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An Analysis of the Economic Contributions of the China Lake Watershed – Final Report
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Summary of Findings

Demographics

- ✓ Approximately 63% of the population of the Town of China lives within the boundary of the China Lake Watershed.
- ✓ China's population grew by 2.4% during the decade of 2012–2022. Most of this growth occurred in close proximity to China Lake.
- ✓ The Town of China witnessed a decline in the number of children and young adults less than 25 years of age since 2012.
- ✓ Median household incomes in China nearly doubled during the decade.

Employment & Earnings Contributions

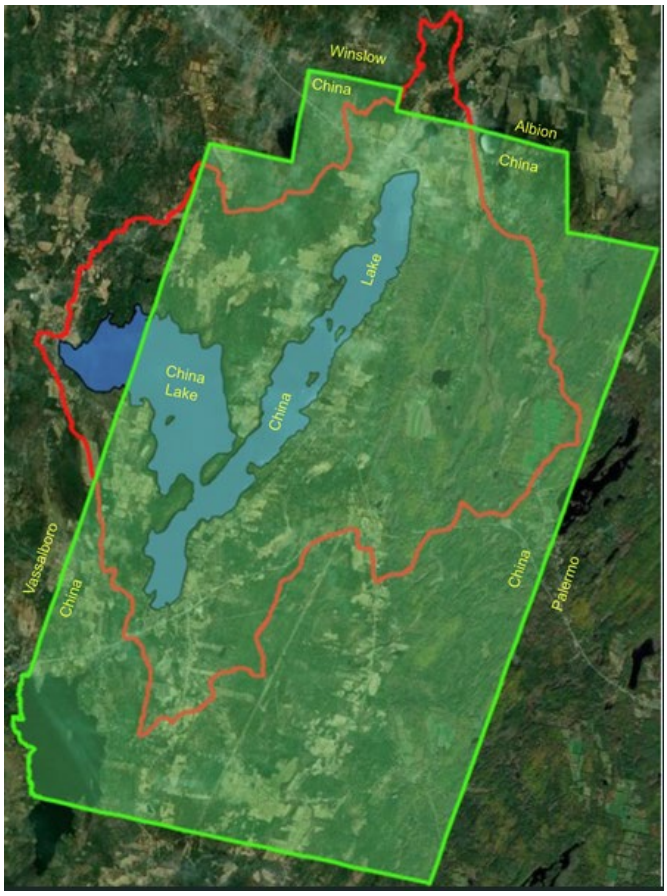
- ✓ In 2022, the top 10 industries represented by firms in the Town of China employed an average of 586 workers and paid approximately $24.2 million in wages.
- ✓ This level of employment and earnings contributed to a total of $71.3 million to the overall level of economic activity in Kennebec County and supported 616 total jobs.

Value of the Watershed to Home Prices in China

- ✓ We used property tax records for the Town of China and GIS mapping and analysis tools to build a statistical model explaining home prices for homes of similar characteristics located in and outside the China Lake Watershed.
- ✓ Based on our econometric modeling of home prices for the Town of China we found that residential properties located inside the China Lake Watershed on average sold for 16% more than comparable residences outside the Watershed.

[†] The Colby Laboratory for Economic Studies (CL4ES) is a collaborative research workshop engaging students and professors with stakeholders and policy makers to provide objective analysis, information, and educational outreach on current issues and events.

Introduction



The China Lake Watershed, outlined in red in the map at right, lies almost entirely within the Town of China, Maine (bordered in green). China Lake itself is fed by streams, surface water runoff, and underground aquafers within the Watershed. During the winter of 2023-24, a team of student researchers at Colby College set about to create an educational outreach resource focused on the economic footprint of the China Lake Watershed on behalf of the China Lake Association to aid their members in ongoing efforts to protect and enhance the ecosystem services provided by the lake.

This report begins with a demographic snapshot for the Watershed and the Town of China, Maine. We then offer our estimate of the economic activity in Kennebec County that can be attributed to employment and earnings flowing from workers and employers in the Town of China. We conclude our report with an estimate of the value added of the China Lake Watershed in terms of its contribution to the sales price of homes located within its boundary.

Accompanying this report is a digital storytelling for the economic footprint of the China Lake Watershed meant to serve as our educational outreach resource for use by the China Lake Association.

Demographic Profile

The table at right provides a snapshot of current demographic trends for the Town of China and our estimate of the population within the borders of the China Lake Watershed.

According to U.S. Census figures, China's population grew by 2.4% during the decade of 2012 – 2022. Most of this growth occurred within the Census Blocks in closest proximity to China Lake.

The Town of China witnessed a decline in the number of children and young adults under the age of 25 during the past decade.

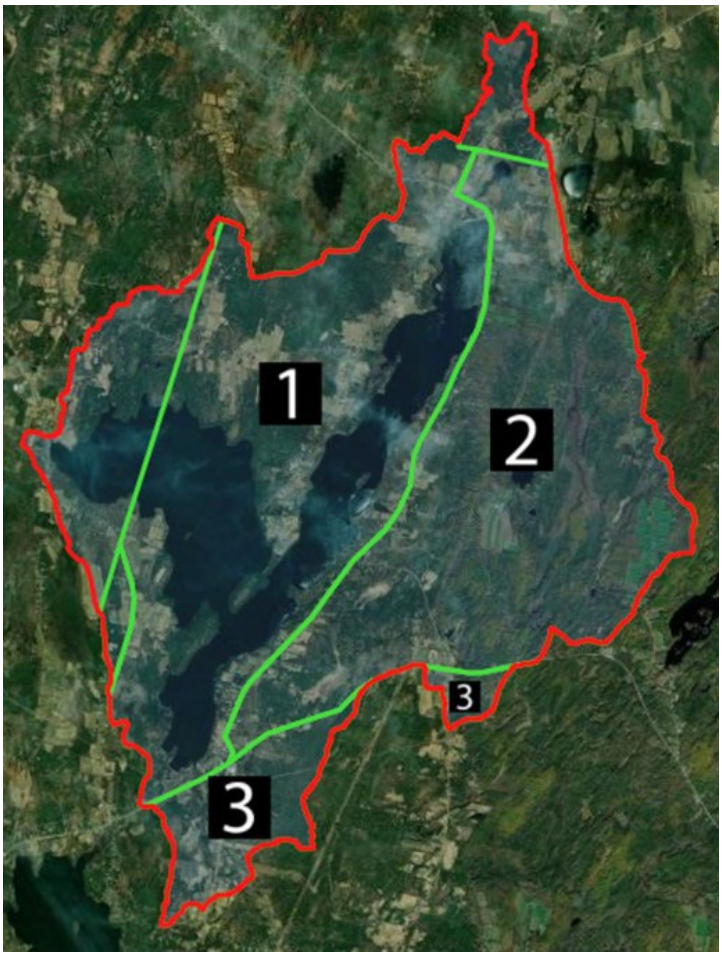
Median household incomes in China nearly doubled during this period.

	2008-2012 Average				2018-2022 Average			
	China	Blk Grp 1	Blk Grp 2	Blk Grp 3	China	Blk Grp 1	Blk Grp 2	Blk Grp 3
Population	4,330	1,129	1,253	1,948	4,434	1,387	1,021	2,026
					2.4%	22.9%	-18.5%	4.0%
In the Watershed	2,728				2,793			
Preschool (<5)	282	0	92	190	339	19	63	257
					20.2%	-79.3%	-31.5%	35.3%
Primary (5-15)	542	122	125	295	418	154	114	150
					-22.9%	26.2%	-8.8%	-49.2%
High School (16-18)	297	85	77	135	153	11	19	123
					-48.5%	-87.1%	-75.3%	-8.9%
18-25	327	91	116	120	183	26	52	105
					-44.0%	-71.4%	-55.2%	-12.5%
25 - 45	1,051	184	399	468	1,502	452	372	678
					42.9%	145.7%	-6.8%	44.9%
45 - 65	1,341	383	381	577	1,265	496	273	496
					-5.7%	29.5%	-28.3%	-14.0%
65 +	490	264	63	163	574	229	128	217
					17.1%	-13.3%	103.2%	33.1%
Male	2,205	559	652	994	2,196	756	464	976
					0%	35%	-29%	-2%
Female	2,125	570	601	954	2,238	631	557	1,050
					5%	11%	-7%	10%
Median Household Income	$143,345	$42,227	$58,571	$42,547	$279,257	$94,668	$94,805	$89,784
					95%	124%	62%	111%

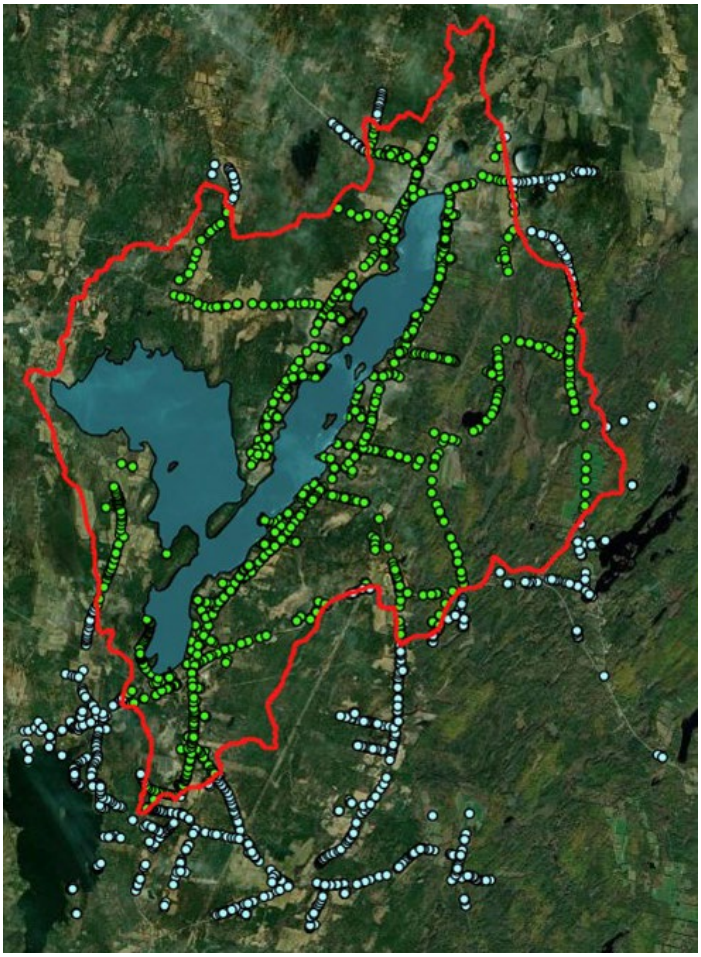
Source: U.S. Bureau of the Census https://data.census.gov/

Click on the table to view the spreadsheet data.

To estimate the fraction of the population living within the boundary of the China Lake Watershed we began with property tax records obtained from the Town of China and geo-located the addresses for each household in the database. We then employed satellite imagery and GIS mapping to estimate the proportion of the total population reported for each Census block that was within, either entirely or partially, the China Lake Watershed boundary. For Census blocks that lay only partially inside the Watershed we visually counted residences using Google Map's Street View, finding the roads that followed the Watershed and overlaid the corresponding U.S. Census block group boundaries. We then multiplied this count of residences by 2.5 – the reported average household size for the Town of China. According to our calculations, roughly 63% of the population in the Town of China lie within the Watershed's boundary.



U.S. Census Block Groups within the China Lake Watershed.



Geo-located property tax addresses. Homes in green are located within the Watershed boundary.

Economic Activity in Kennebec Country Attributable to Employment & Earnings in China

Economic impact analyses rely on a relatively simple concept: spending generates income that in turn generates more spending. Thus, each dollar of spending by a household, business, or government entity is multiplied in terms of its total economic impact. Wage and salary income for workers becomes spending on things like food and rent that in turn generates more income for grocery store workers and landlords. Similarly, businesses spend some of the money they receive for their goods and services on operating expenses – things like utilities, equipment maintenance, and other business services. This spending in turn generates more income followed by successive rounds of spending throughout the economy. This process of income generation from spending is commonly referred to by economists as the *multiplier process* where each dollar of spending has a multiplicative effect on the amount of total economic activity attributable to it. Multipliers can be estimated from business and consumer surveys and model simulations and will differ according to the source and type of spending.

A complete economic impact analysis for the China Lake Watershed would require a comprehensive survey of spending patterns by those business entities that operate in the region as well as households and seasonal visitors that work and play in the region. This type of modeling effort was beyond the scope of this project.

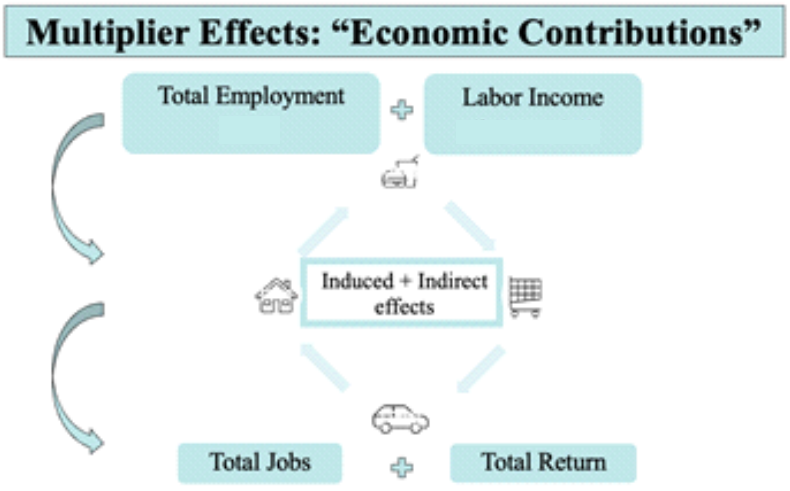
However, it's possible to estimate the contributions of those who work in China to the overall level of economic activity in Kennebec County by modeling the multiplicative effect of total employment and earnings. The table a right provides an economic snapshot for Kennebec County. In the analysis that follows, we provide our estimate of the share of this economic activity and employment that is supported by the number of workers and the earnings paid by firms located in the Town of China.

Kennebec County Economic Snapshot for 2022	
Population	125,540
Households	53,314
Economic Activity (GDP)	$7.96 Billion
Personal income	$6.56 Billion
Total Employment	79,233

Source: IMPLAN

The Maine Department of Labor provides data for total employment by industry for cities and towns across the state. We used data reported by the MDOL for the top 10 industries in the Town of China in 2022 as inputs into the IMPLAN modeling software to apply the economic multipliers embedded in the package for each industry and obtain estimates of the total contribution of workers in the Town of China on economic activity in Kennebec County. These inputs are provided in the table on the next page.

Using the IMPLAN framework, we estimated the contributions made by employers and workers in China to the Kennebec County economy through direct, indirect, and induced effects. The 2022 employment and wage incomes become the *direct effects* for our model of the multiplier process for Kennebec County. *Indirect effects* are estimated from economic interactions among the industrial sectors from purchasing or supplying inputs between sectors (for example when one business purchases



goods or services from another in the county). *Induced effects* occur through the linkages between an affected sector of the economy and households based on the labor they supply and the wages they are paid to capture implicit relationships that result in changes in household spending, i.e., the multiplicative effect of wages paid on employee spending. The aggregate value of these three effects provides our estimate of the total economic impact.

2022 Employment & Earnings for the Town of China, Maine
(IMPLAN inputs)

Industry	Number of Establishments	*Employment*	*Earnings*	Average Weekly Wage
Construction	19	77	$4,273,262	$1,071
Wholesale Trade	3	3	$299,701	$2,231
Retail Trade	14	245	$7,499,142	$590
Transportation and Warehousing	6	20	$1,358,149	$1,322
Finance and Insurance	5	13	$618,323	$903
Professional, Scientific, and Technical Services	13	11	$644,602	$1,136
Administrative and Support and Waste Management and Remediation Services	7	10	$177,950	$357
Educational Services	4	166	$8,018,542	$929
Health Care and Social Assistance	7	29	$815,675	$536
Other Services	7	12	$484,401	$810
Top Ten Industries	85	586	$24,189,751	$811

Source: Maine Department of Labor

As illustrated in the table below, the 586 workers and $24.2 million in earnings paid by firms located in the Town of China contributed a total of $71.3 million to the overall level of economic activity in Kennebec County in 2022 and supported 616 total jobs.

2022 Contributions to Economic Activity in Kennebec County

Impact	Employment	Labor Income	Value Added	Output
Direct	586	$24,189,751	$35,843,054	$61,469,558
Indirect	16	$1,003,298	$3,702,671	$6,358,236
Induced	14	$544,062	$2,130,175	$3,479,746
TOTAL	616	$25,737,111	$41,675,900	$71,307,540

The Value of the Lake Watershed to Residential Home Prices in China

As noted above, approximately 63% of the population in the Town of China is located within the Watershed. To provide an alternative assessment of the economic footprint of the Watershed we crafted a model of home prices using data from the Town of China and GIS mapping tools. The type of statistical analysis we did includes the construction and estimation of the parameters in a hedonic regression model. Hedonic regression modeling is an econometric tool for evaluating the effect of key characteristics on the price or demand of an item. In our application we modeled the impact of characteristics that explain variations in historical sale prices for homes in the Town of China.

Some of the characteristics that we wanted to use were readily available from the Town Assessor's database. These included the year of sale, size of the property in acres, living area for the home, the number of bathrooms, and the number of bedrooms. The Assessor's database does not explicitly identify residential properties so we had to do a bit of data cleaning to identify properties that would be appropriate for our model. Specifically, we used guidelines provided by the assistant to the Assessor's agent for properties that qualified for a homeowner's exemption. We also limited our sample to those properties that had bedrooms and bathrooms, a positive value for square foot living area, and a positive value for the size of the lot.

The goal for this portion of our study was to estimate the effect of the Watershed on the price of a home. The Assessor's database does not accurately identify all shoreline properties within the China Lake Watershed either in terms of location of the amount of lake frontage. Using Geographic Information System tools available from the U.S. Census Bureau in combination with the ArcGIS ESRI mapping and analysis software package we geo-located the latitude and longitude for each address in the Assessor's database. We then overlaid these geotagged locations onto the GIS boundary for the Watershed available from the Maine State Geolibrary to identify locations within the Watershed's boundaries. Geotagging did not always identify the precise physical location of the home, but did provide an accurate location for the property in terms of the mailbox location.

The technical details for our modeling efforts are included at the end of our report. Based on our econometric model of home prices for the Town of China we found that homes located inside the China Lake Watershed sold on average for 16% more than comparable homes outside the Watershed.

Resources

U.S. Census Bureau data

China Lake Watershed-Based Management Plan, March 2022, Ecological Instincts.

Quarterly and Annual Industry Employment and Wages, Maine Department of Labor online database.

Economic Impact Analysis for Planning Software (IMPLAN).

Maine State Geolibrary Data Catalog.

CL4ES update of the Town of China property tax database (.csv file)

Assessing Department for the Town of China (tax maps)

Digital storytelling outreach resource for the China Lake Association.

Technical Details

Summary Statistics for the Variables in Our Hedonic Regression Model

Variable	Mean	Std. Dev.	Minimum	Maximum
Property size (acres)	5.95	14.13	0.14	156.5
Number of bathrooms	1.77	0.66	1	5
Number of bedrooms	2.98	0.83	1	8
Living Area (square feet)	1701.5	653.90	450	6242
Sale price (dollars)	$164,557	$136,967	$4,500	$1,700,000

Properties in the Watershed	57.9% (400 homes)
Total of properties in our model	691

Hedonic Model of Home Prices in China, Maine
Dependent variable is the natural logarithm of the sales price

Explanatory Variables		Effect on the Sale Price *(Holding all other characteristics of the home constant)*
Properties less than 1 acre	0.214** (0.0946)	*For properties less than one acre in size, each additional quarter acre corresponds to a 5% increase in the sales price. However, for properties larger than an acre the net effect on the sales price is not statistically significant.*
Properties more than 1 acre	-0.214** (0.0944)	
Living area (sqf)	0.000251*** (5.42e-05)	*An additional 50 square feet of living space corresponds to a 1.3% increase in the price of a home.*
Number of bedrooms	0.0875** (0.0382)	*Each additional bedroom contributes 8.75% to the price of a home.*
Number of bathrooms	0.0981* (0.0525)	*An additional bathroom corresponds to a 9.8% increase in the price of a home.*
Year of Sale	0.0481*** (0.00304)	*Newer homes are more expensive. Our model includes homes sold between 1987 and 2024.*
Homes in the Watershed	0.150*** (0.0566)	*Homes located inside the China Lake Watershed sold for 16% more than comparable homes outside the Watershed.*
R-squared (Goodness of fit)	0.36	*Our model explains 36% of the variation in home prices.*

Standard errors for each of the model parameter estimates are included in parentheses
p-value levels of statistical significance: *** p<0.01, ** p<0.05, * p<0.1