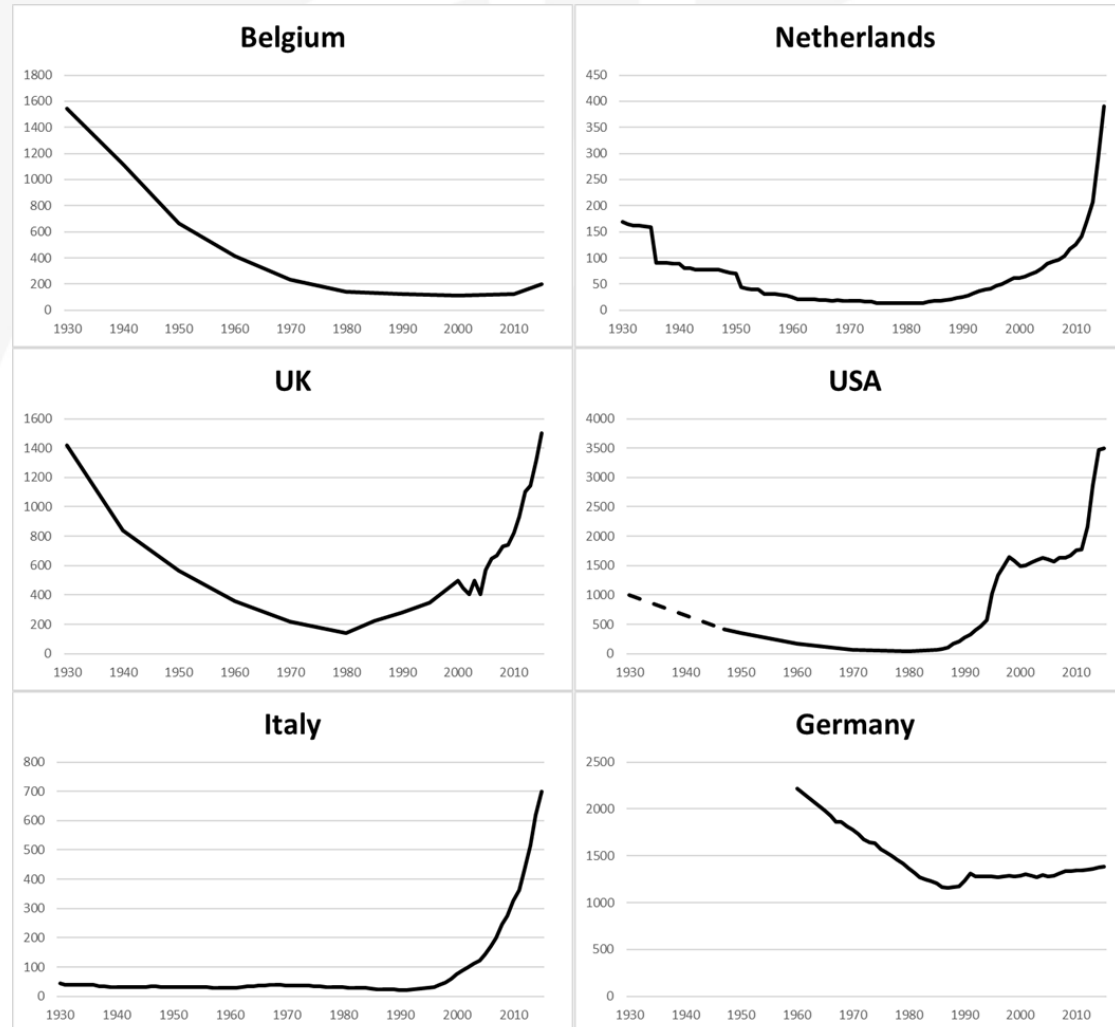


Share (%) of Beer in Total Alcohol Consumption





Number of Breweries, 1930–2015





Unique marketing opportunities

- Fresh (wet) hopping
- International markets
- Vertical integration
- Differentiated product (terroir)



Unique marketing opportunities

- Fresh (wet) hopping
- International markets
- Vertical integration
- Differentiated product (terroir)



Vertical integration

- Start your own (farm) brewery!
- Increasingly popular option



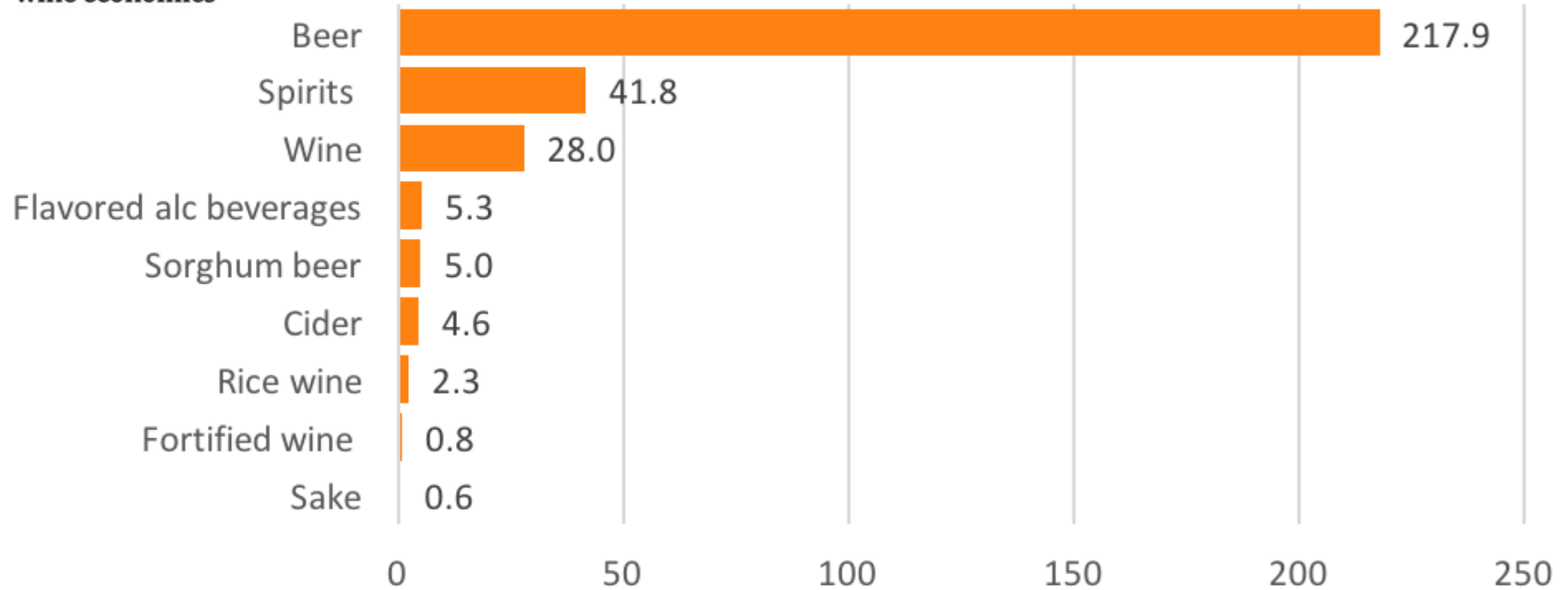
Acme Hops Farm To Open Brewery

By Beth Milligan | Sept. 7, 2017



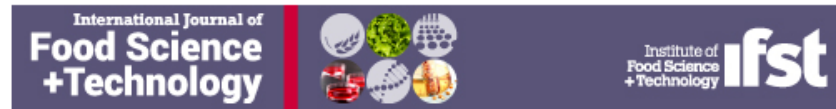
Global Alcoholic Beverage Sales by Category 2016

in billion liters (forecast); Source: TableBase (xCanadean)





Sensory Research on Terroir



[Explore this journal >](#)

Original Article

A preliminary investigation into differences in hops' aroma attributes

Susan Barry, Elizabeth M. Muggah, Matthew B. McSweeney , Shane Walker

First published: 1 November 2017 [Full publication history](#)

- Nova Scotia vs. Oregon/England dry-hopped and whole-leaf
 - Cascade (US), Mt. Hood (US), Nugget (US), and Golding (UK)
- 2 “projected mappings” of 12 untrained female participants

Abstract: “Results indicated that there are differences in the hop aromas of both whole-leaf hops and dry-hopped lager...”



Sensory Research on Terroir



Research article

The brewing value of Amarillo hops (*Humulus lupulus* L.) grown in northwestern USA: A preliminary study of terroir significance

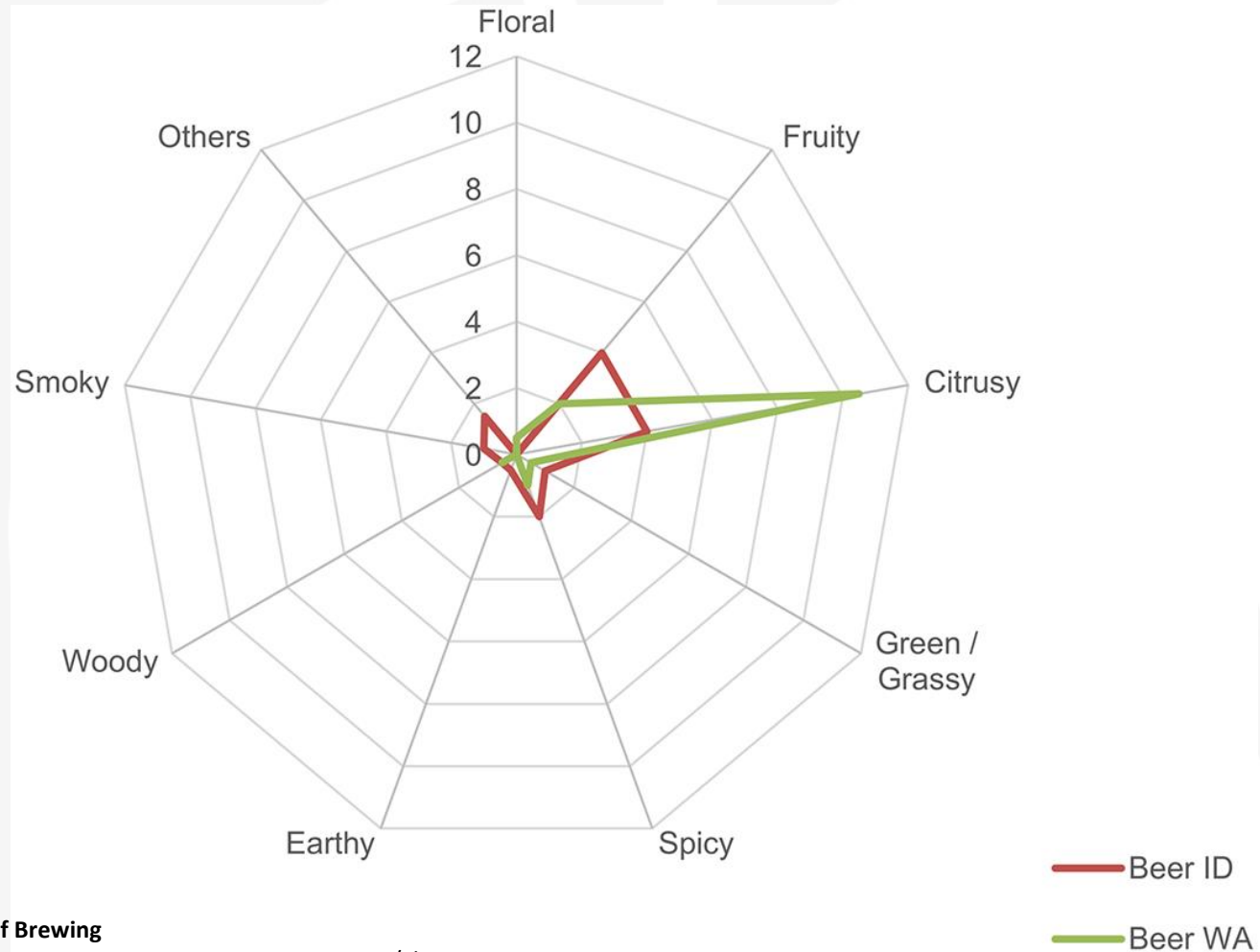
[Ann Van Holle](#), [Anita Van Landschoot](#), [Isabel Roldán-Ruiz](#), [Dirk Naudts](#),
[Denis De Keukeleire](#) ✉

- Idaho vs. Washington Amarillo pellets, Pilsner malt
- Trained taste panel (n = 15)

Abstract: "...This preliminary study indicates that brewers must rely on desired hop varieties from the same terroir in order to achieve consistent hoppy aromas in their beers."



The brewing value of Amarillo hops (*Humulus lupulus* L.) grown in Northwestern USA: A preliminary study of terroir significance



Journal of the Institute of Brewing
[Volume 123, Issue 3](#), pages 312-318, 20 JUN 2017 DOI: 10.1002/jib.433
<http://onlinelibrary.wiley.com/doi/10.1002/jib.433/full#jib433-fig-0004>



Consumer Research on Terroir

- Ha et al., 2018. Consumers' Valuation for Craft Beer: Does the Localness of Inputs Matter?
- Evaluated willingness-to-pay for local and/or organic attributes in Indiana beer

Which of the following craft beer products do you prefer most? If neither option A nor option B meet your preferences, you should choose to opt-out by selecting option C. Select one.

	Option A	Option B	Option C
Brewing location	Indiana	Within the US, outside of the Great Lakes region	I would not choose Option A or Option B.
Location of hops production	Indiana	Within the US, outside of the Great Lakes region	
Production method of ingredients	Organic		
Price	\$10.99	\$6.99	
I prefer...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Consumer Research on Terroir

“...Indiana consumers are willing to pay a **price premium for** craft beer brewed in Indiana, as well as a **positive, but smaller, premium for local hops.**”

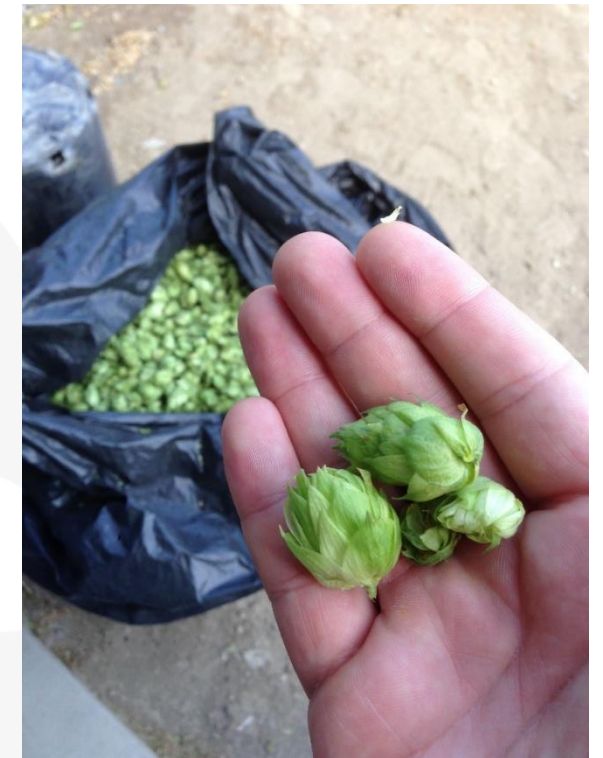
“**Experienced consumers have a high WTP for local attributes** (both processing and origin of inputs) defined at the state level, but discount local attributes defined at the regional level.”

“...**We find that average and inexperienced consumers view localness claims of the different supply chain stages as substitutes.**”



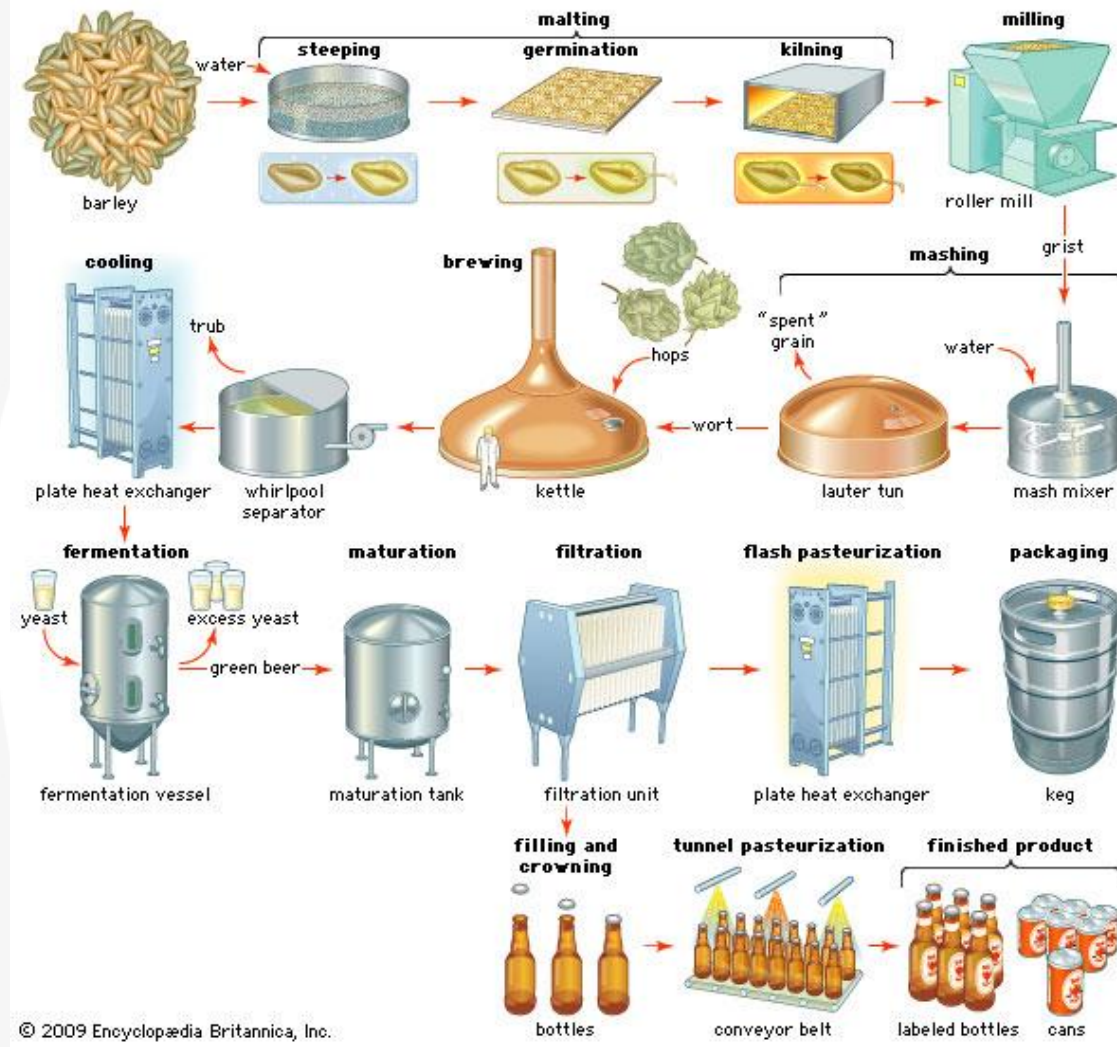
Hops became a part of beer in 12th century

- Increased shelf life
- Bitter to balance sweet of barley malt





Hops is just one step in a massive supply chain





Shifting consumer preferences in the U.S.

Preferred Drink, by Age
Based on those who drink alcohol

	% Beer	% Wine	% Liquor
18- to 29-year-olds			
1992-1994	71	14	13
2012-2013	41	24	28
Change	-30	+10	+15
30- to 49-year-olds			
1992-1994	48	31	17
2012-2013	43	29	24
Change	-5	-2	+7
50+			
1992-1994	28	37	30
2012-2013	29	46	19
Change	+1	+9	-11

GALLUP®



Shifting consumer preferences in the U.S.

Preferred Drink, by Gender

Based on those who drink alcohol

	% Beer	% Wine	% Liquor
Men			
1992-1994	64	15	16
2012-2013	53	20	22
Change	-11	+5	+6
Women			
1992-1994	29	43	25
2012-2013	20	52	24
Change	-9	+9	-1

GALLUP®